

MANCHESTER
1824

The University of Manchester

AMBS Doctoral Research Conference



Programme of Events

3rd and 4th June 2024

Alliance Manchester Business School

The University of Manchester

2024 AMBS Doctoral Research Conference Programme



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Jinlan Zhang

People Management and Organisation

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Fangyi Wang

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Victoria Biagi (University of Liverpool)
Shoumeli Das (University of Liverpool)
Davidmac Ekeocha (University of Liverpool)
Luke Walsh (University of Liverpool)

Monday 3 June

Time	Session	Room
9.00 - 9.30	Coffee and registration	Floor 3, 3.004 The Hive
9.30 - 9.45	Welcome from Professor Lloyd C Harris	Theatre 2.008
9.45 - 10.45	Keynote Speaker: Professor Tine Köhler from The University of Melbourne	Theatre 2.008
10.45 - 11.00	Coffee break	Floor 3, 3.004 The Hive
11.00 - 12.00	Social Responsibility Paper presentations Chair: Dr Magda Hassan	Theatre 2.008
12.00 - 1.00	Lunch	The Mill
1.00 - 3.00	Best Paper Presentations (Parallel sessions): Session 1: Chair: Ed Lee and Karl Taeuscher Yue Feng (A&F) Xiangyu Lin (A&F) Yiwen Sun (IMP) Session 2: Chair: Ilma Chowdhury Guowei Huang (MSM) Roisin Jordan (MSM) Nazanin Nami (MSM) Session 3: Chair: Renfei Gao Jieyichi (Jenny) Zhao (MSM) Eleni Chiarapini (PMO) ABSENT Galih Sakitri (PMO)	Session 1: 3.013A Session 2: 3.013B Session 3: 3.015A
3.00 - 3.30	Coffee break	Floor 3, 3.004 The Hive
3.30 - 4.45	Research Engagement and Policy@manchester: Dr Chris Smith and Suzanne Booth	Theatre 2.008
5.00	Evening Wine Reception (including announcement of Best Paper/Best Social Responsibility Paper Winner)	Floor 3, 3.004 The Hive

Tuesday 4 June

Time	Session	Room
9.00 - 9.30	Coffee and registration	Floor 3, 3.004 The Hive
9.30 - 10.30	Roundtables Economics Roundtable: Chaired by Ozioma Paul Management Roundtable: Chaired by Kashfia Ameen and Jieyichi (Jenny) Zhao	Economics: 3.013A Management: 3.013B
10.30 - 10.45	Coffee break	Floor 3, 3.004 The Hive
10.45 - 12.45	Year 1 Abstract presentations IMP: Chair: Dr Karl Taeuscher MSM: Session 1 Chair: Dr Ilma Chowdhury MSM: Session 2 Chair: Dr Heiner Evanschitzky PMO: Chair: Dr Renfei Gao A&F: Chair: Dr Ed Lee	3.013A: IMP 3.013B: MSM 1 Theatre 2.008: MSM 2 3.015A: PMO 3.015B: A&F
12.45 - 1.45	Lunch	The Mill
1.45 - 3.00	Academic Careers: Dr Sarah Ashworth (Researcher Development Officer)	3.013A/B: Careers
3.00 - 3.45	Divisional Talks IMP: Professor Mark Healey MSM: Professor Michelle Carter PMO: Professor Peter Buckley A&F: Dr Emiel Jerphanion	3.013A: IMP 3.013B: MSM 3.015A: PMO 3.015B: A&F
3.45 - 4.00	Coffee break	Floor 3, 3.004 The Hive
4.00 - 5.00	Final year and SPP Student Panel Ozioma Paul, Year 3 MSM (Chair) Yiwen Sun SPP IMP Kashfia Ameen, Year 3 PMO Mina Malvandy, SPP IMP	Theatre 2.008
5.00 - 5.15	Closing address: Professor Ken McPhail (including announcement of Abstract winners)	Theatre 2.008

Welcome

We are delighted to welcome you to the 2024 Alliance Manchester Business School Doctoral Research Conference!

During the Doctoral Research Conference, we will have talks from academics within AMBS featuring Professor Chris Smith, Professor Mark Healey, Professor Michelle Carter, Professor Peter Buckley and Dr Emiel Jerphanion, a session from Dr Sarah Ashworth on Academic Careers and our opening keynote address will be given by Professor Tine Köhler from The University of Melbourne.

We have also scheduled a panel of final year and submission pending PGRs talking about what their programme meant to them and to take your questions.

The PGR presentations will be similar to typical conference presentations and will be of three types. First, we have Year 1 PhD presentations organised by Division. Second, we are holding roundtable discussion sessions where all years of study can interact and comment on short discussions of each other's research. Third, we have plenary sessions that feature the entrants to the Best Social Responsibility Paper Competition and Best Doctoral Paper Competition.

All together these sessions will:

1. Provide feedback on the PGRs' ongoing thesis research;
2. Offer inspiration on how to conduct engaged management research; and
3. Build a network of collaboration amongst PGRs and faculty members.

We know that everyone is incredibly busy and will have to pick and choose what sessions of the Doctoral Research Conference they can attend, so we invite you to look through this programme and identify those sessions of most suitability and interest.

At the end of the first day, we have a drinks reception where our Best Paper and Best Social Responsibility Paper winners will be announced!

We look forward to seeing you at the conference.

All the best,



Professor Lloyd C. Harris, School PGR Director and DBA Programme Director

School organisation

As a School, AMBS is organised by four Divisions of research studies. Depending upon focus of research and study, all AMBS academics and PGRs reside within the AMBS's four Divisions: Accounting and Finance (A&F); Innovation, Management and Policy (IMP); Management Sciences and Marketing (MSM); or People Management and Organisations (PMO).



ACCOUNTING AND FINANCE (A&F)



INNOVATION, MANAGEMENT AND POLICY (IMP)



MANAGEMENT SCIENCES AND MARKETING (MSM)



PEOPLE, MANAGEMENT AND ORGANISATIONS (PMO)

Many of the presentation allocations of the conference will align within these divisions; others are School-wide PGR events. Everyone is welcome at the Conference, although **Year 1 PGRs *must* attend all sessions as a compulsory part of their programme.**

Session speakers

Keynote

Professor Tine Köhler from The University of Melbourne

Biography



Tine Köhler is Professor for International Management at the University of Melbourne, Australia. Tine is current co-Editor-in-Chief of the journal *Organizational Research Methods*. She has extensive publishing and reviewing experiences through various editor and editorial board member roles at a range of journals in management and organization studies. She is a fellow of the Consortium of the Advancement of Research Methods and Analysis and a co-founder of the Women in Research Methods network. Her research interests include global teamwork, cross-cultural differences in norms,

communication and coordination, and qualitative and quantitative research methods, including grounded theory, case studies, meta-analysis, regression, and research design.

For more information about Tine, please see: [Prof Tine Köhler \(unimelb.edu.au\)](https://unimelb.edu.au)

Keynote:

Replication vs. Restudies: Management science's chance to get it right

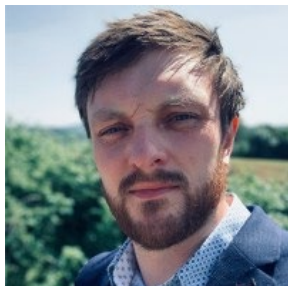
Replication in science has received a great deal of attention over the years. The organizational sciences, though, have seen a particularly strong increase in the discussion of replication over the last few years. Fuelled by the proclamation of a 'replication crisis,' quantitative research has seen an increase in calls for more replication as well as different forms of replication. Part I of this seminar will focus on fruitful ways forward in this quantitative replication debate. I will discuss different forms of replication and specifically highlight the importance of constructive replications to advance knowledge generation and theorizing in management science.

In Part II, I will discuss the unique contribution qualitative research can make to the replication debate, i.e., through restudies. Restudy techniques have a long tradition in other disciplines (e.g., history, sociology, anthropology) and present considerable opportunities for a broader and more impactful application via re-theorizing in management research. Yet, there are only few applications of restudies in management to date. In this presentation, I will introduce a taxonomy of qualitative restudy designs that can be found both in management and strategy research and in the social sciences more broadly. I will then discuss important implications of restudies for re-theorizing in future qualitative and quantitative research – and for rethinking the nature of replication itself.

Research Engagement

Dr Chris Smith

Biography



Dr Chris M. Smith is a Senior Lecturer (Associate Professor) in Operations and Critical Systems at Alliance Manchester Business School. Chris obtained his PhD in 2015 from the University of Warwick in Operational Research and Management Science having been funded through the Warwick Business School Scholarship. His post-doctoral work on the involvement of spontaneous volunteers in a flood event has informed local and national policy. His work with Warwickshire Police identified and implemented over £800,000 of efficiency savings year on year transforming the customer contact department developing a structure that was fit for purpose where resources better matched demand. His research approach is focused on helping organisations and governments make better decisions during times of uncertainty using systems and process modelling approaches.

Synopsis

The session will take a look at what does engagement means for universities staff and faculty in both research and teaching. It considers such questions as, why do we engage with businesses? Why do businesses engage with universities? And, why is impact important? The session seeks to improve the engagement literacy of participants and offers some mechanisms for engagement for PhD students.

Divisional Talks

Dr Emiel Jerphanion, A&F Divisional Talk

Biography



Emiel Jerphanion joined the Manchester Business School as a lecturer (assistant professor) in finance in September 2020. He has obtained a PhD in Finance from Tilburg University. His research received the best paper award on the EFA 2020 Annual Meeting and has appeared on the programmes of other leading conferences such as the SFS Calvalcade North America, Colorado Finance Summit, Adam Smith Workshop and the AEA Conference.

Synopsis

The recent growth in the availability of student loans in many countries has increased the share of graduates with a severe debt burden. However, the economic consequences of the supply of student loans are likely to extend beyond the students since the portfolio of parents is typically designed to finance the education of their children. Most parents report the education of their children is one of the main motivations behind their saving decisions. Despite these potential economic consequences for the parents, we know very little about the effect of student debt on parents' portfolios. I will present empirical evidence on the spillovers of student loan supply on parents' portfolio decision. I document a decrease in parents saving after the expansion in the student loan supply. Subsequently I examine how this decrease in savings translates into portfolio investments.

Professor Mark Healey, IMP Divisional Talk

Biography



Mark Healey is Professor of Strategic Management and Head of the Innovation Management and Policy Division at Alliance Manchester Business School, University of Manchester, UK. His research focuses on managerial and organizational cognition, particularly the role of cognition and emotion in strategic adaptation. Mark's research has appeared in some of the world's leading management journals, including *Academy of Management Journal*, *Academy of Management Review* and *Strategic Management Journal*. His research has featured regularly in the business press, including The Financial Times, Forbes, and Harvard Business Review. He has advised senior leaders and executive teams in various sectors, from financial services to advanced

manufacturing, on the challenges of thinking and acting strategically in a changing world. He is an Associate Editor of the *Journal of Management Studies* and has served on the editorial boards of other leading journals, winning several awards for his services to the scholarly community.

Synopsis

Making your Mark in Management Research: Contribution, Conversation, and Context

Academics often assess contributions to management research in terms of their influence on the scholarly conversation. In this talk, I will draw on a recent editorial on *Changing the Scholarly Conversation* to introduce the idea of research as conversation as a way of thinking about your own scholarly contribution. Reflecting on my experiences as author and editor, I will offer guidance and tips for thinking in terms of the scholarly conversation and how to use this advice to avoid common pitfalls when trying to publish your work in leading management journals.

Professor Peter Buckley, PMO Divisional Talk

Biography



PETER J. BUCKLEY (BA (Econ), York; MA, East Anglia; PhD Economics, Lancaster; Dr hc (Uppsala); DSc hon (Lappeenranta) Dr. Merc.H.C. (Copenhagen)) is Professor of International Business at Alliance Manchester Business School, Founder Director of CIBUL (1995) and Founder Director of the Business Confucius Institute at the University of Leeds (BCIUL). He has held Visiting Professorships at University of Paris I: Pantho-Sorbonne, Faculty of Management and Organization, University

of Groningen, The University of Rennes I, Hong Kong City University, BI Oslo, the University of Granada, University of Lancaster and the University of Reading. He has published 28 books in English in both UK and USA including one in German.

Specific interests include: The theory of the multinational enterprise, methods of foreign market entry and development, the management of co-operative strategies, theoretical and empirical work on joint ventures and alliances (including specific projects on UK international alliances), knowledge management in multinational firms, transfer pricing in multinational firms, economic integration and the strategy of multinational firms, international takeovers (including cultural aspects of post-merger integration, the impact of globalisation and government policies on multinationals. Specific area interests in China, India, the EU and NAFTA. International Business Strategy, MBA Full-time and Executive International Business (U/G, Post-Experience)

Synopsis

The Long Run Development of International Business as a Subject.....and How you can Contribute

th
Peter J. Buckley 200 Anniversary Chair in International Business, Alliance Manchester Business School

Three phases of international business theory are analysed from the 1950s onward.

1. Creating Theory – Explaining the Evolving Phenomena of the Global economy.

2. Reacting to Theory - From Big questions to Grand Challenges.

3. Using Theory for Wider Social Purposes - Grand Challenges.

Future Topics in IB are suggested and suggestions are made about how to join the current conversation.....and how to change the conversation, based on precedents from past development of theory in IB.



Professor Michelle Carter, MSM Divisional Talk

Biography

Michelle Carter is a Professor of Information Systems in the Alliance Manchester Business School's Division of Management Sciences and Marketing at the University of Manchester. Michelle earned her PhD in Management (Information Systems) from Clemson University, SC. Her research focuses on information technologies' involvement in identity and social change, factors that shape IT usage behaviors, and information systems management. Michelle's work has appeared in *MIS Quarterly*, the *European*

Journal of Information Systems, the *Journal of the Association for Information Systems*, the *Journal of Information Technology*, as well as other journals, books, and conference proceedings.

Michelle is co-Editor-in-Chief of *AIS Transactions on Replication Research*. She serves as a senior editor for the *European Journal of Information Systems* and as an associate editor for *MIS Quarterly*. Michelle is a Distinguished Member – Cum Laude of the AIS. She is a past president of the Association for Information Systems (AIS) Special Interest Group on Social Inclusion and previously chaired the AIS committee on diversity and inclusion. In 2021, she was elected to serve on the AIS Council as Vice President for Special Interest Groups and Colleges.

Synopsis

"Navigating Theory Development in an Increasingly Digital World" In a fast-evolving digital landscape, "crafting robust theoretical frameworks is challenging. Yet, with the consequences of emerging technologies for humans and society not fully understood, theory is vitally important. It provides the frameworks to anticipate, understand, and guide the implications of technological innovations. Drawing from my own experiences, I will explore the challenges of developing compelling theories that remain relevant amidst continuous advancements. Students will gain insights into what makes a theory paper rigorous, interesting, and impactful, and how theory development differs from empirical research.



Academic Careers, Dr Sarah Ashworth

I find the pursuit of research fascinating, and I love working with researchers to help them make real whatever they want out of life. I started (professional) life as a microbiologist, studying first at Bristol (BSc), then at Manchester (PhD) with a couple of years in between working in the Pharmaceutical Industry (AstraZeneca).

A quick stint in a charity (Groundwork) and many failed attempts at becoming an environmental consultant saw me land what was to become my dream job in Researcher Development.

Since starting that role in 2003 I have invested time and study to provide the best support I can to UoM (and other, but mostly UoM!) researchers. I hold qualifications in training design; in coaching and mentoring; as well as recognition by AdvanceHE for commitment to teaching in Higher Education.

Appendix

Best Doctoral Paper Competition

The shortlisted candidates for this year's Best Doctoral Paper Competition award are:

Division	Forename	Surname	Title of Paper
PMO	Eleni	Chiarapini	The contribution of immigrant entrepreneurship research to entrepreneurship scholarship: An integrative review.
A&F	Yue	Feng	Outside Employment Opportunities and Tournament Incentives
MSM	Guowei	Huang	The Impact of Influence Tactics on Sharing Behaviour in Brand Messaging
MSM	Roisin	Jordan	The role of essential businesses in whole-of-society resilience to disruption
A&F	Xiangyu	Lin	The Effects of US Open Banking Adoption
MSM	Nazanin	Nami	Circular economy application in pharmaceutical supply chains in the UK: a holistic evolutionary game approach
PMO	Galih	Sakitri	Leisure and Narcissism: Understanding the Dual Effect of Entrepreneurial Leader Proactivity on Team Outcomes through Team Proactive Motivational Pathways
IMP	Yiwen	Sun	Global Digital Platforms' Non-Market Strategies in Response to Institutional Pressure
MSM	Jieyichi (Jenny)	Zhao	Green CSR Initiatives and Customer Outcomes: A Meta-analysis

Social Responsibility Paper Competition

Social Responsibility (SR) is one of the three core goals of the University of Manchester and the Alliance Manchester Business School. We aim to embed SR fully in our research, including research conducted by our PGR students. One way to make our research socially responsible is to follow the basic principles of Responsible Research in Business and Management (RRBM).

The shortlisted candidates for this year's SR Paper Competition award are:

Division	Forename	Surname	Title of Paper
PMO	Kashfia	Ameen	Worker Power in the Garment Global Value Chain: Evidence from the Bangladeshi Garment Industry
IMP	Drake Keyang	Zhou	Enhancing Social Responsibility in Business Schools: A Comparative Analysis of Responsible Management Learning and Education Integration Patterns and Connection to Responsible Research in Business and Management

Abstracts Roundtable Sessions

Division	Forename	Surname	Title of Abstract
Management (University of Lancaster)	Achmad Faizal	Azmi	The Effect of Disaggregated Assets and Liabilities Held for Sale Disclosure in Partial-Firm Acquisitions
Economics (University of Liverpool)	Victoria	Biagi	Making way for education: the localised effects of reusing confiscated Mafia houses in the South of Italy
Economics (University of Liverpool)	Shoumeli	Das	The impact of a safe motherhood cash transfer programme on intimate partner violence in India
Management (University of Liverpool)	Davidmac	Ekeocha	Energy Efficiency Capitalization
Economics (University of Liverpool)	Luke	Walsh	The Effect of Pay Secrecy Bans on Wages and Discrimination Complaints

Copies of all papers and abstracts:

The contribution of immigrant entrepreneurship research to entrepreneurship scholarship: An integrative review

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ABSTRACT

Immigrants make important contributions to entrepreneurship in many countries. While interest in immigrant entrepreneurship has been steadily growing over time, immigrant entrepreneurship research and the broader entrepreneurship field have developed largely in isolation from one another. Our integrative review aims to demonstrate the contributions that immigrant entrepreneurship research can make to the broader field of entrepreneurship scholarship. To this end, based on our review, we develop a multilevel framework, identifying micro-, meso- and macro-level factors shaping immigrants' entrepreneurial actions and outcomes. Our framework has implications for several important debates in immigrant entrepreneurship research specifically and the

entrepreneurship field more broadly, including the role of context and embeddedness in entrepreneurship, the insights from multilevel analysis of entrepreneurship, the heterogeneity of entrepreneurs and forms of entrepreneurship, migration as environmental change influencing entrepreneurship, and the nature of entrepreneurial opportunities. We also identify promising avenues for future research.

INTRODUCTION

In 2020, there were 281 million international migrants worldwide (United Nations, 2020). Once settled in their countries of migration destination, many immigrants engage in entrepreneurship, and immigrant entrepreneurship is of significant economic and societal relevance. For instance, in the United States, immigrant entrepreneurs constitute a substantial share of the self-employed and start 25% of new ventures, with 40% of Fortune 500 companies being founded by first or second-generation immigrants (Kerr and Kerr, 2020). Thus, on the one hand, immigrant entrepreneurs are overrepresented amongst the sole proprietors and self-employed in “corner shops”, restaurants and similar businesses. On the other hand, immigrants are also overrepresented amongst high-impact entrepreneurs (Azoulay *et al.*, 2022; Fairlie and Lofstrom, 2015b; Kerr and Kerr, 2020) being 35% more likely to have a patent (Azoulay *et al.*, 2020) and more likely to implement product or process innovation (Ostrovsky and Picot, 2020).

Despite immigrants’ important role as entrepreneurs, immigrant entrepreneurship has remained a marginal field in the broader entrepreneurship literature (Ram *et al.*, 2017), with the two literatures developing largely separately. This is lamentable as immigrant entrepreneurship presents both a highly relevant phenomenon in itself as well as a fruitful context to learn about broader entrepreneurial and societal phenomena (Portes and Sensenbrenner, 1993; Coleman 1988). In this integrative review, based on a “review of reviews” and our own review of 93 articles in entrepreneurship and management journals, we investigate how immigrant entrepreneurship research can inform the theoretical and empirical understanding of entrepreneurship at large, i.e., how immigrant entrepreneurship research can inform the broader entrepreneurship field. We also

investigate how a closer integration with mainstream entrepreneurship can offer opportunities for advancing immigrant entrepreneurship.

We develop a *multilevel* framework capturing how micro-, meso- and macro-level factors shape immigrant entrepreneurship activities and outcomes, integrating key insights from the literature. At the micro-level, immigrants possess specific heterogeneous resources, human capital, social capital, entrepreneurial motivations, and experiences that shape entrepreneurial endeavors (Dheer, 2018; Duan *et al.*, 2020). Meso-level influences on immigrant entrepreneurship include co-ethnic enclaves (Borjas, 1986; Marinoni, 2023), and in some cases even cross-border social networks (Drori *et al.*, 2009). Co-ethnic enclaves offer both market opportunities and resources to immigrants. However, in order to grow their ventures, some immigrant entrepreneurs eventually move beyond the co-ethnic network to target the mainstream market in the destination country, and some may also internationalize. Macro-level influences include *destination*-country institutions affecting immigrant entrepreneurship directly (e.g., extent of regulation of entrepreneurship) and indirectly (e.g., immigration and integration processes) (Agarwal *et al.*, 2021; Aldrich and Waldinger, 1990), *origin*-country influences such as cultural imprints (Kleinhempel *et al.*, 2023), and *dyadic distance* effects between immigrants' country of origin and migration destination (Mata and Alves, 2018). Micro, meso, and macro-level effects critically influence immigrant entrepreneurship through distinct, albeit interdependent and complementary, mechanisms. We take a *multifaceted* view of immigrant entrepreneurship, focusing both on venture creation as well as on the subsequent growth of the enterprise by targeting new markets, innovation, and internationalization, and economic and non-economic outcomes at different levels.

Our multifaceted multilevel framework offers a novel integrated perspective to immigrant entrepreneurship research (Amornsiripanitch *et al.*, 2023; Kerr and Kerr, 2020; Morgan *et al.*, 2018; Neville *et al.*, 2014). We extend previous reviews identifying drivers and obstacles associated with immigrant entrepreneurship (Aldrich and Waldinger, 1990; Dabić *et al.*, 2020; Fairlie and Lofstrom, 2015b; Sinkovics and Reuber, 2021). This framework also allows us to speak to the relationship between immigrant entrepreneurship research and broader entrepreneurship scholarship, i.e., to

identify how immigrant entrepreneurship research can enrich entrepreneurship theory. By highlighting the multiple embeddedness of immigrant entrepreneurship (Harima *et al.*, 2021; Kloosterman, 2010), our framework helps deepen the understanding of context in mainstream entrepreneurship research. Our multilevel framework allows us to synthesize the literature in an integrative and novel way, responding to recent calls to carefully unpack levels of analysis in (immigrant) entrepreneurship research (Kim *et al.*, 2016).

Our framework enables us to explore how immigrant entrepreneurship relates to key debates in the broader entrepreneurship field, including ongoing efforts to contextualize entrepreneurship research (Welter, 2011). As noted by Welter (2011, p. 165), “[t]here is growing recognition in entrepreneurship research that economic behaviour can be better understood within its historical, temporal, institutional, spatial, and social contexts, as these contexts provide individuals with opportunities and set boundaries for their actions”. Recent contributions link the notion of context closely to embeddedness (Korsgaard *et al.*, 2022), which we explore in the setting of immigrant entrepreneurship. Based on our framework, we develop a research agenda for (immigrant) entrepreneurship, unpacking the heterogeneity of immigrant entrepreneurship and entrepreneurs, and considering how the key prior decision of migration links to entrepreneurship decisions.

REVIEW APPROACH

We adopt an integrative review format, “seek[ing] to review, critique, and synthesize ‘representative’ literature to generate new theoretical frameworks and perspectives” (Fan *et al.*, 2022, p. 173).

Balancing the respective benefits of narrative and systematic reviews, this approach is suitable for our aim of exploring the theoretical and empirical integration of immigrant entrepreneurship and the broader entrepreneurship field. Our approach consists of three main components, in line with the aim of this review to contextualize immigrant entrepreneurship research and explore the relationship between immigrant entrepreneurship and broader entrepreneurship research. First, we investigated several previous reviews that have explored the immigrant entrepreneurship literature from different perspectives (Aldrich and Waldinger, 1990; Aliaga-Isla and Rialp, 2013; Dabić *et al.*, 2020; Fairlie and Lofstrom, 2015b; Parker, 2004; Sinkovics and Reuber, 2021). Second, we consulted literature

reviews on the broader entrepreneurship field, to gauge the impact of immigrant entrepreneurship so far (Busenitz *et al.*, 2003; Meyer *et al.*, 2014). This “reviews of reviews” approach helped us gain a broad overview of the sub-field and its co-evolution with the broader entrepreneurship field. Third, we carried out our own review focusing on English-language articles in highly ranked ABS-ranked journals in entrepreneurship and business and management. Besides capturing the most recent contributions in the main entrepreneurship and management journals, this review specifically aimed to complement the insights offered by previous reviews in three ways: (i) taking an explicit multilevel approach in reviewing the literature to better understand the interactions between the different level of analysis (ii) explicitly investigating whether and how immigrant entrepreneurship studies discuss the relationship with the broader entrepreneurship field; and (iii) focusing on emerging topics in immigrant entrepreneurship such as a multifaceted approach to entrepreneurship, including performance, innovation, and internationalization.

Previous reviews of immigrant entrepreneurship

Immigrant entrepreneurship can be defined as *entrepreneurial activities of foreign born-individuals in a country different from their country of birth* (Aldrich and Waldinger, 1990), with the ‘immigrant’ being used to refer “to individuals (first generation) and their children (second generation) who were born abroad or who arrived in the host country with their parents as children” (Sinkovics and Reuber, 2021, p. 2). Immigrant entrepreneurship research has overlaps –to varying degrees– with the literatures on transnational entrepreneurship (Drori *et al.*, 2009), ethnic entrepreneurship (Meyer *et al.*, 2014), refugee entrepreneurship (Abebe, 2023), returnee entrepreneurship (D. Lin *et al.*, 2016; Qin *et al.*, 2017), and diaspora entrepreneurship (Elo *et al.*, 2022). However, immigrant entrepreneurship is distinct from each these in important ways. While some immigrants engage in transnational entrepreneurship across borders, most focus their activities to the destination country. While ethnicity, diaspora and minority status often play an important role in immigrant entrepreneurship, unlike immigrants who have arrived in the destination relatively recently, a given ethnic, or diaspora group may have been present in a country for centuries. As noted by (Malki *et al.*, 2020), this can also imply some important differences between immigrant entrepreneurs and ethnic

entrepreneurs. Refugee entrepreneurs represent a subset of immigrant entrepreneurs, while returnee entrepreneurs are immigrants returning to their origin country to engage in entrepreneurship. Immigrant entrepreneurship is thus defined by the recent migration event, preceding the entrepreneurial activity.

Immigrant entrepreneurship research originates from a variety of disciplines, including from economics (Borjas, 1986), and sociology (Aldrich and Waldinger, 1990; Bonacich, 1973) and spanning fields such as migration studies (I. Light and Bonacich, 1990; Rath and Kloosterman, 2000), management, and entrepreneurship research (Kloosterman, 2010). These rich diverse roots have gone hand in hand with a diversity of perspectives, and, at times a fragmentation of the literature (Sinkovics and Reuber, 2021). Several recent reviews have consolidated the field. (Aliaga-Isla and Rialp, 2013, p. 820) conducted the “first systematic review of the immigrant entrepreneurship field”, covering articles from various disciplines, including entrepreneurship, economics, IB and general management. The review identified the research objectives, geographical research settings, theoretical frameworks and methodologies appearing in the literature so far. Fairlie and Lofstrom (2015) reviewed economics literature on immigrant entrepreneurship, with a focus on the economic contributions of immigrant entrepreneurs. Dheer (2018) identified antecedents, process, and outcomes of immigrant entrepreneurship at different levels of analysis, also offering insights on the emerging contribution of this literature to the broader entrepreneurship field. Dabić *et al.* (2020) identified six main themes in the literature: entrepreneurial motivations and intentions, identity building and competences, strategies and internationalization, ethnic networks, intercultural relations, and resources.

Later reviews considered specific aspects of immigrant entrepreneurship. Malki *et al.* (2020) focused on issues relating to financing of immigrant entrepreneurship, while Malerba and Ferreira (2021) considered strategies employed by immigrant entrepreneurs, in terms of key decisions such as which markets to serve (co-ethnic or mainstream), sourcing of resources, and the process of opportunity identification. Duan *et al.* (2020) zoomed in on the motivations for immigrants to engage in entrepreneurship, discussing push and pull factors related to personal characteristics as well as external conditions. Aiming to inform future research efforts in the discipline of international business

(IB), Sinkovics and Reuber (2021) conducted a multi-disciplinary review and identified antecedents (push and pull factors), success factors and outcomes from immigrant entrepreneurship.

Lastly, Ramos-Escobar *et al.* (2022) undertook a bibliometric review, identifying an exponential growth in the number of publications, with distinct stages in the evolution of the literature. The early literature featured a relatively limited set of topics focused on labor markets, ethnic enclaves, and ethnic minority status. Over time, research broadened to cover additional aspects in terms of migration, and the drivers of, barriers to and outcomes of immigrant entrepreneurship. Literature compared immigrants to natives, considered entrepreneurial motivations, investigated new countries, and focused more on the role of context. Ramos-Escobar *et al.* (2022) also demonstrated that most studies had been published in migration and ethnic studies journals, but with some entrepreneurship journals being represented.

Original review

Our review focused on selected ABS 3 and 4 journals in entrepreneurship and management, focusing on the diffusion of immigrant entrepreneurship into mainstream journals. The research process for the review was focused on database searches in the selected journal homepages using keyword strings combining “entrepreneur” with relevant terms such as “migrant”, “immigrant”, “diaspora”, “transnational”. While our focus is not on the latter two, we included them to ensure that we captured relevant studies that might have used other terms. We also conducted specific searches with additional keywords such as “internationalisation” and “innovation”, to capture literature related to these emerging themes in immigrant entrepreneurship. Furthermore, we also included innovation and international business journals to capture studies focusing on innovation and internationalization in the setting of immigrant entrepreneurship. We did not restrict the timeframe of the review backwards and added studies up until February 2024. We screened out among others articles that were not referring to entrepreneurship but only migration, such as in the case of articles focusing on multinationals employing immigrants. Once we scoped out papers that were not relevant to our review, we analysed the papers by coding factors at the macro, meso and micro level of analysis and

we highlighted the interlinkages between them. Our sample for analysis consisted of 193 articles, with the distribution across journals shown in Table 1.

Table. 1

<i>Journal Name</i>	<i>Papers number</i>
<i>Academy of Management Journal</i>	1
<i>Administrative Science Quarterly</i>	3
<i>Asia Pacific Journal of Management</i>	3
<i>Entrepreneurship & Regional Development</i>	8
<i>Entrepreneurship Theory and Practice</i>	6
<i>Environment and Planning C: Government and Policy</i>	1
<i>Global Strategy Journal</i>	1
<i>International Business Review</i>	3
<i>International Small Business Journal</i>	2
<i>Journal of Business Venturing</i>	5
<i>Journal of International Business Policy</i>	3
<i>Journal of International Business Studies</i>	8
<i>Journal of International Management</i>	4
<i>Journal of Management Studies</i>	1
<i>Journal of Small Business</i>	2
<i>Journal of World Business</i>	9
<i>Management Science</i>	4
<i>Research Policy</i>	9
<i>Small Business Economics</i>	9
<i>Strategic Entrepreneurship Journal</i>	5
<i>Strategic Management Journal</i>	2
<i>Organizational Science</i>	4
<i>Total Journal Articles</i>	93

A MULTILEVEL REVIEW

We adopt an explicit multi-level structure for the discussion (Kim *et al.*, 2016; Terjesen *et al.*, 2016), considering micro-, meso- and macro-level factors for both origin-country and destination-country (as well as their dyadic distances), and highlighting key links between factors at the different levels of analysis.

Micro-level

Micro-level factors refer to individual- and firm-level factors here. Like in general entrepreneurship literature, immigrant entrepreneurship literature has considered the motivations () for immigrants to engage in entrepreneurship and the resources they can mobilize for entrepreneurial efforts (Murnieks *et al.*, 2019; Duan *et al.*, 2021). In terms of motivations, a key theme in the literature has been the distinctions between *necessity-driven* and *opportunity-driven* immigrant entrepreneurship (Clark and Drinkwater, 2000; Kloosterman, 2003; Malerba and Ferreira, 2021) or push and pull entrepreneurship (Duan *et al.*, 2021). Necessity-driven entrepreneurs are those who have little choice other than to engage in entrepreneurship due to barriers and challenges in the host country's labor market. For example, the literature has highlighted the role of limited access to formal employment (Clark and Drinkwater, 2000; E. S. Lee *et al.*, 2020; von Bloh *et al.*, 2020), shifting market opportunities depending on the business sector (Aldrich & Waldinger, 1990), high unemployment rates (Baycan-Levent and Nijkamp, 2009; Karadal *et al.*, 2021), discrimination (Constant & Zimmermann, 2006), low wages (Karadal *et al.*, 2021), limited promotion opportunities due to the “accent ceiling” (Aldrich and Waldinger, 1990; Collins and Low, 2010; González-González *et al.*, 2011; Karadal *et al.*, 2021). Such issues may be experienced not only by first-generation but also second-generation immigrants (Beckers and Blumberg 2013).

In contrast, opportunity-driven entrepreneurs are those who, despite often having attractive alternative opportunities such as employment, exploit their innovative skills (Hunt, 2011) and transnational networks (Portes *et al.*, 2002) to create and grow businesses, often making notable contributions to the host country's economy and innovation (Kahn *et al.*, 2017; Saxenian, 2002). The literature has

increasingly recognized the value of high-skilled immigrants for the host country (Kerr *et al.*, 2015; Saxenian, 2002) but also the home country (Wang, 2020). One study refers to these two stylized categories of (immigrant) entrepreneurs as “misfits” and “stars”, respectively (Åstebro and Thompson, 2011; Kahn *et al.*, 2017)

To some extent, this distinction between necessity-driven and opportunity driven entrepreneurs is related to the decision of immigrant entrepreneurs of which markets to serve. The literature highlights that many immigrant entrepreneurs focus, at least to begin with, on co-ethnic markets within so-called *ethnic enclaves*, defined as “immigrant groups that concentrate within a specific spatial location” (Marinoni, 2023, p. 1). Within enclaves, immigrant entrepreneurs may find demand for specific products and services and access to inputs, including employees, while facing lower entry barriers in terms of the required investments. An important theme in the literature has however been that although such enclaves may provide a “safety net”, focusing on co-ethnic markets may restrict growth opportunities, and even jeopardize longer-term survival if the markets are characterized by fierce low-cost competition (Kloosterman, 2010; Malerba & Ferreira, 2021; Shinnar *et al.*, 2011).

Entrepreneurial motivations have also been linked to personal and demographic characteristics (Duan *et al.*, 2021). Psychological perspectives on entrepreneurial motivation focus on the role of social-cognitive and affective processes, influenced by personal perceptions, identity, and interactions with the environment. Entrepreneurial motivations are also driven by a desire for autonomy, achievement, power, and social status. The literature has also demonstrated the relevance of characteristics such as a preference for self-employment and “being one’s own boss”, self-confidence and willingness to take risks, innovativeness, and others (Gorgievski and Stephan, 2016; Kerr *et al.*, 2018; Rauch and Frese, 2007; Zhao *et al.*, 2010; Rametse *et al.*, 2018). Some studies have found that migration is motivated by a desire for freedom and autonomy, which in turn was positively associated with entrepreneurial motivation (Bosiakoh and Tetteh 2019). A specific motivation for immigrants may also be to become more integrated in the host country.

Other demographic characteristics have also been studied, such as age and gender. The effect of age is mixed in the literature, but with some evidence that the propensity for entrepreneurship increases from

around 20 years to 50 years of age, declining afterwards (Azoulay *et al.*, 2020). In terms of gender, studies have found that men immigrants have a stronger tendency for entrepreneurship than women immigrants, which has been explained by men's need to earn money for familial responsibilities. While one study set in Sweden found that immigrant-owned firms have better performance than native owned firms (Neuman 2021), it also found that men have higher profits.

Immigrant entrepreneurship is also influenced by the *resources* immigrants possess. The literature consistently highlights the key importance of human capital, social capital and financial capital for immigrant entrepreneurship (Brieger and Gielnik, 2020; Lin and Yang, 2017; Sanders and Nee, 1996). Human capital includes education and skills. In the case of immigrant entrepreneurs, insufficient host-country language skills can make entrepreneurial efforts challenging (although lack of language skills can also be a barrier to employment). Moreover, some immigrants may have strong educational credentials from the home country that are not recognised in the host country. In some cases, these individuals may still be able to benefit from their education and skills through entrepreneurship (Kloosterman, 2010; Sanders and Nee, 1996).

Resources are also closely linked to the type of entrepreneurship that is undertaken. Immigrants can compensate for lack of host-country language skills and (recognized) education by focusing on co-ethnic markets. However, to benefit from opportunities in the mainstream market, immigrant entrepreneurs generally require a certain level of education, country-specific language and cultural skills, and social contact with the native population (Beckers and Blumberg 2013). The literature also highlights that barriers are still faced by minority entrepreneurs when it comes to access to financing, the inexperience, cultural barriers, perceived discrimination, market penetration and marketing as well as the lack of business and social connections in the country (Teixeira et al. 2007; Malki et al., 2010). A lesser extent of integration in the host society may lead to lower trust between immigrant entrepreneurs and financiers. Studies have also demonstrated discrimination in the formal credit market, leading to a higher rate of denial of loans. Less integration and discrimination also both lead to a greater degree of information asymmetry, with less access to information on available financing means and processes on the open market (Malki et al, 2020).

Immigrants may have less social capital with reference to the mainstream market, due to lack of access to networks, liability of foreignness and less legitimacy (Achidi Ndofor and Priem, 2011; Griffin-El and Olabisi, 2020). A key theme in immigrant entrepreneurship literature is how co-ethnic networks can help entrepreneurs access information, as well as key resources such as finance and labour. Social capital is intimately related with meso-level factors as discussed next.

Meso-level

By *meso-level* factors, we mean factors that are situated at a higher level of analysis than the individual entrepreneur and firm, but at a lower level than macro factors such as formal and informal institutions, culture and government policy (Kim *et al.*, 2016). Migrant social capital refers to the resources attainable by the entrepreneur through a network of social relationships (Adler and Kwon, 2002). Entrepreneurs may form or access networks through participating in various ethnic, religious, professional and social groups (Malerba & Ferreira, 2021).

One of the most important themes in immigrant entrepreneurship since the first studies has been the extent of immigrants' "embeddedness" in co-ethnic networks (Achidi Ndofor and Priem, 2011; Marinoni, 2023; Portes and Sensenbrenner, 1993). The literature has demonstrated how embeddedness in such networks has implications both for the resources immigrants can access for entrepreneurial activities, and the nature of the activities undertaken. The seminal work of Borjas (1986) highlighted that the proximity with immigrants sharing a common background promotes self-employment of immigrants. Ethnic networks and ties can provide economic resources, knowledge spill-overs and social capital (Bates, 1997; Czinkota *et al.*, 2021; Sanders and Nee, 1996; Saxenian, 2002). For instance, family resources can act as substitutes of formal financial institutions for the financing of new immigrant firms as in the case of Chinese and Korean immigrants in the USA have relied on financial credit association when formal financing was inaccessible (Bates, 1997).

Moreover, co-ethnic enclaves provide specific opportunities for immigrants to serve "ethnic" markets. By leveraging co-ethnic ties immigrant entrepreneurs can access cheap raw materials, information and production resources, allowing the pursuit of commercial opportunities closed to natives (Pruthi *et al.*, 2018). Firms with immigrant owner-managers often benefit from lower costs by employing co-

ethnics, especially in labour intensive industries (Kulchina, 2016, 2017; Wang and Liu, 2015). The literature highlights the importance of the ethnic community as an essential source of economic capital when the access to formal financing is limited (Malki et al., 2020). Geographical proximity with family members allows the support, guidance, and unpaid family labour (Bird and Wennberg, 2016). Moreover, members of the family can help support the entrepreneurs with financial family capital (Zhang and Reay, 2018). Although co-ethnic networks can provide important resources and opportunities for immigrant entrepreneurs, embeddedness in such networks can also act as constraints to immigrant entrepreneurs' developments (Zhang and Reay, 2018). The use of family financial capital can have both positive and negative effects. On one hand, it allows lower reliance on financial institutions, but on the other hand immigrants entrepreneurs may experience financial control from the family members (Zhang and Reay, 2018).

Another important question in the literature has therefore been the circumstances under which immigrant entrepreneurs are able to "break out" from the co-ethnic market to target the host-country mainstream market or even international markets (Dabić *et al.*, 2020; Malerba and Ferreira, 2021). The level of integration that immigrants have in the host society influences the decision to serve the ethnic or the mainstream market (Chaganti and Greene, 2002). The sociology literature has explored the interaction of immigrants in the host country and their ability to integrate (Agius Vallejo and Keister, 2020; Aldrich and Waldinger, 1990; Bonacich, 1973; Drouhot and Nee, 2019; Portes and Sensenbrenner, 1993; Waters and Jiménez, 2005). Conversely, a strong involvement of immigrant entrepreneurs with ethnic ties can bound their operations to operate within the co-ethnic community, while lower levels of involvement allow entrepreneurs to operate in the mass market (Chaganti and Greene, 2002). The decision of serving the mainstream market presumes some independence of the entrepreneur from the co-ethnic community, as the immigrant entrepreneur must have the professional and managerial skills as well as the information available to operate outside the ethnic community (Arrighetti *et al.*, 2014).

Higher levels of co-ethnic human capital generate positive spillovers (Borjas, 1986) as well as previous entrepreneurial experience increase the likelihood that immigrant entrepreneurs target the

mainstream market (Achidi Ndofor and Priem, 2011). As highlighted by many recent studies, while traditionally a large share of immigrant entrepreneurship consists of small self-employment ventures, immigrant entrepreneurs also establish innovative ventures that go on to become large firms with many employees (Saxenian, 2002). Studies found that SMEs with immigrant founders are more likely to innovate than firms founded by natives (Ostrovsky and Picot, 2020) and more likely to produce patents and achieve financial success (Amornsiripanitch *et al.*, 2023). Such examples illustrate the importance of the distinction between self-employment and high-impact entrepreneurship. Immigrants firms' contributions to innovation have been widely acknowledged in the US setting (Kahn *et al.*, 2017; Kerr and Kerr, 2020, 2016) and Canada (Arrighetti *et al.*, 2014).

Some immigrant ventures take a further step to internationalize their activities beyond the destination country. The literature highlights how migrant owned firms engaging in international activities have higher survival rates compared to migrant firms not engaged in international activities (Jiang, 2016). Again, the literature has found networks to play a relevant role. Family and ethnic ties and connections with business and social networks in the host society influence not only the integration of an immigrant in the host society (Beckers and Blumberg, 2013) but also the successful creation, internationalization and performance of their ventures, enabling access to international markets and opportunities (Ellis, 2000). The level of embeddedness of immigrants in their ethnic community is often a predictor of their international activities (Cai *et al.*, 2021; Lin & Yang, 2017). Specifically, the immigrant's ethnic network in the host society influences the trade and export levels; trade is affected by the immigrants' ethnic network skill level, as lower-skilled immigrants have a pro-trade effect (Lin and Yang, 2017).

Moreover, studies have demonstrated that immigrant entrepreneurs can build on cross-border networks back to the origin country for their internationalization. Some empirical results demonstrate that immigrants enjoy superior survival rates and export performance compared to native firms when pursuing international markets (Neville *et al.*, 2014). Higher legitimacy experienced in the foreign country and their ability to leverage their double embeddedness between the host and home countries, results in early internationalization strategies (Sui and Baum, 2014). While internationalising

entrepreneurial firms generally face high risks due to their limited assets and need to leverage their resources to overcome such limitations (Zacharakis, 1997), immigrants' international networks can help them overcome the information asymmetry and issues with contract enforcement, resulting in lower transaction costs (Dunlevy, 2004). Immigrants' language skills and knowledge of home country and institutionally similar countries present valuable assets (García-Cabrera *et al.*, 2020), allowing them to monitor their local as well as the global environment, without incurring in information asymmetry (Vinogradov and Jørgensen, 2017). Language presents an important factor for immigrant entrepreneurs internationalization strategies, as immigrant entrepreneurs prefer global internationalization over regional internationalization when language barriers hinder relationship building in regional markets (Sui *et al.*, 2015).

While international activities are linked with the presence of networks in the host country (Wang and Liu, 2015), export intensity does not automatically translate into higher export performance (Morgan *et al.*, 2018). The financial performance of high export intensity to the home country is influenced by the length of residence in the country of migration destination and the geographical proximity to the country of origin (Morgan *et al.*, 2020).

As an interesting example of the role of cross-border networks for finance specifically, crowdfunding platforms allow the immigrant entrepreneur to leverage outside networks, especially the home country networks allowing them to secure financial resources (Butticè and Useche, 2022). Moreover, the immigrants' connection with co-nationals allows venture capital firms (VC) firms to pursue foreign financial opportunities, otherwise inaccessible, as the knowledge of co-nationals enables VC firms to acquire reliable informal information which otherwise would be inaccessible (Balachandran and Hernandez, 2020). Immigrant linkages are not limited to within-country new venture financing but have also been associated with venture capital internationalization (Iriyama, Li, & Madhavan, 2010; Madhavan & Iriyama, 2009; Zhang, Wong, & Ho, 2016).

Macro-level

Although much immigrant entrepreneurship research has focused on ethnic networks, immigrant entrepreneurship is also deeply embedded in the macro context, including the institutional, economic

and cultural conditions of the host as well as the home country of the immigrants (Dabić *et al.*, 2020). Such influences of macro factors on immigrant entrepreneurship can be direct, such as when host-country institutional factors shape the opportunities and resources available for entrepreneurs (Urbano *et al.*, 2019). Many of these factors may have similar effects on immigrant and native entrepreneurs, but some, such as immigration regulations, affect only immigrants. Moreover, the immigrant entrepreneurship setting also introduces new channels for institutional influences on entrepreneurship, based on immigrants' links back to the *origin* countries (Liesl Riddle and Brinkerhoff, 2011) or cultural influences transmitted intergenerationally (Kleinhempel *et al.*, 2023). Lastly, institutional, and cultural differences between the origin and destination countries may be relevant.

Destination country

Numerous factors in the host country can have a major impact on the success of immigrants and their business. Relevant factors as identified by Ramos-Escobar *et al.*, (2022) include availability of funding, labour market conditions, access to suppliers and customers, social acceptance, professional service options, regulations in place and political climate. Advantageous conditions for the establishment of new entrepreneurial ventures include a robust economy, secure property rights, inclusive legislation and constrained market opportunities. (Morales *et al.*, 2022). Immigration regulations hinders the immigrant ability to pursue entrepreneurship as an early career path by linking immigration status to employment (Agarwal *et al.*, 2021). More specifically, entrepreneurial immigrants have to work in paid employment and wait until their citizenship is finalized before starting a business. Nonetheless, when restrictions are finally lifted, immigrants are more likely to establish incorporated ventures, the types of businesses where specialized human capital is leveraged and projected returns can outweigh higher opportunity costs (Agarwal *et al.*, 2021; Amornsiripanitch *et al.*, 2023; Y. S. Lee and Eesley, 2018).

Awaworyi Churchill (2017) considers how increases in ethnic groups or multiplicity of ethnicities in a community may have an impact on the business density of new businesses as well as the institutional environment. When looking more closely at female immigrant entrepreneurship, Brieger and Gielnik (2020) found that policy enhancing supportive conditions can augment female immigrant

entrepreneurship. Kontos (2003) when looking at the German context highlighted the importance of public support in place in Germany “*Überbrückungsgeld*” and how adequate support policy for underprivileged business starters with no access to the ethnic resources can allow better entrepreneurship participation. The entrepreneurial culture is influenced by the immigrants’ social networks and the perception of the community of the host country (Urbano *et al.*, 2011).

Referring to host-country institutions, the *mixed embeddedness* perspective of Kloosterman and colleagues (Barberis and Solano, 2018; Kloosterman, 2003, 2010) has explicitly linked the “opportunity structures” facing immigrant entrepreneurs to macro-level factors. Kloosterman’s argument was that entrepreneurial opportunities are intrinsically linked to markets. Kloosterman identified key types of markets based on the combination of two factors: Whether there is a low or a high threshold to enter the markets, and whether the markets are expanding or stagnating. Markets with low entry barriers and low growth potential (vacancy-chain markets) are often targeted by immigrants with limited resources. Ethnic markets are seen as a special case of these, which can (at least temporarily) provide a protected market niche, but one that is vulnerable to competition. Other markets (Kloosterman cited postal and parcel delivery markets) have low entry barriers but good growth opportunities. As these are attractive for both natives and immigrant entrepreneurs, the former may have incentives to attempt to erect other types of barriers such as formal educational qualifications. A third type of market involves higher entry barriers notably in terms of human capital, but also significant growth opportunities. Key examples include high-technology sectors as well as consultancy. Such markets are attractive for immigrants with high levels of education. Kloosterman goes on to discuss how different institutional framework, in terms of such dimensions as the state’s regulation of labour markets and business and the provision of goods and services, influence the access to different types of markets.

Host-country policies towards immigrant entrepreneurship also play an important role. Designing policies intended to attract and promote immigrant entrepreneurship has proved challenging, with researchers highlighting fallacies in their conception and the need for refinement of their application (Collins, 2003; Collins and Low, 2010). Migration programs introduced by different countries (e.g.,

Australia, Canada, US, Netherlands) produced heterogeneous effects, emphasizing how the volume and quality of entrepreneurial activities differ greatly across countries. For example, Australian policies were drafted to promote immigrant entrepreneurship like the “*New Enterprise Incentive Scheme*” however, only a limited number of unemployed immigrants have benefitted. At the micro-level, the paper has shown the importance to improve training and education for immigrant entrepreneurs to improve existing attempts to improve communications with the different governments’ levels. Policies should have acknowledged the gendered nature of migrant entrepreneurship and promote policies attracting female migrant entrepreneurs (Collins, 2003). Some successes have been reported with Dutch policies aimed at promoting self-employment among immigrants; these policies have successfully shifted push factors entrepreneurial motivation into pull factors towards self-employment (Beckers and Blumberg, 2013; Kloosterman, 2003), including the use of business incubators to promote innovative business ventures (Riddle *et al.*, 2010).

Origin country

An important characteristic of immigrant entrepreneurs is their various links to the home country, meaning that home-country institutional and cultural factors also play a role in their entrepreneurial decisions. As noted by Dabic *et al.* (2020), while cultural factors have only more recently been considered in the general entrepreneurship literature, they have been core to the immigrant entrepreneurship literature for a long time, due to the influence home-country culture may assert on immigrant entrepreneurs. Hence, home-country culture may affect the propensity for entrepreneurship, but also shape the particular activities that are undertaken in terms of what is accepted and valued in the country of origin (Drori *et al.*, 2009). A recent study shows how national entrepreneurial culture is transmitted intergenerationally and has a positive effect on second-generation immigrant entrepreneurship (Kleinhempel *et al.*, 2023).

Dyadic distance between the origin and the destination country

Dissimilarities between destination and origin countries matter due to the institutional, cultural and language differences between the two (Kulchina, 2017; Wang, 2020). Studies from international business have analysed home-host “distance”, based on concepts such as the liability of foreignness

(LOF) (Kostova and Zaheer, 1999; Luo *et al.*, 2002; Zaheer, 1995). Originally referring to the disadvantages of being foreign for a firm due to factors such as the lack of legitimacy and familiarity with the environment in the host country, constraints imposed by the host country; literature has showed that LOF affects not only enterprises (Mata and Alves, 2018), but also individuals (Kostova *et al.*, 2020; Kulchina, 2017; D. J. Wang, 2020). For MNEs, LOF has often been linked to institutional and cultural distance (Kostova *et al.*, 2020; Kostova and Zaheer, 1999). Wang (2020) applied Kostova's institutional distance concept to study returnee immigrant entrepreneurs, finding that institutional distance also plays a role for immigrants doing business across borders (Kostova *et al.*, 2020; Wang, 2020). The familiarity with the host country is an important aspect influencing survival rates and performance of immigrant firms (Mata and Alves, 2018).

IB literature has also used terms as “institutional acculturation” to refer to individuals' adaption to the differences between their home institutional environment and the new institutional environment (Riddle and Brinkerhoff, 2011). The migration literature has emphasized that the degree of institutional and socio-cultural diversity affects the level of embeddedness that immigrants have with co-ethnics in the host society (Mata and Alves, 2018), their level of success (Guercini *et al.*, 2017) and the entrepreneurial motivation in the host society (García-Cabrera *et al.*, 2020) as well as the home society (Wang, 2020). The institutional distance between home and host society can be an asset as well as a liability. The notion of Asset of Foreignness (AOF) (An *et al.*, 2021; Sethi and Judge, 2009) has also been applied to demonstrate how immigrants can sometimes benefit from their foreignness, thanks to the access to the collective resource referred to as transactive memory (Stoyanov *et al.*, 2018) nationalities to identify business opportunities (García-Cabrera *et al.*, 2020).

A MULTILEVEL FRAMEWORK AND AGENDA FOR (IMMIGRANT) ENTREPRENEURSHIP RESEARCH

Summary of framework

Our framework, illustrated in Figure 1, provides an integration of the immigrant entrepreneurship literature.

[FIGURE 1 HERE]

The framework is organized according to antecedents (drivers of entrepreneurship) at different levels of analysis and divided by home and host country, opportunities (here with focus on the markets targeted), and outcomes at micro, meso and macro level. At the *micro-level*, the framework captures individual motivations and resources for entrepreneurship, both of a push (e.g., labour market discrimination and language barriers) and pull (a desire to leverage human capital) nature. As typically ethnic (minority) entrepreneurs, immigrant entrepreneurs may differ from natives in terms of human, social and financial capital, but also on aspects such as entrepreneurial motivation.

Importantly, however, as noted in the literature these micro-level factors are themselves influenced by meso and macro-level factors. A key *meso-level* factor is the entrepreneurs' embeddedness in sub-societies represented by co-ethnic enclaves. Such co-ethnic networks can provide essential resources and shape entrepreneurial motivations and are often the starting point for entrepreneurial ventures.

However, to grow their businesses many immigrant entrepreneurs eventually target mainstream markets, requiring embeddedness in the destination country. Some entrepreneurs also target international markets in addition to (or instead of) mainstream host markets, implying embeddedness in international networks.

Immigrant entrepreneurship also involves a distinct meso-level factor in terms of varying degrees of embeddedness in cross-border networks representing links with the home country (Christensen et al. 2021). This implies that home-country macro-level factors are also relevant for immigrants' entrepreneurial activities and outcomes. Such influences may work directly when immigrant

entrepreneurs are embedded in both home and host networks. In other cases, the influence may be indirect when cultural factors from the home country are transplanted in the new setting through intergenerational transmission (Kleinhempel *et al.*, 2023). Finally, the framework captures how the pursuit of different opportunities via different markets shape outcomes of entrepreneurship at the micro, meso and macro level. These range from individual outcomes such as economic ones in terms of survival and growth of the venture, to non-economic ones including personal achievement, social status and integration.

Building on our framework, we now present a research agenda, outlining the key contributions of immigrant entrepreneurship research to broader entrepreneurship scholarship, as well as identify areas where immigrant entrepreneurship researchers can build further on insights from the broader field. As illustrated in Table 2, which includes some statements by authors of immigrant entrepreneurship, studies in the literature seem only to a little extent to have considered the wider contribution of studying the phenomenon, and our discussion also contributes by identifying such contributions.

[TABLE 2 HERE]

Contextualizing immigrant entrepreneurship

The literature has emphasized that entrepreneurship context matters and highlighted the importance of careful generalization across different environments (Shirokova *et al.*, 2022). Equally, studying different combinations of destinations and origins can provide fundamental insights on the nature of the contextual change involved for immigrant entrepreneurs. This presents rich opportunities for future research on immigrant entrepreneurship.

Macro-context: Countries of destination and origin and distance

The first studies on immigrant entrepreneurship emerged in the US (Bonacich, 1973; Borjas, 1986; Light and Bonacich, 1990; Light, 1972), which has remained the most important destination country studied over time (Ramos-Escobar *et al.*, 2022). Research was later expanded to Canada (Collins, 2003; Collins and Low, 2010) and Australia as well as European countries such as the United

Kingdom, France, Germany and the Netherlands. The most studied groups of immigrants originate in China, India, Korea, Latin American countries, along with many other countries. In general, the literature has focused on the situation of immigrant entrepreneurs from less developed countries in Asia, Latin America and Africa operating in advanced economies (Malerba & Ferreira, 2021). There has been less research on immigrant entrepreneurship within Europe, despite the rich research opportunities offered by European integration (Garcia-Cabrero et al., 2020), and less research within the Global South. Different institutional and cultural contexts may affect immigrant entrepreneurship differently; therefore, more research is needed on how immigrant entrepreneurs create, perform, innovate and internationalize in developing countries. There are still also relatively few comparative studies on how institutions affect immigrant entrepreneurship (Malerba & Ferreira, 2021).

Moreover, while studies have considered innovative high-impact immigrant entrepreneurship in the US (Lee and Eesley, 2018; Saxenian, 2002), researching high-innovative immigrant-founded start-ups in the UK and the European Union will help us comprehend shortcomings of migration policies and future studies may provide useful insights to policymakers to identify how to attract highly innovative entrepreneurs which may benefit host countries as well as home countries.

Further study of the implications of bilateral origin-distance effects would also be valuable. So far, the literature has mostly studied the case of South-North immigrant entrepreneurs, where migrants have moved from a less developed institutional setting to a more developed one. More studies in the North-North context as well as the South-South context could help gain a broader view on the effects of institutional distance as well as the distinct effects of destination and origin institutions, which is currently a prominent topic in the international business discipline. However, when studying institutional distance and institutional effects, IB researchers have warned that studies with a single home country or single host country in the sample cannot identify institutional distance versus institutional profiles effects (Brouthers et al., 2016; van Hoorn and Maseland, 2016).

IB literature has also devoted more attention to the implications of connectivity across locations offered by IB activities (Mudambi & Zahra, 2007). The notion of connectivity could also be useful to

theorise the links between countries created by immigrants' networks and other links back to their home countries.

Meso-context: Ethnic, mainstream and transnational networks

The immigrant entrepreneurship literature has highlighted that most immigrant entrepreneurs start out by targeting co-ethnic markets and leverage co-ethnic networks in order to do so before some of these ventures “break out” to mainstream markets in the destination country or even to transnational markets. Instructive exceptions to this pattern exist, however, and would be useful to explore further in future research. Some immigrant entrepreneurs may target the mainstream or even the international market directly. However, achieving embeddedness in networks is likely to be key also in these cases. The literature demonstrates that immigrants can benefit from cross-border networks back to the country of origin when internationalizing, consistent with the importance assigned to networks in international business and entrepreneurship literature (Coviello, 2006; Johanson and Vahlne, 2009). Similarly, direct access to mainstream markets, for instance with entrepreneurial migration, may build upon network connections. Hence, embeddedness in networks is likely to be of key importance not only in co-ethnic markets, but also in mainstream and international ones. Entrepreneurship research has increasingly viewed context through the lens of embeddedness (Korsgaard et al., 2022), as will be elaborated below.

The key importance of meso-level structures (Kim et al., 2016) for much immigrant entrepreneurship, together with the acknowledgement of the macro-level within key home-grown frameworks such as the mixed embeddedness perspective (Kloosterman 2010), indicates that immigrant entrepreneurship is a highly insightful context for efforts of contextualization of entrepreneurship research (Welter, 2011). In particular, this relates to the role of the meso-level in multilevel models of entrepreneurship. While much entrepreneurship research aims to link macro-level factors (including institutional factors such as regulations) and micro-level entrepreneurial actions, Kim et al. (2016) argue that the theoretical links between macro and micro levels are often tenuous due to the omission of intermediating meso-level factors, which implies gaps in terms of relevant theoretical mechanisms. The authors hence advocate for the inclusion of social groups in terms of “collectives of individuals in

interdependent relationships” (Kim et al. 2016: 276). Immigrant entrepreneurship literature illustrates the importance of social groups in terms of co-ethnic networks (some of which may also be cross-border) and enclaves. But the point has broader applicability: Entrepreneurship studies have identified the key role of embeddedness for entrepreneurship, for instance in rural settings (Jack & Anderson, 2012).

Micro within meso and macro

Much of the immigrant entrepreneurship literature has focused on the micro level (Dheer, 2018). At a micro level, immigrants have attracted interest as a specific category of entrepreneurs for a variety of reasons. An important line of research in the broader entrepreneurship literature has searched for characteristics of individuals that are associated with entrepreneurial actions; i.e., the (contested) question of “who is an entrepreneur” (Ramoglu et al. 2020). Immigrant entrepreneurs are likely a self-selected group with strong entrepreneurial motivations and resources allowing to undertake migration in the first place. The literature has also highlighted, however, the crucial role of meso and macro level factors, including ethnic networks and cultural factors, on immigrant entrepreneurship.

Entrepreneurship scholarship is increasingly focusing on the context of entrepreneurial activities (Welter, 2011; Welter et al., 2019), linking this to the notion that all entrepreneurship is embedded in various contexts (Korsgaard et al., 2022). Granovetter (1985) emphasized how entrepreneurship relies on networks for access to opportunities and information, and embeddedness as an individual-level construct is assumed to provide key advantages for entrepreneurs (Korsgaard et al., 2022). This has been a key theme in immigrant entrepreneurship research in terms of embeddedness in ethnic networks. However, embeddedness can also present constraints through, among others, the need to comply with prevailing norms that could constrain entrepreneurial activity (Berglund, Gaddefors, and Lindgren 2016; Korsgaard et al., 2022). Indeed, such embeddedness may shape the very perception of resources and opportunities (Korsgaard et al., 2022).

Unpacking immigrant entrepreneurship

Different kinds of entrepreneurship

Immigrant entrepreneurship is a highly diverse phenomenon, ranging from self-employment in small “corner shops” in ethnic enclaves to the creation of enterprises that go on to become large multinational enterprises. Several studies have highlighted the importance of distinguishing between these forms of entrepreneurship (e.g. for policy, see Schoar 2010; Henrekson and Sanandaji, 2013), as findings from self-employment cannot necessarily be extrapolated to high-impact entrepreneurship. There have also been debates on how to identify these two different forms of entrepreneurship in research, with one suggestion being to separate incorporated from unincorporated self-employment (Levine and Rubinstein, 2017).

Different kinds of entrepreneurs

As the literature shows, immigrant entrepreneurs are also highly diverse in terms of their entrepreneurial motivations and resources. Human capital is consistently identified as a factor shaping the form of entrepreneurship pursued. There is scope for further research to explore such differences among immigrant entrepreneurs. In entrepreneurship literature, two important concepts have been entrepreneurial orientation and entrepreneurial cognition. Until recently, such aspects received relatively little attention in immigrant entrepreneurship literature, with Dheer’s (2018: 51) review noting that “the role of immigrant’s cognitive and psychological preparedness, their emotions, stereotypical thinking, efficacy and intentions in identification, evaluation and exploitation of opportunities have not been adequately examined.” Some recent studies on refugee entrepreneurship have considered the effect that previous trauma can have on entrepreneurial processes (Jiang et al. 2021). Further study on how the migration experience influences the psychological aspects of entrepreneurship would be valuable.

Intersectionality

As noted above, some studies found that gender influences immigrant entrepreneurship rates (Brieger and Gielnik, 2020; Collins and Low, 2010) and that women immigrant entrepreneurs face specific challenges (Malerba & Ferreira, 2021). For instance, one study argued that immigrant women

entrepreneurs can be constrained by the husband's actions as the "lead" immigrant, limiting the growth opportunities of the business. This is caused by the wife's adaptation to the husband's necessities and the potential stigmatization of the men figure which has been generationally perceived as the breadwinner when the wives are earning higher incomes (Lassalle and Shaw, 2021).

Applying intersectionality to immigrant entrepreneurship may allow further insights (Dabić *et al.*, 2020) as demonstrated by Lassalle and Shaw (2021) with their study of women immigrant entrepreneurs at the intersection of their migration contexts and their household. The notion of intersectionality highlights that human experiences are shaped by individual factors such as race, gender, and nationality combined together and creating something distinctive from each constituent part (Crenshaw, 1991). The gender, race, class, nationality and legal status that each member maintains, create, transform and reproduce opportunities of members within a highly stratified society (Valdez, 2011). Intersectionality indicates specific conditions when individuals hold more than two social statuses and recognizes the interactive and simultaneous statuses and the effects of these combinations (Romero and Valdez, 2016). Home country societal values affect women entrepreneurial identity as for the case of Romanian women entrepreneurs, the fixed socio-cultural roles revoke women entrepreneurial identity due to the patriarchal Romanian society (Chitac, 2023). Intersections are perceived as concomitant processes of identity, social and institutional practices (Holvino, 2010). Intersectionality is a tool to highlight non-obvious similarities and understand differences, it can highlight intersectional invisibility, where belonging to different subordinate-group identities results in a member group "invisibility" which may be experienced differently by individuals with a single subordinate group identity (Purdie-Vaughns and Eibach, 2008).

Social Entrepreneurship

Unlike traditional entrepreneurship, social enterprises alongside their social value capture contribute to economic outcomes (Costanzo *et al.*, 2014; Mair and Martí, 2006) contrary to traditional for-profit ventures which primarily aims to generate private economic value. Social enterprises pursue social value through market aligned tools and techniques used by traditional for-profit ventures (Bornstein, 2007; Costanzo *et al.*, 2014; OECD, 2021; Perrini *et al.*, 2010). Social entrepreneurship plays a crucial

role in addressing societal challenges, in particular where government actions and institutions are inadequate. Government activism reflects the state's capacity to provide public goods and address social issues (Stephan *et al.*, 2015) while formal institution influence the redistribution of economic wealth through taxes and welfare for its citizens (Aidis *et al.*, 2012).

Migrant social entrepreneurs are important agents in both home and host societies by providing effective social solutions in the country of origin and destination and are promoting the participation of newcomers in the host societies, providing examples to younger generations and implementing solutions at the root level (Naimi, Hehenberger, and Clewett, 2020).

Whereas the literature has clearly underlined the economic contribution of immigrant entrepreneurs at the macro-level (Fairlie and Lofstrom, 2015a; Kerr and Kerr, 2020), less analysis exists of social value creation. A small set of studies show how social entrepreneurs from immigrant backgrounds are supporting their communities (Naimi, Hehenberger, Bacq, *et al.*, 2020). The social impact initiatives of immigrant enterprises and entrepreneurs have not yet been fully analysed (Harima and Freudenberg, 2020). Therefore, we call for further multilevel studies focusing on the social aspects of immigrant entrepreneurship in both host and home countries. Understanding how immigrant social entrepreneurs overcome institutional obstacles is central in order to comprehend how immigrants and refugees are serving local communities (Harima and Freudenberg, 2020), and how their past experiences shape opportunity recognition (Corner and Ho, 2010; Mair and Noboa, 2006). This will serve as a means to expand the discussion about migration and highlight how immigrant social entrepreneurs are empowering themselves and others through social enterprises (Naimi, Hehenberger, and Clewett, 2020), overcoming legitimacy challenges (Nicholls, 2010), uncovering how and why migrants establish social enterprises compared to traditional businesses, how they differ from natives in doing so, and the social impact strategies and outcomes they have in both destination and origin countries.

Unpacking immigration

A fuller understanding of immigrant entrepreneurship requires an understanding of the prior decision of migration. Migration takes place under very different circumstances, which can influence later

entrepreneurship in different ways via migrants' experiences, resources and (lack) of networks (Christensen et al., 2021).

Different forms of migration

The literature has identified a number of important drivers of migration, including both “push” factors motivating people to leave their home country, and “pull” factors attracting them to specific host-country locations. Global migration may stem from socio-political factors. War, persecutions, famine and lack of political rights are push factors, while common pull factors affecting migration fluxes can be found in past colonial and trading ties, geographic distance, cultural affinity and family reunification (Ferrie and Hatton, 2015). Geographic distance limits the cost of migration, as do language and religious communalities by enhancing cultural affinity (Ferrie and Hatton, 2015). The gravity model of migration shows that a dominant pulling factor affecting global migration is the presence of previous immigrants from a given source country; as the presence of friends and relatives in host societies is a strong factor guiding global migration flows and the ratification of immigration policies (Beine *et al.*, 2015; Vanderkamp, 1977). Different migration situations affect the resources immigrants have for entrepreneurship, with refugees often at least temporarily losing home networks. In contrast, entrepreneurial migrations specifically target certain locations and bring with them resources (Christensen et al., 2021). Studies have highlighted how migration can involve not only embeddedness in new contexts, but also disembeddedness, with potential later reembedding, in the origin context (Korsgaard et al., 2022).

An understanding of different forms of migration is also essential for immigrant entrepreneurship policy. The European Union was a late mover in encouraging member countries to introduce policies aimed to attract immigrant entrepreneurs (European Commission, 2013). Other countries such as Canada, Australia and the United States have long tested and developed specific migration programs based on two main types of policies (Chand and Tung, 2019). The first is the merit-base model or the “supply-side” approach, which uses a point system aimed at increasing the proportion of individuals with a high level of education, skills and training considered to be of particular long-term economic value for the host country. A second employer-driven model or “demand-side” approach, prioritizes

the firms who select skilled immigrants, who are afterwards selected by the government (Barnard *et al.*, 2019; Chand and Tung, 2019; Kerr *et al.*, 2015).

Impact of immigrant entrepreneurship

Entrepreneurship is widely considered to be important for the socio-economic development and growth of a country (Zahra, 1999) and many have noted the positive contribution of immigrant entrepreneurs to economic growth of host countries (Fairlie and Lofstrom, 2015a; Kerr and Kerr, 2020). Entrepreneurship, in all its forms is linked with job creation (Baumol, 1996; Malchow-Møller *et al.*, 2011), through self-employment and sometimes additional employment. Employment has been found to be a powerful tool to promote refugees and immigrant integration in host societies (Ager and Strang, 2008).

Moreover, migrant entrepreneurs can build linkages between the host and home countries by creating jobs, developing human capital and providing investments (Czinkota *et al.*, 2021; Kerr & Kerr, 2020; Saxenian, 2002). Immigrants in the host countries indirectly influence the home country outcomes through financial and knowledge remittances, attracting home-country governments to create policies aimed to attract immigrants back to the country of origin (Vaaler, 2011; Pidduck *et al.*, 2022). As evidenced from the literature, emigration and patents applications rates in the home country are connected (Fackler *et al.*, 2020).

The literature has hence suggested important impacts of immigrant entrepreneurship at multiple levels: On immigrants themselves (micro), their ethnic communities and transnational networks (meso) and destination and origin countries (macro). These effects may not be exclusively positive in all cases. If we look critically at the results presented by Kulchina (2016, 2017), we can see that employing co-ethnics due to low labour expenditures, the ability to work long hours and their employability in labour intensive industries presents a double-edged sword, as on the one side immigrants entrepreneurs can achieve better performance for their businesses, on the other side, immigrant co-ethnic from vulnerable backgrounds such as refugees, are prone to exploitation and low career progression, preserving the status quo of staying under the canvas ceiling (Lee *et al.*, 2020).

Nevertheless, there remain substantial further opportunities to explore how immigrant entrepreneurship has potential to change the broader context in which it is embedded in the destination country as well as in the origin country. In particular, to date little research in immigrant entrepreneurship has considered potential bottom-up effects in terms of economic impact and cultural and institutional change, despite this having been outlined as an important topic for multilevel research (Kim et al., 2016; Welter, 2011). There could be interesting opportunities for studying how entrepreneurship by immigrants affects, for instance, the standing of immigrant communities in the host country, whether through the development of formal organisations representing such constituencies or more indirectly through influencing the image of the immigrant group.

Moreover, existing important frameworks such as the mixed embeddedness perspective of Kloosterman (2010) have introduced the macro context mainly in relation to how it affects market opportunities for immigrants. However, there is also further scope to explore top-down linkages via the meso level, in terms of destination market and institutions shaping meso-level co-ethnic structures and resources.

Overall, we believe an integrated consideration of bottom-up and top-down linkages within a multilevel framework to be a promising avenue. Our framework could be further elaborated in future research as a bath-tub model (Coleman, 1990; Cowen et al., 2022; Kim et al., 2016) exploring the myriad linkages between macro institutional and cultural factors, meso network structures and the opportunities and resources available to immigrant entrepreneurs.

The nature of (immigrant) entrepreneurship

Lastly, we also propose that the unique setting of immigrant entrepreneurship speaks to several central themes and debates in the entrepreneurship field. Busenitz et al. (2003, 2014) noted that the entrepreneurial process is considered to consist of four key elements: opportunities, enterprising individuals, environment and modes of organising. Dheer's (2018) review of immigrant entrepreneurship discussed how the phenomenon has related to all these four elements. Firstly, specific *opportunities*, seen as situations that result in new means-end relationships (Busenitz et al.,

2003), exist for immigrant entrepreneurs in terms of serving demand in ethnic markets as mainstream entrepreneurs are unable to enter or uninterested in these markets. Secondly, *enterprising individuals* have been identified as being of two distinct types in immigrant entrepreneurship literature, namely necessity entrepreneurs and opportunity entrepreneurs. Thirdly, *environmental conditions* have been addressed through perspective such as mixed embeddedness (Kloosterman, 2010), referring to macro-level factors such as labour markets and regulatory conditions, as well as meso-level factors such as co-ethnic networks in enclaves. Fourthly, *modes of organising* have also been considered in terms of how entrepreneurs mobilise key resources for business ventures, notably via family and network ties.

Extensive debates have taken place within the entrepreneurship field over the last two decades regarding the nature of opportunities, the roles of the entrepreneurial agent and the environment, and what is meant by venture creation. An influential, although increasingly contested, perspective on entrepreneurship focuses on factors allowing for the “discovery” of pre-existing entrepreneurial “opportunities” (Shane & Venkataraman, 2000; for its influence see e.g., Meyer et al., 2014; for critiques e.g., Alvarez & Barney, 2007; Davidsson, 2021; Ramoglu and Tsang, 2020). According to this perspective, the essence of entrepreneurship is the nexus between opportunities and individuals. Following Austrian economic theory (Kirzner, 1997), opportunities are seen as disequilibria in markets that certain individuals are able to discover and profit from, while other individuals are not (Shane, 2000; Shane & Venkataraman, 2000). From this “nexus” perspective, a straightforward argument would be that due to their unique background that could among others influence entrepreneurial cognition (Pidduck *et al.*, 2022), immigrants might be in a position to spot opportunities that go unnoticed by natives and/or have particular motivations and resources to harness such opportunities. This could include an ability to understand unmet demand in co-ethnic enclaves that natives lack, which can represent an important opportunity although as noted in the literature such markets can also be contested and have limited growth potential. It could however also include an ability to spot novel opportunities due to “outsidership” in terms of the broader host-country context, enabling them to think outside the proverbial box and recombine resources in novel ways (Baker & Nelson, 2005; Pidduck *et al.*, 2024).

Alternative perspectives that have arisen in reaction to the “discovery” perspective also open up for some interesting specific aspects of immigrant entrepreneurship. A social constructivist perspective, criticising the view of opportunities as essentially unnoticed “dollar bills on the sidewalk” (Ramoglu & Tsang, 2020), waiting to be found by the right entrepreneur, argues instead that entrepreneurial opportunities are “created” by entrepreneurs themselves (Alvarez and Barney, 2007; Baker and Nelson, 2005). This perspective is therefore often referred to as the “creation” perspective, as opposed to the “discovery” perspective discussed above. Taking a constructivist perspective, an intuitive argument could hold immigrant from entrepreneurs are able to conceive new product ideas (to certain settings) based on their unique backgrounds and recombination of cultural elements.

Like the “discovery” perspective, the “creation” perspective has attracted its share of criticism, among others for seemingly discarding the role of environmental factors and constraints on entrepreneurship (Davidsson, 2021). An attempt at a more middle-ground perspective claims to be compatible with social constructivism, while allowing for the objective existence of opportunities (Ramoglu & Tsang, 2020). More recently, entrepreneurship scholars have suggested to move beyond the “opportunity wars” by introducing new perspectives that do not focus on the nature of opportunities. We here consider one promising such perspective, developed by Davidsson and colleagues, termed the *external enablement* perspective.

Building on a notion that rather than “opportunity”, the core of the entrepreneurship field is *venture creation*, defined as “the journey from non-existence to existence of new ventures” (Davidsson, 2021: 8), the external enablement perspective focuses on various types of environmental change that may either benefit or hinder specific ventures. Such forms of environmental change may include “technological, socio-cultural, regulatory, and natural-environmental” (Davidsson, 2021: 11). Based on the various characteristics of immigrant entrepreneurs, a given environmental change could affect their ventures differently (e.g., due to different exposures to institutional factors than natives). More fundamentally, however, the relevance of the external enablement perspective to immigrant entrepreneurship can be seen once we recognize that the act of migration itself involves substantial environmental change for the immigrants (whether planned or unplanned). This environmental change

can be intended, with entrepreneurial migration taking place to access contexts that are more conducive to entrepreneurship. In other cases, the change of environment may be a result of forced migration, as in the case of refugees (Christensen et al., 2021). This indicates the importance of understanding also the prior migration decision, a point to which we return further below. We consider the external enablement perspective, which so far seems to have found little application in immigrant entrepreneurship, to be promising for pushing the sub-field further forward.

CONCLUDING REMARKS

This paper has sought to demonstrate the contributions of immigrant entrepreneurship research to broader entrepreneurship scholarship, as well as how this emergent sub-field can benefit from developments in general entrepreneurship. By doing so, we hope to contribute to strengthening the links between the fields and promote further research efforts. Our multilevel framework developed from an integrative review of the literature provides a valuable tool for further research in immigrant entrepreneurship and beneficial integration with the broader field of entrepreneurship.

REFERENCES

- Achidi Ndofor, H. and Priem, R. L. (2011). Immigrant Entrepreneurs, the Ethnic Enclave Strategy, and Venture Performance, *Journal of Management*, **37**, pp. 790–818.
- Adler, P. S. and Kwon, S.-W. (2002). Social Capital: Prospects for a New Concept, *Academy of Management Review*, **27(1)**, pp.17-40.
- Agarwal, R., Ganco, M. and Raffiee, J. (2021). Immigrant Entrepreneurship: The Effect of Early Career Immigration Constraints on New Venture Formation, *Organization Science*, **33(4)**, pp. 1372-1395.
- Ager, A. and Strang, A. (2008). Understanding Integration: A Conceptual Framework, *Journal of Refugee Studies*, **21**, pp. 166–191.
- Agius Vallejo, J. and Keister, L. A. (2020). Immigrants and wealth attainment: migration, inequality, and integration, *Journal of Ethnic and Migration Studies*, **46**, pp. 3745–3761.
- Aidis, R., Estrin, S. and Mickiewicz, T. M. (2012). Size matters: entrepreneurial entry and government, *Small Business Economics*, **39**, pp. 119–139.
- Aldrich, H. E. and Waldinger, R. (1990). Ethnicity and Entrepreneurship, *Annual Review of Sociology*, **1**, pp. 111–135.
- Aliaga-Isla, R. and Rialp, A. (2013). Systematic review of immigrant entrepreneurship literature: previous findings and ways forward, *Entrepreneurship & Regional Development*, **25**, pp. 819–844.
- Alvarez, S. A. and Barney, J. B. (2007). Discovery and creation: alternative theories of entrepreneurial action, *Strategic Entrepreneurship Journal*, **1**, pp. 11–26.
- Amornsiripanitch, N., Gompers, P. A., Hu, G. and Vasudevan, K. (2023). Getting schooled: Universities and VC-backed immigrant entrepreneurs, *Research Policy*, **52**, pp. 104782.

An, Y. H., Zagelmeyer, S. and Rygh, A. (2021). Between liability and asset: a critical review of 25 years of foreignness research in international business, *Critical Perspectives on International Business*, **18**, pp. 666–698.

Arrighetti, A., Bolzani, D. and Lasagni, A. (2014). Beyond the enclave? Break-outs into mainstream markets and multicultural hybridism in ethnic firms, *Entrepreneurship & Regional Development*, **26**, pp. 753–777.

Åstebro, T. and Thompson, P. (2011). Entrepreneurs, jacks of all trades or hobos?, *Research Policy*, **40**, pp. 637–649.

Awaworyi Churchill, S. (2017). Fractionalization, entrepreneurship, and the institutional environment for entrepreneurship, *Small Business Economics*, **48**, pp. 577–597.

Azoulay, P., Jones, B. F., Kim, J. D. and Miranda, J. (2022). Immigration and entrepreneurship in the United States, *American Economic Review: Insights*, **4**, pp. 71–88.

Azoulay, P., Jones, B., Kim, J. D. and Miranda, J. (2020). *Immigration and Entrepreneurship in the United States*, *American Economic Review, Insights*, **4(1)**, pp. 71-88.

Baker, T. and Nelson, R. E. (2005). Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage, *Administrative Science Quarterly*, **50**, pp. 329–366.

Balachandran, S. and Hernandez, E. (2020). *Mi Casa Es Tu Casa: Immigrant Entrepreneurs as Pathways to Foreign Venture Capital Investments* (SSRN Scholarly Paper No. 3331264). Rochester, NY: Social Science Research Network.

Barberis, E. and Solano, G. (2018). Mixed Embeddedness and Migrant Entrepreneurship: Hints on Past and Future Directions. An Introduction, *Sociologica*, **Vol 12**, pp. 1- 22.

- Barnard, H., Deeds, D., Mudambi, R. and Vaaler, P. M. (2019). Migrants, migration policies, and international business research: Current trends and new directions, *Journal of International Business Policy*, **2**, pp. 275–288.
- Bates, T. (1997). Financing small business creation: The case of Chinese and Korean immigrant entrepreneurs, *Journal of Business Venturing*, **12**, pp. 109–124.
- Baumol, W. J. (1996). Entrepreneurship: Productive, unproductive, and destructive, *Journal of Business Venturing*, **11**, pp. 3–22.
- Baycan-Levent, T. and Nijkamp, P. (2009). Characteristics of migrant entrepreneurship in Europe, *Entrepreneurship & Regional Development*, **21**, pp. 375–397.
- Beckers, P. and Blumberg, B. F. (2013). Immigrant entrepreneurship on the move: a longitudinal analysis of first- and second-generation immigrant entrepreneurship in the Netherlands, *Entrepreneurship & Regional Development*, **25**, pp. 654–691.
- Beine, M., Docquier, F. and Özden, Ç. (2015). Dissecting Network Externalities in International Migration, *Journal of Demographic Economics*, **81**, pp. 379–408.
- Berglund, K., Gaddefors, J. and Lindgren, M. (2016). Provoking Identities: Entrepreneurship and Emerging Identity Positions in Rural Development. *Entrepreneurship & Regional Development*, **28** (1-2), pp. 76-96.
- Identity Positions in Rural Development.” *Entrepreneurship & Regional Development* **28** (1–2), pp. 76–96.
- Bird, M. and Wennberg, K. (2016). Why family matters: The impact of family resources on immigrant entrepreneurs’ exit from entrepreneurship, *Journal of Business Venturing*, **31**, pp. 687–704.
- Bonacich, E. (1973). A Theory of Middleman Minorities, *American Sociological Review*, **38**, pp. 583.

Borjas, G. J. (1986). *The Self-Employment Experience of Immigrants* (Working Paper No. 1942). National Bureau of Economic Research.

Bornstein, D. (2007). *How to change the world: Social entrepreneurs and the power of new ideas*. Oxford University Press.

Brieger, S. A. and Gielnik, M. M. (2020). Understanding the gender gap in immigrant entrepreneurship: a multi-country study of immigrants' embeddedness in economic, social, and institutional contexts, *Small Business Economics*, **56(3)**, pp. 1007-1031.

Brzozowski, J., Cucculelli, M. and Surdej, A. (2014). Transnational ties and performance of immigrant entrepreneurs: the role of home-country conditions, *Entrepreneurship & Regional Development*, **26**, pp. 546–573.

Busenitz, L. W., Plummer, L. A., Klotz, A. C., Shahzad, A. and Rhoads, K. (2014). Entrepreneurship research (1985–2009) and the emergence of opportunities, *Entrepreneurship Theory and Practice*, **38**, pp. 1–20. SAGE Publications Sage CA: Los Angeles, CA.

Busenitz, L. W., West III, G. P., Shepherd, D., Nelson, T., Chandler, G. N. and Zacharakis, A. (2003). Entrepreneurship research in emergence: Past trends and future directions, *Journal of Management*, **29**, pp. 285–308.

Butticè, V. and Useche, D. (2022). Crowdfunding to overcome the immigrant entrepreneurs' liability of outsidership: the role of internal social capital, *Small Business Economics*, **59**, pp. 1519–1540.

Chaganti, R. and Greene, P. G. (2002). Who Are Ethnic Entrepreneurs? A Study of Entrepreneurs' ethnic involvement and business characteristics, *Journal of Small Business Management*, **40**, pp. 126–143.

Chand, M. and Tung, R. L. (2019). Skilled immigration to fill talent gaps: A comparison of the immigration policies of the United States, Canada, and Australia, *Journal of International Business Policy*, **2**, pp. 333–355.

Chitac, I. M. (2023). Identity is a matter of place: intersectional identities of Romanian women migrant entrepreneurs on the Eastern-Western European route, *International Journal of Entrepreneurial Behavior & Research*.

Christensen L.J., Newman A.B., Herrick H., Godfrey P. (2021). Separate but not equal: Toward a nomological net for migrants and migrant entrepreneurship. *Journal of International Business Policy* **3**, pp. 1-22.

Clark, K. and Drinkwater, S. (2000). Pushed out or pulled in? Self-employment among ethnic minorities in England and Wales, *Labour Economics*, **7**, pp. 603–628.

Collins, J. (2003). Cultural diversity and entrepreneurship: policy responses to immigrant entrepreneurs in Australia, *Entrepreneurship & Regional Development*, **15**, pp. 137–149.

Collins, J. and Low, A. (2010). Asian female immigrant entrepreneurs in small and medium-sized businesses in Australia, *Entrepreneurship & Regional Development*, **22**, pp. 97–111.

Corner, P. D. and Ho, M. (2010). How opportunities develop in social entrepreneurship, *Entrepreneurship: Theory and Practice*, **34**, pp. 635–659.

Costanzo, L. A., Vurro, C., Foster, D., Servato, F. and Perrini, F. (2014). Dual-Mission Management in Social Entrepreneurship: Qualitative Evidence from Social Firms in the United Kingdom, *Journal of Small Business Management*, **52**, pp. 655–677.

Coviello, N. E. (2006). The network dynamics of international new ventures, *Journal of International Business Studies*, **37**, pp. 713–731.

Crenshaw, K. (1991). Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color, *Stanford Law Review*, **43**, pp. 1241–1299.

Czinkota, M., Khan, Z. and Knight, G. (2021). International business and the migrant-owned enterprise, *Journal of Business Research*, **122**, pp. 657–669.

- Dabić, M., Vlačić, B., Paul, J., Dana, L.-P., Sahasranamam, S. and Glinka, B. (2020). Immigrant entrepreneurship: A review and research agenda, *Journal of Business Research*, **113**, pp. 25–38.
- Davidsson, P. (2023). Ditching discovery-creation for unified venture creation research, *Entrepreneurship Theory and Practice*, **47**, pp. 594–612.
- Drori, I., Honig, B. and Wright, M. (2009). Transnational Entrepreneurship: An Emergent Field of Study, *Entrepreneurship Theory and Practice*, **33**, pp. 1001–1022.
- Drouhot, L. G. and Nee, V. (2019). Assimilation and the Second Generation in Europe and America: Blending and Segregating Social Dynamics Between Immigrants and Natives, *Annual Review of Sociology*, **45**, pp. 177- 199
- Dunlevy, J. A. (2004). Interpersonal networks in international trade: evidence on the role of immigrants in promoting exports from the American states, *Review of Economics and Statistics*.
- Ellis, P. (2000). Social Ties and Foreign Market Entry, *Journal of International Business Studies*, **31**, pp. 443–469.
- Elo, M., Täube, F. A. and Servais, P. (2022). Who is doing “transnational diaspora entrepreneurship”? Understanding formal identity and status, *Journal of World Business*, **57**, pp. 101240.
- European Commission (2013, January 14). Entrepreneurship 2020 Action Plan, *European Economic and Social Committee*.
- Fackler, T. A., Giesing, Y. and Laurensyeva, N. (2020). Knowledge remittances: Does emigration foster innovation?, *Research Policy*, **49**, pp. 103863.
- Fairlie, R. W. and Lofstrom, M. (2015a). Chapter 17 - Immigration and Entrepreneurship. In Chiswick, B. R. and Miller, P. W. (eds), *Handbook of the Economics of International Migration*. North-Holland, **1**, pp. 877–911.

Fairlie, R. W. and Lofstrom, M. (2015b). Immigration and entrepreneurship. In *Handbook of the economics of international migration*. Elsevier, **1**, pp. 877–911.

Fan, D., Breslin, D., Callahan, J. L. and Iszatt-White, M. (2022). Advancing literature review methodology through rigour, generativity, scope and transparency, *International Journal of Management Reviews*, **24**, pp. 171–180.

Ferrie, J. P. and Hatton, T. J. (2015). Chapter 2 - Two Centuries of International Migration. In Chiswick, B. R. and Miller, P. W. (eds), *Handbook of the Economics of International Migration*. North-Holland, **1**, pp. 53–88.

García-Cabrera, A. M., Lucía-Casademunt, A. M. and Padilla-Angulo, L. (2020). Immigrants' entrepreneurial motivation in Europe: liabilities and assets, *International Journal of Entrepreneurial Behaviour and Research*, **26**, pp. 1707–1737.

González-González, J. M., Bretones, F. D., Zarco, V. and Rodríguez, A. (2011). Women, immigration and entrepreneurship in Spain: A confluence of debates in the face of a complex reality, *Women's Studies International Forum*, **34**, pp. 360–370.

Gorgievski, M. J. and Stephan, U. (2016). Advancing the psychology of entrepreneurship: A review of the psychological literature and an introduction, *Applied Psychology*, **65**, pp. 437–468.

Griffin-El, E. and Olabisi, J. (2020). Non-Liability of “Foreignness”: Theorizing Immigrant Entrepreneurs in the Practice of Bricolage, *Academy of Management Proceedings*, **2020**, pp. 20444.

Guercini, S., Dei Ottati, G., Baldassar, L. and Johanson, G. (2017). Liabilities of Native and Immigrant Entrepreneurship in the Processes of Globalization. In Guercini, S., Dei Ottati, G., Baldassar, L., and Johanson, G. (eds), *Native and Immigrant Entrepreneurship : Lessons for Local Liabilities in Globalization from the Prato Case Study*. Springer International Publishing, pp. 7–29.

Harima, A. and Freudenberg, J. (2020). Co-Creation of Social Entrepreneurial Opportunities with Refugees, *Journal of Social Entrepreneurship*, **11**, pp. 40–64.

- Harima, A., Periac, F., Murphy, T. and Picard, S. (2021). Entrepreneurial Opportunities of Refugees in Germany, France, and Ireland: Multiple Embeddedness Framework, *International Entrepreneurship and Management Journal*, **17**, pp. 625–663.
- Henrekson M., Sanandaji T. (2014). Small business activity does not measure entrepreneurship. *Proceedings of the National Academy of Sciences* **111**, pp. 1760-1765.
- Hernandez, E. and Kulchina, E. (2020). Immigrants and Foreign Firm Performance, *Organization Science*, **31**, pp. 797–820.
- Holvino, E. (2010). Intersections: The Simultaneity of Race, Gender and Class in Organization Studies, *Gender, Work & Organization*, **17**, pp. 248–277.
- Hunt, J. (2011). Which Immigrants Are Most Innovative and Entrepreneurial? Distinctions by Entry Visa, *Journal of Labor Economics*, **29(3)**, pp. 417-457.
- Jiang, G. (2016). Early internationalization and the role of immigration in new venture survival, *International Business Review*, **25(6)**, pp. 1285-1296.
- Johanson, J. and Vahlne, J.-E. (2009). The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership, *Journal of International Business Studies*, **40**, pp. 1411–1431.
- Kahn, S., La Mattina, G. and J. MacGarvie, M. (2017). “Misfits,” “stars,” and immigrant entrepreneurship, *Small Business Economics*, **49**, pp. 533–557.
- Karadal, H., Shneikat, B. H. T., Abubakar, A. M. and Bhatti, O. K. (2021). Immigrant Entrepreneurship: the Case of Turkish Entrepreneurs in the United States, *Journal of the Knowledge Economy*, **12**, pp. 1574–1593.
- Kerr, S. P. and Kerr, W. (2020). Immigrant entrepreneurship in America: Evidence from the survey of business owners 2007 & 2012, *Research Policy*, **49**, pp. 103918.

- Kerr, S. P. and Kerr, W. R. (2016). *Immigrant Entrepreneurship. In measuring entrepreneurial businesses: Current knowledge and challenges*, pp.187-249. University of Chicago Press.
- Kerr, S. P., Kerr, W. R. and Lincoln, W. F. (2015). Skilled Immigration and the Employment Structures of US Firms, *Journal of Labor Economics*, **33**, pp. S147–S186.
- Kerr, S. P., Kerr, W. R. and Xu, T. (2018). Personality traits of entrepreneurs: A review of recent literature, *Foundations and Trends® in Entrepreneurship*, **14**, pp. 279–356.
- Kim, P. H., Wennberg, K. and Croidieu, G. (2016). Untapped riches of meso-level applications in multilevel entrepreneurship mechanisms, *Academy of Management Perspectives*, **30**, pp. 273–291.
- Kirzner I.M. (1997). Entrepreneurial discovery and the competitive market process: An Austrian approach. *Journal of Economic Literature* **35**, pp. 60-85.
- Kleinhempel, J., Klasing, M. J. and Beugelsdijk, S. (2023). Cultural roots of entrepreneurship: Evidence from second-generation immigrants, *Organization Science*, **34**, pp. 1800–1819.
- Kloosterman, R. C. (2003). Creating opportunities. Policies aimed at increasing openings for immigrant entrepreneurs in the Netherlands, *Entrepreneurship & Regional Development*, **15**, pp. 167–181.
- Kloosterman, R. C. (2010). Matching opportunities with resources: A framework for analysing (migrant) entrepreneurship from a mixed embeddedness perspective, *Entrepreneurship and Regional Development*, **22**, pp. 25–45.
- Kostova, T., Beugelsdijk, S., Scott, W. R., Kunst, V. E., Chua, C. H. and van Essen, M. (2020). The construct of institutional distance through the lens of different institutional perspectives: Review, analysis, and recommendations, *Journal of International Business Studies*, **51**, pp. 467–497.
- Kostova, T. and Zaheer, S. (1999). Organizational Legitimacy under Conditions of Complexity: The Case of the Multinational Enterprise, *The Academy of Management Review*, **24**, pp. 64–81.

- Kulchina, E. (2016). A path to value creation for foreign entrepreneurs, *Strategic Management Journal*, **37**, pp. 1240–1262.
- Kulchina, E. (2017). Do foreign entrepreneurs benefit their firms as managers?, *Strategic Management Journal*, **38**, pp. 1588–1607.
- Lassalle, P. and Shaw, E. (2021). Trailing Wives and Constrained Agency Among Women Migrant Entrepreneurs: An Intersectional Perspective, *Entrepreneurship Theory and Practice*, **45**, pp. 1496–1521.
- Lee, E. S., Szkudlarek, B., Nguyen, D. C. and Nardon, L. (2020). Unveiling the Canvas Ceiling: A Multidisciplinary Literature Review of Refugee Employment and Workforce Integration, *International Journal of Management Reviews*, **22**, pp. 193–216.
- Lee, Y. S. and Eesley, C. (2018). The persistence of entrepreneurship and innovative immigrants, *Research Policy*, **47**, pp. 1032–1044.
- Li, Y., Hernandez, E. and Gwon, S. (2019). When Do Ethnic Communities Affect Foreign Location Choice? Dual Entry Strategies of Korean Banks in China, *Academy of Management Journal*, **62**, pp. 172–195.
- Light, I. and Bonacich, E. (1990). Immigrant Entrepreneurs: Koreans in Los Angeles 1965-1982, *International Migration Review*, **23**.
- Light, I. H. (1972). Ethnic enterprise in America. In *Ethnic Enterprise in America*. University of California Press.
- Lin, D., Lu, J., Liu, X. and Zhang, X. (2016). International knowledge brokerage and returnees' entrepreneurial decisions, *Journal of International Business Studies*, **47**, pp. 295–318.
- Lin, X. and Yang, X. (2017). From human capital externality to entrepreneurial aspiration: Revisiting the migration-trade linkage, *Journal of World Business*, **52**, pp. 360–371.

Luo, Y., Shenkar, O. and Nyaw, M.-K. (2002). Mitigating liabilities of foreignness: Defensive versus offensive approaches, *Journal of International Management*, **8**(3), pp. 18.

Mair, J. and Martí, I. (2006). Social entrepreneurship research: A source of explanation, prediction, and delight, *Journal of World Business*, **41**, pp. 36–44.

Mair, J. and Noboa, E. (2006). Social entrepreneurship: How intentions to create a social venture are formed. In *Social entrepreneurship*. Springer, pp. 121–135.

Malchow-Møller, N., Schjerning, B. and Sørensen, A. (2011). Entrepreneurship, job creation and wage growth, *Small Business Economics*, **36**, pp. 15–32.

Malerba, R. C. and Ferreira, J. J. (2021). Immigrant entrepreneurship and strategy: a systematic literature review, *Journal of Small Business & Entrepreneurship*, **33**, pp. 183–217.

Malki, B., Uman, T. and Pittino, D. (2020). The entrepreneurial financing of the immigrant entrepreneurs: a literature review, *Small Business Economics*, pp.1-29.

Marinoni, A. (2023). Immigration and Entrepreneurship: The Role of Enclaves, *Management Science*, **69**, pp. 7266–7284.

Mata, J. and Alves, C. (2018). The survival of firms founded by immigrants: Institutional distance between home and host country, and experience in the host country, *Strategic Management Journal*, **39**, pp. 2965–2991.

Meyer, M., Libaers, D., Thijs, B., Grant, K., Glänzel, W. and Debackere, K. (2014). Origin and emergence of entrepreneurship as a research field, *Scientometrics*, **98**, pp. 473–485.

Morales, C., Brieger, S. A., De Clercq, D. and Martin, F. J. (2022). Explaining differences in entrepreneurial activity between immigrants and natives: moderating roles of economic, sociocultural and institutional factors, *International Journal of Entrepreneurial Behavior & Research*, **28**, pp. 1609–1630.

- Morgan, H. M., Sui, S. and Baum, M. (2018). Are SMEs with immigrant owners exceptional exporters?, *Journal of Business Venturing*, **33**, pp. 241–260.
- Morgan, H. M., Sui, S. and Malhotra, S. (2020). No place like home: The effect of exporting to the country of origin on the financial performance of immigrant-owned SMEs, *Journal of International Business Studies*, **52**, pp.504-524.
- Naimi, A., Hehenberger, L. and Clewett, K. (2020). *Humans at the centre*.
- Naimi, A., Hehenberger, L. K., Bacq, S. C. and Kickul, J. R. (2020). How Social Entrepreneurs with a Migrant Background Create Opportunities for their Own Community, *Academy of Management Proceedings*, **2020 (1)**, pp. 18946.
- Neville, F., Orser, B., Riding, A. and Jung, O. (2014). Do young firms owned by recent immigrants outperform other young firms?, *Journal of Business Venturing*, **29**, pp. 55–71.
- Nicholls, A. (2010). The Legitimacy of Social Entrepreneurship: Reflexive Isomorphism in a Pre-Paradigmatic Field, *Entrepreneurship Theory and Practice*, **34**, pp. 611–633.
- Njoku, K. C. and Cooney, T. M. (2022). How is immigrant entrepreneurial opportunity formation influenced by interactions between home and host countries, *International Journal of Entrepreneurship and Small Business*, **45**, pp. 170-192.
- OECD (2021). Social Entrepreneurship in Europe- An OECD-European Commission Project - OECD. Available at: <https://www.oecd.org/cfe/leed/social-entrepreneurship-oecd-ec.htm> [Accessed 2 December 2021].
- Ostrovsky, Y. and Picot, G. (2021). Innovation in immigrant-owned firms, *Small Business Economics*, **57(4)**, pp. 1857-1874.
- Parker, S. C. (2004). The economics of self-employment and entrepreneurship. Cambridge university press.

- Perrini, F., Vurro, C. and Costanzo, L. A. (2010). A process-based view of social entrepreneurship: From opportunity identification to scaling-up social change in the case of San Patrignano, *Entrepreneurship & Regional Development*, **22**, pp. 515–534.
- Pidduck, R. J., Clark, D. R. and Busenitz, L. W. (2022). Revitalizing the ‘international’ in international entrepreneurship: the promise of culture and cognition, *The International Dimension of Entrepreneurial Decision-Making: Cultures, Contexts, and Behaviours*, pp. 11–35.
- Pidduck R.J., Clark D.R., Zhang Y.J. (2024). Generating entrepreneurial imaginativeness from intercultural Janusian thinking. *European Management Journal*.
- Portes, A. and Sensenbrenner, J. (1993). Embeddedness and Immigration: Notes on the Social Determinants of Economic Action, *American Journal of Sociology*, **98**, pp. 1320–1350.
- Pruthi, S., Basu, A. and Wright, M. (2018). Ethnic ties, motivations, and home country entry strategy of transnational entrepreneurs, *Journal of International Entrepreneurship*, **16**, pp. 210–243.
- Purdie-Vaughns, V. and Eibach, R. P. (2008). Intersectional Invisibility: The Distinctive Advantages and Disadvantages of Multiple Subordinate-Group Identities, *Sex Roles*, **59**, pp. 377–391.
- Qin, F., Wright, M. and Gao, J. (2017). Are ‘sea turtles’ slower? Returnee entrepreneurs, venture resources and speed of entrepreneurial entry, *Journal of Business Venturing*, **32**, pp. 694–706.
- Ram, M., Jones, T. and Villares-Varela, M. (2017). Migrant entrepreneurship: Reflections on research and practice, *International Small Business Journal*, **35**, pp. 3–18.
- Ramoglou, S., Gartner, W. B. and Tsang, E. W. K. (2020). “Who is an entrepreneur?” is (still) the wrong question, *Journal of Business Venturing Insights*, **13**, pp. e00168.
- Ramos-Escobar, E. A., García-Pérez-de-Lema, D., Castillo-Vergara, M. and Valdez-Juárez, L. E. (2022). Immigrant entrepreneurs: A review of the literature and an agenda for future investigations, *International Journal of Intercultural Relations*, **91**, pp. 170–190.

- Rath, J. and Kloosterman, R. (2000). Outsiders' Business: A Critical Review of Research on Immigrant Entrepreneurship, *The International Migration Review*, **34**, pp. 657–681.
- Rauch, A. and Frese, M. (2007). Let's put the person back into entrepreneurship research: A meta-analysis on the relationship between business owners' personality traits, business creation, and success, *European Journal of Work and Organizational Psychology*, **16**, pp. 353–385.
- Riddle, L., Hrivnak, G. A. and Nielsen, T. M. (2010). Transnational diaspora entrepreneurship in emerging markets: Bridging institutional divides, *Journal of International Management*, **16**, pp. 398–411.
- Riddle, Liesl and Brinkerhoff, J. (2011). Diaspora entrepreneurs as institutional change agents: The case of Thamel.com, *International Business Review*, **20**, pp. 670–680.
- Romero, M. and Valdez, Z. (2016). Introduction to the special issue: intersectionality and entrepreneurship, *Ethnic and Racial Studies*, **39**, pp. 1553–1565.
- Sanders, J. M. and Nee, V. (1996). Immigrant self-employment: The family as social capital and the value of human capital, *American Sociological Review*, pp. 231–249.
- Saxenian, A. (2002). Silicon Valley's New Immigrant High-Growth Entrepreneurs, *Economic Development Quarterly*, **16**, pp. 20–31.
- Schoar A. (2010). The divide between subsistence and transformational entrepreneurship. *Innovation Policy and the Economy* **10**, pp. 57-81.
- Sethi, D. and Judge, W. (2009). Reappraising liabilities of foreignness within an integrated perspective of the costs and benefits of doing business abroad, *International Business Review*, **18**, pp. 404–416.

- Shirokova, G., Beliaeva, T. and Manolova, T. S. (2022). The Role of Context for Theory Development: Evidence From Entrepreneurship Research on Russia, *Entrepreneurship Theory and Practice*, **47**(6), pp. 2384-2418
- Sinkovics, N. and Reuber, A. R. (2021). Beyond disciplinary silos: A systematic analysis of the migrant entrepreneurship literature, *Journal of World Business*, **56**, pp. 101223.
- Stephan, U., Uhlaner, L. M. and Stride, C. (2015). Institutions and social entrepreneurship: The role of institutional voids, institutional support, and institutional configurations, *Journal of International Business Studies*, **46**, pp. 308–331.
- Stoyanov, S., Woodward, R. and Stoyanova, V. (2018). The Embedding of Transnational Entrepreneurs in Diaspora Networks: Leveraging the Assets of Foreignness, *Management International Review*, **58**, pp. 281–312.
- Sui, S. and Baum, M. (2014). Internationalization strategy, firm resources and the survival of SMEs in the export market, *Journal of International Business Studies*, **45**, pp. 821–841.
- Sui, S., Morgan, H. M. and Baum, M. (2015). Internationalization of immigrant-owned SMEs: The role of language, *Journal of World Business*, **50**, pp. 804–814.
- Terjesen, S., Hessels, J. and Li, D. (2016). Comparative International Entrepreneurship: A Review and Research Agenda, *Journal of Management*, **42**, pp. 299–344.
- United Nations (2020). International migration 2020: Highlights.
- Urbano, D., Aparicio, S. and Audretsch, D. (2019). Twenty-five years of research on institutions, entrepreneurship, and economic growth: what has been learned?, *Small Business Economics*, **53**, pp. 21–49.

Urbano, D., Toledano, N. and Ribeiro-Soriano, D. (2011). Socio-cultural factors and transnational entrepreneurship: A multiple case study in Spain, *International Small Business Journal*, **29**, pp. 119–134.

Vaaler, P. M. (2011). Immigrant remittances and the venture investment environment of developing countries, *Journal of International Business Studies*, **42**, pp. 1121–1149.

Vanderkamp, J. (1977). The gravity model and migration behaviour: An economic Interpretation, *Journal of Economic Studies*, **4**, pp. 89–102.

Vinogradov, E. and Jørgensen, E. J. B. (2017). Differences in international opportunity identification between native and immigrant entrepreneurs, *Journal of International Entrepreneurship*, **15**, pp. 207–228.

von Bloh, J., Mandakovic, V., Apablaza, M., Amorós, J. E. and Sternberg, R. (2020). Transnational entrepreneurs: opportunity or necessity driven? Empirical evidence from two dynamic economies from Latin America and Europe, *Journal of Ethnic and Migration Studies*, **46**, pp. 2008–2026.

Wang, D. J. (2020). When do return migrants become entrepreneurs? The role of global social networks and institutional distance, *Strategic Entrepreneurship Journal*, **14**, pp. 125–148.

Wang, Q. and Liu, C. Y. (2015). Transnational activities of immigrant-owned firms and their performances in the USA, *Small Business Economics*, **44**, pp. 345–359.

Waters, M. C. and Jiménez, T. R. (2005). Assessing Immigrant Assimilation: New Empirical and Theoretical Challenges, *Annual Review of Sociology*, **31**, pp. 105–125.

Welter, F. (2011). Contextualizing entrepreneurship—conceptual challenges and ways forward, *Entrepreneurship Theory and Practice*, **35**, pp. 165–184.

Welter F., Baker T., Wirsching K. (2019). Three waves and counting: The rising tide of contextualization in entrepreneurship research. *Small Business Economics* **52**, pp. 319-330.

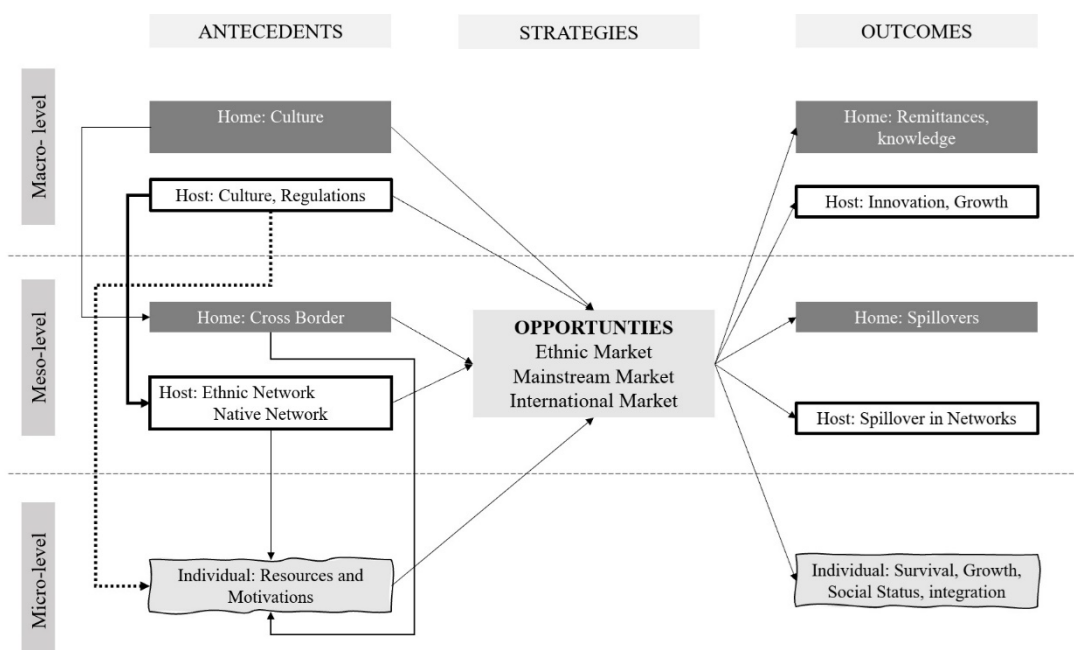
Zacharakis, A. (1997). *Entrepreneurial Entry into Foreign Markets: A Transaction Cost Perspective* (SSRN Scholarly Paper No. ID 1506373). Rochester, NY: Social Science Research Network.

Zaheer, S. (1995). Overcoming the Liability of Foreignness, *Academy of Management Journal*, **38**, pp. 341–363.

Zhang, Z. and Reay, T. (2018). Managing the Yin and Yang of family capital: a study of Chinese immigrant entrepreneurs, *Entrepreneurship & Regional Development*, **30**, pp. 722–748.

Zhao, H., Seibert, S. E. and Lumpkin, G. T. (2010). The relationship of personality to entrepreneurial intentions and performance: A meta-analytic review, *Journal of Management*, **36**, pp. 381–404.

Figure. 1



Outside employment opportunities and tournament incentives

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Abstract

We present robust evidence that firms enlarge the executive pay gap when executive mobility is constrained by the enhanced enforceability of non-compete agreements. We interpret this finding as evidence that firms increase tournament incentives to keep executives incentivized after the loss of valuable outside employment options. Consistent with this argument, we observe more significant increases in pay gaps for executives with greater ex ante mobility options and in years close to CEO-dismissal events in which tournament-incentive mechanisms are more prevalent. Following restrictions to executive mobility, equity portfolios that long (short) firms that (do not) boost the executive pay gap generate positive alphas. We rule out CEO power, managerial talent differentials, and CEO bargaining power as alternative explanations driving our results. Our findings suggest that there is a substitution effect between external (outside employment opportunities) and internal (pay gap) tournament incentives, hence provide novel evidence on a new executive pay gap determinant.

Keywords: Non-compete agreements; Human capital; Executive pay gap; Tournament incentives

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1 Introduction

The compensation gap across the ordinal rank of workers in an organization is commonly proposed as a form of rank-order tournament incentive in which an individual’s performance is relatively evaluated (e.g., Lazear and Rosen, 1981). The reward for the best relative performer is theoretically the leadership of the organization, a position that is associated with increased pecuniary wealth and social reputation. Thus, a pay gap, like a tournament prize, provides motivation for existing employees to work harder.

In modern corporations, promotion-driven pay increases are particularly significant among top executives (Belzil and Bognanno, 2008), especially those who get the top prize, that is, the coveted Chief Executive Officer (CEO) position. Therefore, tournament-incentive effects are likely to greatly affect the behavior of the firm’s vice presidents (VPs). There is significant evidence that tournament incentives induce VPs to exert effort and boost their willingness to take risk (e.g., Kale, Reis, and Venkateswaran, 2009; Kini and Williams, 2012; Lazear and Rosen, 1981), thus, shape various corporate outcomes.¹

While various findings are about the real effects of rank-order tournament incentives, the evidence on their determinants is scant.² We provide a novel contribution to this literature by studying whether exogenous variations in VPs’ outside job opportunities affect the magnitude of the internal tournament incentives VPs face in their current workplace. In other words, we aim to address the following question: do firms adjust their VPs’ internal tournament incentives following changes to the VPs’ external job opportunities?

Internal promotions (vertical moves), and the resulting pay increases, are important incentive devices for VPs but, in a mobile market, VPs are also incentivized by employment

¹For example, existing studies show the significant impact of tournament incentives on firm performance and valuation (Burns, Minnick, and Starks, 2017; Kale et al., 2009), financial policies (Hasan, Navone, To, and Wu, 2020; Kini and Williams, 2012; Kubick and Masli, 2016; Phan, Simpson, and Nguyen, 2017), as well as the incidence of corporate lawsuits or fraud (Haß, Mller, and Vergauwe, 2015; Shi, Connelly, and Sanders, 2016). Tournament incentives also affect companies’ Initial Public Offerings, for example, their failure risk (Colak, Gounopoulos, Loukopoulos, and Loukopoulos, 2021). See Lazear (2018) for a relevant recent review.

²Earlier economic research concludes that pay differentials are greater when promotion rates are lower (e.g., Bognanno, 2001; Main, O’Reilly, and Wade, 1993). Kale et al. (2009) document the importance of several other dimensions and provide related evidence (see Section 3.1 for details). Henderson and Fredrickson (2001) argue that considerations around management coordination are associated with pay gap design. Burns et al. (2017) show that cultural factors are helpful in explaining cross-country variation in the executive pay gap.

opportunities outside the firm. They can strive for the CEO position in other firms (diagonal move) or join another firm on a similar job title but with better pay and status (horizontal move). Horizontal and diagonal moves are particularly common. Graham, Kim, and Kim (2020) document that CFO mobility is higher and has increased faster than CEO mobility since the last century, and Kale, Reis, and Venkateswaran (2014) report that 40% of the VPs in S&P 500 firms assume the CEO position after moving across firms.

We term external tournament incentives those associated with a VP’s opportunity to leave for an outside job, which would motivate the VP to perform better.³ The concept of an external tournament is broad, as it relates to all the prospective job opportunities in the horizontal and/or diagonal directions, and implies multiple outcomes of the prize size in various external horse races. As a result, it is obviously hard to develop a proxy for the external tournament incentives.⁴ However, we argue that the most straightforward factor associated with such incentives is a VP’s potential job mobility. If a VP’s ability to join another firm is low, the tournament incentives arising from the external executive market, in any form, are limited, and vice versa.

Based on this argument, and similar to Ewens and Marx (2018) and Kini, Williams, and Yin (2021), we use the variations in the state-level enforceability of non-compete agreements (NCAs) between firms and their employees as quasi-natural experiments associated with changes to VPs’ external tournament incentives. NCAs are legal clauses that are frequently embedded in employment contracts to restrict employees’ ability to join other firms. In particular, more than 70% of top executives are constrained by NCAs (Garmaise, 2011; Kini et al., 2021).⁵ The actual numbers are likely higher because firms do not necessarily report such em-

³We recognize that a CEO also has the potential to join external tournaments, for example to be the CEO of a larger or more prestigious firm (Coles, Li, and Wang, 2018). However, recent evidence suggests that CEO reallocation across firms is rare (Cziraki and Jenter, 2022). In Section 5.3, we find that differences in the external tournament opportunities between a firm’s CEO and VPs cannot explain our findings.

⁴In addition, because non-pecuniary factors, such as corporate social reputation (Focke, Maug, and Niessen-Ruenzi, 2017), also characterize an individual’s external tournament incentives, a VP may not always choose a career destination with the largest foreseeable pay increase, which further complicates the design of an empirical proxy.

⁵A widely cited survey by Starr, Prescott, and Bishara (2021) finds that NCAs are commonly used not only for executives, but also for less-strategic workers. Such clauses are estimated to affect at least 18% of U.S. labor participants. Several states, such as Oregon, Nevada, and Illinois, have amended their laws prohibiting the use of non-compete clauses for low-paid earners (see, for example, “Oregon, Nevada and Illinois further limit restrictive covenants”, JDSUPRA, June 9, 2021). The Federal Trade Commission (FTC) recently suggested a rule to forbid employers from imposing non-competes on their workers (see, “FTC proposes rule

ployment contracts (Lin, Peters, and Seo, 2022). Due to the segmentation in executive labor markets (e.g., Ma, Pan, and Stubben, 2020; Yonker, 2017) and assuming that the tendency to include NCAs for VPs is a persistent firm-level feature (Chen, Jung, Peng, and Zhang, 2022), state-level rules increasing (reducing) the enforceability of NCAs should negatively (positively) affect the mobility of a firm’s VPs in the labor market (Garmaise, 2011). Notably, these state-level rules are unlikely to be influenced by the actions of a particular firm and can, therefore, be deemed exogenous to a firm’s executive pay system.⁶ We identify nine (six) states that have been through increases (decreases) in NCA enforceability from 1993 to 2018.⁷ Exploiting the changes in enforceability in a difference-in-differences (DID) framework, we examine how labor market frictions shape internal tournaments and, specifically, the executive pay gap, i.e., the pay gap between the CEO and executive directors.

We expect an increase in NCA enforceability to lead to a larger executive pay gap for two main reasons. First, the outside opportunities that function as implicit incentives for executives are less effective when NCAs become more enforceable and executive mobility is reduced. Internal promotion becomes the only way for executives to boost their utility. As a consequence, firms are incentivized to restructure executive compensation contracts and widen the gap between the pay of their CEOs and that of the VPs. A larger pay gap enhances the utility associated with future promotions (i.e., tournament prize) and makes up for the lost external opportunities (Gibbons and Murphy, 1992). Second, if executive mobility is reduced on the labor market, firms might struggle to search for capable candidates externally, therefore selecting and promoting well-performing current employees becomes crucial. A more competitive internal tournament generates information on and signals about the quality of executives, which are useful to find ideal candidates for promotion. In short, the internal pay gap is expected to increase as a substitute for VPs’ weaker external tournament incentives.

to ban noncompete clauses”, FTC, January 5, 2023). However, our focus throughout this paper is on the top management team, which is not the target of these initiatives.

⁶Bai, Eldemire, and Serfling (2023) and Johnson, Lavetti, and Lipsitz (2021) present formal evidence that an array of state-level economic and political characteristics and other laws for labor protection and trade secrets are not correlated with NCA enforcement. Jeffers (2022) also report that the distributions of macro conditions are similar across states with or without changes in enforceability. These findings further support the argument that changes in NCA enforceability are plausibly exogenous.

⁷The events analyzed here are comparable to those in studies with similar sample windows, such as Bai et al. (2023), Ewens and Marx (2018), and Kini et al. (2021). A few discrepancies are discussed in detail and motivated in Appendix A.

A counterargument, however, is that firms might be less motivated to increase tournament incentives for their executives in the presence of stricter NCA enforcement. First, fewer outside employment opportunities mean that VPs are motivated to perform better in their current jobs since potential dismissal could result in costly and delayed reentry to the executive labor market. Second, prior studies find that executives face higher dismissal risks under stricter NCA enforcement since firms now encounter lower costs of competitive harm from forced executive turnover decisions (Kini et al., 2021; Lin et al., 2022). Therefore, the threat of dismissal is rather powerful in this case and could motivate VPs even in the absence of greater incentives. Overall, it is an empirical question whether firms will increase internal tournament incentives when there is a reduction in executives' outside employment opportunities.

As a preliminary step to our empirical analysis, we show that more (less) restrictive state-level rules on NCAs lead to a significant reduction (growth) in executive mobility. In the main DID tests, we find a statistically significant enlargement in the executive pay gap following a state-level increase in NCA enforceability, after controlling for a comprehensive set of other variables as in Kale et al.'s (2009) study. In these tests, the executive pay gap (*Total Gap*) is computed as the difference between a CEO's total pay and the average total pay of the VPs from the CEO's firm. On average, a firm affected by the shock (a treated firm) approximately has a \$0.70 million larger pay gap than a non-treated firm. In the same model, we estimate that the interquartile change of the distribution of firm size, the most economically significant variable in determining executive compensation (Gabaix and Landier, 2008; Gabaix, Landier, and Sauvagnat, 2014), enlarges the pay gap by about \$3.05 million. Therefore, the impact of stronger NCA enforcement is economically meaningful as it is almost a quarter of that of firm size. We extend our regression analysis in a dynamic setting and find the effects on the pay gap, which are persistent over time, materialize after one year following an increase in NCA enforceability. Also, consistent with the parallel trends assumption, pre-shock trends in the pay gap are similar between treated and non-treated firms.

Though our central focus is on *Total Gap*, we decompose total executive compensation into the short- (ST) and long-term (LT) components and build two additional outcome variables: *ST Gap* and *LT Gap*. ST pay is the sum of salary and bonus, while LT pay mainly consists of

stock and options grants. The baseline finding of a positive effect of increased NCA enforceability on *Total Gap* also extends to both the *ST Gap* and *LT Gap*. However, the change in *ST Gap* is observed mainly in the first two years after the shock with the *LT Gap* playing a dominant role in explaining the long-lasting effects. The differences in timings are likely attributable to the nature of the specific components in the executive pay package.

We utilize several other specifications to help mitigate econometric concerns that may bias the baseline results. We first use a propensity score matched sample in our DID model and find similar results, showing that differences in observable characteristics between treated and non-treated firms do not drive our findings. Next, recent studies have criticized the staggered DID method for using already-treated units as controls, leading to potentially biased estimations due to heterogeneous treatments (Baker, Larcker, and Wang, 2022; Goodman-Bacon, 2021). Following the extant studies, we use both the Callaway and Sant’Anna (2021) estimator and the stacked regression method suggested by Baker et al. (2022), and find our results to be robust. Last, we construct a set of counterfactual events by keeping the time distribution of event years and randomly matching them with the states that have never been affected by the shock. The distribution of coefficients from 1,000 runs of the falsification tests shows that our findings are unlikely to be observed by chance.

In cross-sectional tests, we evaluate our argument that reduced executive mobility is the mechanism behind the observed increase in pay gap by focusing on VPs that are more likely to value mobility. We find that the effect of an increase in NCA enforceability is more significant in the subsample of firms belonging to states that tend to rely on CEOs hired from other firms or with higher skewness of CEO pay levels, or firms with founder CEOs. In these firms, VPs value outside employment options more and have a high ex ante tendency for mobility because within-firm promotion expectations are limited or across-firm movements are more rewarding. Further, the impact of enhanced enforceability is more pronounced in firms in which VPs have more significant outside job opportunities, i.e., in firms with younger VPs, more able managers, and in industries with lower product market concentration.

Running a rank-order tournament to find the best VP is not the only way for firms to select internal candidates for the CEO position. Pass-the-baton practices are another typical pattern.

In a pass-the-baton model, a firm can designate a person as the CEO’s successor in advance and promote her when the incumbent CEO leaves (Vancil, 1987). Having a succession plan in place contributes to smoother CEO switches by reducing the possibility of forced turnover (Cvijanovic, Gantchev, and Hwang, 2022; Naveen, 2006) and impairs the value of competition among VPs. We find that the effects of increases in NCA enforceability are more pronounced in years right before CEO dismissals, when firms are more likely to adopt the tournament model rather than the pass-the-baton model.

We next switch our focus to the opposite change pattern, i.e., a reduction in NCA enforceability, to check whether the effect is symmetric. We note that we have no priors as to whether the effect should be symmetric or not. We find a negative but weaker effect on executive pay gaps, implying an asymmetric impact of changes in NCA enforceability. This would be consistent with prior evidence that firms are reluctant to reduce CEO pay (Dittmann, Maug, and Zhang, 2011) as well as recent findings that relate CEO pay arrangements to issues beyond incentives, such as, perception of fairness (Edmans, Gosling, and Jenter, 2022).

One important question to address is whether adjustments to executive pay gaps driven by shocks to NCA enforceability have implications on firm value. Prior studies highlight the adverse effects of more enforceable NCAs on firm efficiency owing to limitations to the reallocation of talent (Anand, Hasan, Sharma, and Wang, 2018; Bai et al., 2023; He and Wintoki, 2020; Shi, 2023). Arguably, firms can counteract these adverse effects by adjusting internal tournament incentives. We provide stock-market-based evidence which shows that a strategy that goes long (short) in a portfolio comprising treated companies with (without) increased pay gaps can generate positive alphas. Put differently, firms that increase their internal tournament incentives for VPs when the external ones weaken perform significantly better than other treated firms.

We interpret our findings through the framework of rank-order tournament incentives, but at first sight other explanations could also hold. One alternative interpretation is that an expanded pay gap is a manifestation of the excessive compensation extracted by a powerful CEO (Bebchuk, Cremers, and Peyer, 2011).⁸ Stringent restrictions to executive labor mobility

⁸Entrenched CEOs may also be inclined to pursue a quiet life by, for example, offering more pecuniary benefits to VPs, which would make them more loyal followers. Therefore, CEOs can derive private benefits from

prevent firms from recruiting candidates whose skillsets best match their needs and this may give the incumbent CEO more power. Another common view is that the pay gap reflects talent differentials across corporate hierarchies rather than being an incentive tool (Mueller, Ouimet, and Simintzi, 2017; Terviö, 2008). If NCA shocks lead firms to implement changes in the composition of their executive teams, talent differentials among executives will also be affected. The last alternative explanation we consider relates to the CEO bargaining power argument (Kini et al., 2021). The intuition behind this argument is that affected CEOs may have stronger bargaining power compared to the VPs and claim more consideration for themselves than other executives, which creates a differential in the effects of non-compete enforcement shocks that favors CEOs. We run a battery of additional tests to rule out all the above competing explanations. Taken together, the executive pay gap changes following shifts in non-compete enforcement are likely to capture variations in tournament incentives.

To the best of our knowledge, our study is the first to provide direct evidence showing a substitution effect between external and internal tournament incentives for top executives. In a related study, Coles et al. (2018) argue that CEO departures through external tournaments can be the precondition for an effective internal rank-order tournament, otherwise the VPs' opportunities on the internal promotion ladder would be negligible. This argument is incomplete given that CEOs can be dismissed, and, importantly, VPs also have external career opportunities. In this study, we argue that analyzing the interplay between VPs' internal promotion and external employment opportunities is key to enhancing our understanding of the drivers of the internal tournament. More broadly, we contribute to the literature investigating the drivers of rank-order tournament incentives, especially the executive pay gap (e.g., Bognanno, 2001; Burns et al., 2017; Kale et al., 2009; Main et al., 1993). Previous studies document that the executive pay gap substantially impacts real corporate outcomes (Kale et al., 2009; Kini and Williams, 2012). Therefore, it is important to understand its determinants better.

We also contribute to the related topic on the effects of labor mobility on managerial compensation (e.g., Chen et al., 2022; Kini et al., 2021). Kini et al. (2021) argue that CEOs receive higher compensation because NCAs raise their unemployment risks. In this paper,

saving effort in wage bargaining and improving social relations (Bertrand and Mullainathan, 2003; Cronqvist, Heyman, Nilsson, Svaleryd, and Vlachos, 2009). However, this prediction is at odds with our main findings.

however, we identify an alternative explanation for this increase in CEO compensation, which is based on VPs tournament incentives.

Lastly, a recent study by Johnson et al. (2021) finds that the strengthening of NCA enforceability exacerbates gender and racial salary gaps. We, instead, study the executive pay gap and show that firms intentionally expand the gap to generate internal tournament incentives as a substitute for the loss of external ones. Importantly, we also study the firm value implications of this practice, complementing other studies on non-compete enforceability that provide inconsistent results regarding its effect on firm value (Anand et al., 2018; Bai et al., 2023; Garmaise, 2011; He and Wintoki, 2020). Our findings help reconcile the conflicting prior evidence concerning the real effects of executive mobility and provide insights for the ongoing debate about pay inequality.

2 Institutional background

Non-compete clauses embedded in a firm’s employment contracts restrict signers from joining competitors if that could infringe upon the legitimate business of the firm in the future. Prior work shows that these restrictions protect the firm against losing its key human capital for around two years (Malsberger, 1996; Vanko, 2002). The scope of geographic constraints specified in NCAs varies but can typically cover all the places where the employer has operations (Bishara, Martin, and Thomas, 2015; Kini et al., 2021).

By convention, U.S. courts do not scrutinize the reasonableness or adequacy of contract terms under contract laws, and employers can freely include non-compete clauses in employment contracts (Vanko, 2002). At the same time, employers have a strong incentive to sue employees who breach the agreements. Thus, the costs of violating NCA terms are potentially significant. It is not only individuals suspected of violating NCAs who are vulnerable to lawsuits from their former employers, but also the new employers may be liable for possible monetary damages. At worst, the new employment relation could be ceased forcefully (Bai et al., 2023; Vanko, 2002).

Therefore, non-compete limitations for top executives can be far-reaching and not necessarily within the same industry or state (Bishara et al., 2015). Nonetheless, the real extent of

non-compete restrictiveness is determined by state-level enforceability, which is further determined by legislative actions or prior court rulings. Although non-compete laws vary considerably across different states and individuals may escape local regulations through cross-state movements (Marx, Singh, and Fleming, 2015), this appears not to be an optimal solution for executives’ career developments, because many studies find that the executive labor markets are geographically segmented (e.g., Ma et al., 2020; Yonker, 2017). Thus, executives are likely to take into account the effect of state-level restrictions. In turn, these rules can also affect firms’ decisions. It is critical for firms to grasp the legal surroundings and adjust production factors on the premise of state law compliance (Anand et al., 2018).

Malsberger (1996), Garmaise (2011) and several subsequent studies (e.g., Bai et al., 2023; He and Wintoki, 2020; Kini et al., 2021; Lin et al., 2022) consider answers to twelve questions to evaluate the level of NCA enforceability in a particular state and track substantial changes in enforceability. We follow the same empirical strategy and find that, during our sample period, the following nine states have experienced increases in NCA enforceability: Florida in 1996, Georgia in 2004 and 2010, Ohio in 2004, Vermont in 2005, Idaho in 2008, Wisconsin in 2009, Texas in 2010, Colorado in 2011, and Virginia in 2013. We also record a weakening in enforceability in Texas in 1994, Louisiana in 2001, Oregon in 2008, New Hampshire in 2012, Illinois in 2013, and Kentucky in 2014. We present the empirical strategy and summary of the events in Appendix A.

Though some studies propose using a discrete enforceability index based on Garmaise’s (2011) twelve questions as a test variable (e.g., counting the number of positive answers), we instead prefer a binary test variable, which captures changes in the index, in a difference-in-differences (DID) specification. Three reasons justify our choice. First, it is difficult to assess whether each question is of equal importance and has equivalent impact on executive mobility. By creating a dummy indicator, we only need to detect if there are events causing qualitative differences in enforceability. Second, our approach allows us to classify a firm into either the treated or control group according to its home state and cleanly estimate the effect of the treatment. Last, having separate dummies for upward and downward changes in enforceability allows us to examine the heterogeneous effects of the two types of events. In robustness checks,

we find our results are in line with our baseline findings when using the discrete enforceability index.

If a state has been through more than one change in the same direction during our sample period, we only focus on the first transition. If multiple changes are in opposite directions, we set our test variable to one when the first event happens and re-set it to zero following the second event (Klasa, Ortiz-Molina, Serfling, and Srinivasan, 2018). In our sample, the average rate of VP turnover is 14.8% and, in Table OA.1, we observe that stronger (weaker) enforceability decreases (increases) mobility by about 29.7% (18.9%), indicating that the shifts in the NCA enforcement have similar impacts in terms of magnitude. We primarily focus on upward shifts in enforceability but also discuss the effects of downward shifts.

3 Methodology

3.1 Empirical methodology

To examine the impact of variations in NCA enforceability on the executive pay gap, we primarily estimate the following DID specification:

$$\ln (\textit{Pay Gap})_{i,t+1} = \alpha + \beta \cdot \textit{NCA Enforceability}_{t,s} + \gamma \cdot \mathbf{X} + \mu_i + \rho_t + \theta_s + \varepsilon \quad (1)$$

where i , t , and s denote firm, year, and state of firm headquarters, respectively.

The dependent variable describes the gap in pay between a CEO and the average VP in the firm, following prior studies (e.g., Bognanno, 2001; Henderson and Fredrickson, 2001). We take the average VP compensation as the benchmark to construct the *Pay Gap* proxy for two reasons. First, all the VPs can be subject to NCAs that restrict their mobility. They are, therefore, all susceptible to changes in state-level NCA enforceability (Chen et al., 2022; Garmaise, 2011). Second, using information for all VPs is helpful in capturing variations due to changes in the size of top management teams. We follow prior studies and take the natural logarithm of the highly skewed *Pay Gap*, and also use alternative proxies and transformations in robustness tests. We measure all the dependent variables at $t + 1$ to ease reverse causality

problems and in recognition that adjustments to executive pay are not instantaneous and inevitably happen with a lag.

The main test variable, $NCA\ Enforceability_{t,s}$, is a binary variable that equals one if state-level NCA enforceability has changed in the current or previous years, and zero otherwise. We follow Kale et al. (2009) and include a vector of controls, $\mathbf{X}$, related to CEO, firm, and industry characteristics that are expected to determine the size of the *Pay Gap*. Specifically, firm size, median industry-level gap, stock return volatility, and the number of business segments are firm characteristics that are predicted to directly affect the executive pay gap. In addition, Kale et al. (2009) highlight that the total utility for VPs in each internal tournament depends on the size of the prize they obtain in case of promotion and the probability of promotion. Promotion likelihood should be negatively correlated with prize size since firms do not need to guarantee their executives a large, expected benefit from a promotion when such event is particularly likely. Thus, factors directly associated with VPs' promotion chances can be considered as determinants of the pay gap. These factors include variables capturing whether the CEO is new, an insider, or retiring, as well as CEO duality, CEO age, CEO tenure, number of VPs, whether the CFO is a VP, whether the firm has a propensity for relay succession, and industry homogeneity. Detailed variable definitions can be found in Appendix B. We measure all the executive characteristics at year $t + 1$ and firm financials or industry characteristics at year t . We do not discuss the expected signs of these controls here for brevity.

The baseline models include firm (μ_i) and year (ρ_t) fixed effects (FEs) to control for time-invariant omitted firm characteristics and time-specific factors. Firm FE can also help capture the firm-level variations in NCA usage since this should be persistent over time (Chen et al., 2022). In addition, we control for the time-invariant state attributes with state FE (θ_s) because firms can relocate their headquarters to other states (Bai, Fairhurst, and Serfling, 2020; Chen et al., 2022). The standard errors are robust to heteroskedasticity and clustered at the headquarter state level.

3.2 Sample selection

Our initial sample comes from the S&P ExecuComp database over the period 1993 to 2018. We use the “CEO annual flag” ($\text{CEOANN} = \text{CEO}$) to identify a firm’s CEO. However, some firm-year annual flags either do not allow us to find any CEO or indicate the existence of multiple CEOs. BoardEx database helps us to fill or correct 42.2% of those observations. In particular, we identify CEOs by their “role name”, considering variants of the term “CEO”. Other non-CEO corporate executives are categorized as VPs (Kale et al., 2009; Kini and Williams, 2012). We drop the firm-year observations still without an identifiable CEO, or with missing CEO annual pay (ExecuComp item: TDC1). Consistent with Kini and Williams (2012), we retain firm-years as long as ExecuComp lists at least one senior executive besides the CEO. However, requiring firms to have at least two or three VPs does not affect our results.

ExecuComp modified its reporting format of executive compensation after the passage of FAS 123R, making the comparability between pre- and post-FAS 123R problematic. As discussed by Walker (2011), prior to FAS 123R, TDC1 fails to measure the ex-ante value of performance shares. In our main analysis, following prior studies (e.g., Focke et al., 2017; Gabaix et al., 2014), we adjust the pre-regulation data to make compensation data consistent across our whole sample period. That is, we firstly subtract the amount paid for long-term incentive plans (ExecuComp item: LTIP) from TDC1 and add the product of the number of performance shares granted (ExecuComp item: SHRTARG) and the stock price at the fiscal year end. SHRTARG is replaced by zero if missing (Gabaix et al., 2014). We use the TDC1 data as is for the period after FAS 123R.

We are aware that the above method to adjust ExecuComp data is imperfect. An obvious limitation is that SHRTARG is often missing (Gabaix et al., 2014), which risks biasing our estimations. However, as discussed in Coles, Daniel, and Naveen (2014), all TDC1 components in ExecuComp except SALARY have changed definitions since the regulation change. Eliminating the differences between two reporting regimes is rather difficult to achieve. In the Online Appendix, we consider two alternative approaches to ease concerns. We follow the procedures by Kini and Williams (2012) to recalculate the values of stock option awards using the Black-Scholes model for the post-FAS 123R period and substitute the ExecuComp item,

OPTION_AWARDS_FV, in the same period. We also split the full sample depending on the data reporting formats to guarantee within-group comparability. The results are unaffected by these changes.

We compute the *Total Gap*, *ST Gap*, and *LT Gap* as previously discussed and exclude non-positive values from the baseline regression.^{9,10} When *Total Gap* values are excluded, we argue that VPs are not substantially incentivized in terms of monetary compensation and also discard the same observations for both the *ST Gap* and the *LT Gap*.

Employment laws are typically applicable to the states where employees are working. Executives and managers are likely to locate in the states of their firms' headquarters (Bai et al., 2020; Dang, De Cesari, and Phan, 2021). Since Compustat only provides the latest data on firms' headquarters locations, we extract historical data from Bai et al. (2020) for the period until 2003 and from 10-X Header Data from Bill McDonald's website for the subsequent period.¹¹ We retain the Compustat location data when the historical data is not available. Firm-years without U.S. headquarters are dropped.

Finally, we combine our sample with other financials, mainly from Compustat and CRSP databases. Firms in the utility or financial industries or without recorded asset values are excluded. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 1 summarizes the descriptive statistics for the main variables used in our baseline models. The sample consists of 28,449 firm-year observations with 2,368 unique firms. The mean (median) value of the *Total Gap* is \$3.44 (\$1.97) million, which is larger than that reported in prior related studies (e.g., Kini and Williams, 2012; Kubick and Masli, 2016).

⁹Kini and Williams (2012) find that instances of negative executive pay gap are mostly because CEOs are also founders, who receive low compensation but have large equity stakes. A negative gap is also possible when the former CEO becomes a VP while continuing to receive a high compensation that is larger than that of the new CEO. Thus, negative pay gaps are likely to introduce noise. We alternatively recalculate the variable in different ways: (1) we monotonically add a constant to make all pay gaps positive; (2) we replace the negative values with the median industry pay gap; (3) we replace the CEO's pay when smaller than VPs' with the industry median CEO pay. Next, we transform the dependent variables using natural logarithms. In all cases the results are qualitatively similar to those from our baseline estimations.

¹⁰In around 5.7% of the observations the *LT Gap* is equal to zero, because ExecuComp reports that all executives get zero or the same amount of long-term incentives. These observations are less likely to reflect tournament dynamics and are, therefore, excluded.

¹¹The information in 10-X Header Data comes from SEC EDGAR, which formally starts in 1994. For the period preceding this date, Bai et al. (2020) collect the headquarter location data from Moody's Manuals and Dun & Bradstreet's Million Dollar Directory. Over the period 1994 to 2003, there is a very significant overlap between the two datasets. We note that around 12.1% of firms have at least once relocated their headquarters to other states in our sample. The results are robust when excluding all the observations for these firms.

However, this pattern is not surprising considering the rapid growth of CEO pay in recent years. The distributions of variables are comparable to prior research (Acharya, Gabarro, and Volpin, 2021; Hasan et al., 2020; Hayes, Lemmon, and Qiu, 2012; Kale et al., 2009).

4 Empirical Results

4.1 Main results

4.1.1 Graphical analysis

Our baseline model employs a DID specification, so it is necessary to check if it satisfies the underlying assumption of parallel trends. We include leads and lags around the year of enhanced NCA enforceability and estimate the equation:

$$\ln(\text{Pay Gap})_{i,t+1} = \alpha + \sum_{k=-20, k \neq -1}^{k=21} \delta_k \cdot D_{t,s}^k + \mu_i + \rho_t + \theta_s + \varepsilon \quad (2)$$

where dummy variables $D_{t,s}^k$ capture periods preceding, following, and contemporaneous to an event of increased NCA enforceability, and δ_k is the parameter of interest in the graphical analysis of this section. The definitions of the other components in Eq. (2) are identical to those in Eq. (1). The vector of control variables is not included to mitigate the effects of the possible endogeneity of any control variable (Baker et al., 2022). The firm FEs μ_i is included in the estimation, so that δ_k reflects average within-firm variations over time.

Since our sample period is from 1993 to 2017 and given the timings of the studied events, we have a maximum of 20 years preceding and 21 years following any event. We do not bin or truncate any relative-time indicators to avoid contamination in the event-study specifications (Baker et al., 2022; Sun and Abraham, 2021). We omit the dummy indicating year -1 from Eq. (2) to avoid collinearity (Borusyak, Jaravel, and Spiess, 2022) and, therefore, take this period as the reference year.

Figure 1 plots the coefficients estimated from Eq. (2) for a 21-year-window around the shock. Consistent with the parallel trends assumption, the figure shows that the pay gap is not statistically different between treated and control firms before an enhanced enforceability

event. The non-existing pre-treatment effects indicate that differences in treated and control firms' inherent preferences cannot be the drivers of our findings.

4.1.2 Baseline results

Table 2 presents results for the baseline model of Eq. (1). All regressions are estimated using OLS with firm, year, and state fixed effects (FEs). Column (1) reports results for specifications on how enhanced enforceability affects the executive pay gap without time-varying covariates. In Column (2), we further add a comprehensive set of other variables following Kale et al. (2009). The results from both columns show that the positive coefficients on *NCA Enforceability Up* are highly significant, indicating that firms enlarge the pay gap if their headquarters are in a treated state. The effect is also economically meaningful: on average, compared with the control firms, the affected firms experience a growth in pay gap amounting to 20.3% ($= \exp(0.185) - 1$), corresponding to an absolute increase of about \$0.70 million ($= \$3.44 \text{ million} \times 20.3\%$). The effects of other variables in Column (2) are generally in line with the empirical results or theoretical predictions by Kale et al. (2009) and, in particular, confirm the statistical and economic significance of firm size (Gabaix and Landier, 2008; Gabaix et al., 2014). Given that the interquartile change in $\ln(\text{Total Asset})$ leads to a \$3.05 million ($= \$3.44 \text{ million} \times [\exp(0.286 \times 2.22) - 1]$) larger pay gap, the impact of the enhanced enforceability is almost a quarter of this effect and, therefore, economically substantial.

We further provide insights into the two components of the executive pay gap, namely the *ST Gap* and *LT Gap*, in Columns (3) to (6). The coefficients on *NCA Enforceability Up* continue to be positive and significant in both instances. The economic magnitudes, however, are distinct between the two dependent variables: compared to a control firm, an average treated firm experiences an increase of about 5.7% in the *ST Gap* and about 20.6% in the *LT Gap*. Thus, the *LT Gap* can be interpreted as the main driver of the change in *Total Gap*. This confirms the growing importance of the stock and option components in executive compensation (Graham et al., 2020), and suggests that the observed variations in the pay gap are mainly about long-term incentives.

In the Online Appendix, we follow previous research and use several alternative measures of the executive pay gap. Table OA.2 indicates that our main finding does not differ for any of those measures. Overall, we posit that the enhanced NCA enforceability expands the relative pay gap between the CEO and the VPs.

4.1.3 Dynamic effects

We extend our analysis by examining the dynamic effects of an increase in NCA enforceability. In particular, we decompose the periods preceding and following this event into five bins. The indicators are equal to one if a firm’s headquarters are in a state that experiences or experienced the event (i) in either three or four years in the future (*NCA Enforceability* $Up^{-3,-4}$); (ii) in either one or two years in the future (*NCA Enforceability* $Up^{-1,-2}$); (iii) in either the current or the previous year (*NCA Enforceability* $Up^{0,+1}$); (iv) either two or three years ago (*NCA Enforceability* $Up^{+2,+3}$); (v) at least four years ago (*NCA Enforceability* $Up^{>=+4}$). The regressions of Columns (2), (4), and (6) of Table 2 are re-estimated by replacing the test variable *NCA Enforceability* Up with this set of binary variables.

The results reported in Column (1) of Table 3 are generally consistent with the plotted trends in Figure 1, which show that the assumption of parallel trends holds, and the treated effects on the overall pay gap get stronger over time. We further examine the *ST Gap* and the *LT Gap*. The statistically significant effect of the increased NCA enforceability on the *ST Gap* is relatively transient and mainly exists in the first two periods and then becomes marginal. By contrast, the impact of the treatment on the *LT Gap* is persistent. The differences in timing are likely attributable to the nature of the different components in the executive pay package. Changes in long-term pay, consisting of stock and option grants, usually take longer to materialize and produce significant effects relative to changes in short-term pay, that is, salary and bonus. Consistent with Table 2, variations in the *LT Gap* are the main drivers of the enlarged *Total Gap* that follows an enhanced enforceability in NCA.

4.2 Econometric concerns

4.2.1 Matched sample

Treated and control firms should be similar along dimensions that pertain to executive pay. The treatment effects may otherwise suffer from biases caused by omitted or unobserved factors. We consider a propensity score matching approach to match treated observations with control observations and reduce the systematic differences across observable factors.

Recall that in Figure 1, we show that the enhanced NCA enforceability has lasting effects on the executive pay gap until year +10. Therefore, we set a window from $t - 10$ to $t + 10$ around each treatment event in year t for the treated firms. These firms are required not to change their home states during the window to avoid opportunistic relocations (Bai et al., 2020). The treated group consists of firms headquartered in states that have undergone an increase in enforceability in year t . The control group comprises firm-years of (i) firms that are never treated, or (ii) firms that are ever treated in a year that is outside of the event window.¹² A matched sample is identified based on one-to-one matching (with replacement) between treated and control groups. For all candidate firms, propensity scores are estimated using the covariates in Eq. (1) for the year prior to the increase in enforceability in logit models. In the matched sample, the control firm for a particular treated firm is the non-treated firm from the same year as the treated one with the most similar propensity score. We apply a caliper of 5‰ to exclude matches with scores that are not close enough. We retain firms with available data for at least one year in both the pre- and post-treatment periods. If an ever-treated firm is matched as a control firm, the firm-years that fall into the period of $t \pm 10$ around its own treatment are excluded. Overall, we obtain 191 matched pairs. Panel A of Table 4 demonstrates that the means of observable characteristics for the treated and control groups are quite similar after matching. Using the matched sample, in Panel B, we continue to find a significant growth of pay gap for the treated relative to control firms following an increase in NCA enforceability.

¹²In untabulated analysis, we find that the results using propensity score matching are robust to restricting the control group to consist of only never-treated firms.

4.2.2 Alternative specifications

Staggered DID applications have been questioned in recent years owing to the frequent use of already-treated units as control firm-years. The comparison between an earlier- and later-treated group potentially suffers from an estimation bias when treatment effects are heterogeneous, for example in relation to the time the treatment effect takes to affect the outcome variable (Baker et al., 2022; Goodman-Bacon, 2021; Sun and Abraham, 2021). This issue is relevant in our context since the timing of the treatment effect of enhanced enforceability might vary across a long sample period. In the baseline regression, however, we note that 81.7% of observations are never treated, helping reduce the likelihood of bias (Baker et al., 2022).

We provide two more pieces of evidence to alleviate any possible concerns. First, in Table OA.3, we put a restriction on the window, $t \pm 1$, $t \pm 3$, $t \pm 5$, or $t \pm 10$ around the treatment for the treated firms and show that our results persist. By truncating the treatment effects to vary in a relatively short timeframe, there is a reduction in the likelihood that previously-treated firms act as future controls and lead to biased estimations. Second, we follow Baker et al. (2022) and use both the Callaway and Sant’Anna (2021) (CS) estimator and stacked specifications to evaluate our baseline results. Consistent with the event-study estimates in Figure 1, the test window is set from $t - 10$ to $t + 10$ for each specific event in year t . We use “not yet treated” or “never treated” firms as clean comparisons and consider firm- and year-cohort FEs in the estimation.¹³ Unlike the “never treated” group, the “not yet treated” group also includes observations for firms that will be treated in the future. Last, we stack the events together and calculate an average effect for all the events. Panels C and D of Table 4 report the results of regressions with the CS estimator and the stacked regression, respectively. The coefficients estimated from the alternative methodologies are similar to those in the baseline regression, confirming the robustness of our main findings.

¹³In the CS estimator, we do not include state FEs as in Eq. (1) to avoid perfect collinearity. We thank Fernando Rios-Avila for clarifications on this issue. In the stacked regression, we find similar results when additionally controlling for state-cohort FEs.

4.2.3 Falsification tests

A remaining concern, however, is that our results may be driven by other unobserved shocks that coincide with the increase in NCA enforceability. We follow Dang et al. (2021) and implement 1,000 runs of a placebo test based on a counterfactual increase in enforceability. In each iteration, we keep the actual distribution of the event years while randomly assigning to them the states that have never been through the enhanced enforceability during our sample period (without replacement), and then re-estimate Eq. (1). Given the random assignment of the treatments, the 1,000 estimated coefficients are expected not to be significant in most cases. In Figure 2, the distribution of the probability density of the placebo estimates is centered around zero, and the coefficients are far from the true estimated value.¹⁴ Thus, the results in the baseline regressions are unlikely to be driven by chance.

4.2.4 Other robustness checks

In the Online Appendix, we present a series of tests that establish the robustness of our inference. All tests are informed by the extant literature; however, we explain the rationale behind each test only in the Online Appendix to conserve space here. First, our results are not sensitive to using different coding schemes to capture shifts in enforceability; to the choice of sample window; or to the existence of potential expectations as to future legislative actions driven by corporate lobbying activities (Table OA.4). Second, we show that our results are still significant after accounting for a set of extra control variables, including tournament possibility, compensation structure, firm strategy, and several accounting variables (Table OA.5). Furthermore, we control for additional FEs to alleviate concerns for other sources of omitted variables that may relate to the pay gap. Specifically, we consider FEs to capture the time-varying heterogeneity across industries, firm size quartiles, census tract regions, or states of incorporation, and also firm age FEs (Bai et al., 2020; Dang et al., 2021) (Table OA.6). Fourth, the relevance of the internal horse race varies over a CEO’s tenure in that a new CEO is less likely to be dislodged (Coles et al., 2018). We test and verify that the

¹⁴In untabulated results, we repeat the procedure several times, implementing trials for up to 2,000 times. Because the placebo states are randomly assigned, the estimated results vary each time. However, the fraction of the placebo coefficients that are larger than the actual coefficient is consistently smaller than 2%.

effects of enforceability on the pay gap, in general, get stronger after excluding the years just after CEO turnover events (Table OA.7). Fifth, and last, our results are robust if we (i) examine the full sample including financial and utility firms; (ii) exclude observations for the financial crisis period 2008-2009; (iii) restrict the sample to companies with at least two or three VPs; (iv) exclude the sample of CEOs identified through BoardEx; (v) examine only the sample with available historical headquarter data from 10-X Header Data (from 1994 to 2018); (vi) exclude relocated firms; (vii) exclude states that have experienced changes in NCA enforceability during the period from 1980 to 1993; (viii) exclude firms headquartered in Florida and/or Ohio that constitute 46.6% of the treated sample; (ix) construct industry-level financials (*Industry Homogeneity* and *Median Industry Gap*) based on the SIC-2 or NAICS-3 industry classification (Table OA.8).

4.3 Mechanisms underlying the baseline findings

4.3.1 Outside opportunities

We argue that the mechanism underlying our findings is that firms enlarge the executive pay gap to motivate and incentivize VPs whenever VPs' external mobility becomes more restricted. Thus, the impact of shocks to NCA enforceability on the pay gap should depend on the VPs' external opportunities and incentives pre-shock, also in relation to internal promotion prospects. Adjustments to the pay gap should be less significant when the relative importance of VPs' external opportunities is more limited. We consider several variables that capture variations in this dimension to test our conjecture.

We first focus on the incidence of outside hires at the state level since executive mobility often happens within the same state (Ma et al., 2020; Yonker, 2017). We expect firms belonging to states in which CEOs tend to be promoted internally to rely less on the external labor market and thus be less sensitive to mobility shocks.¹⁵ We calculate the fraction of insider CEOs at year t in each state and trisect the sample. As shown in Columns (1) and (2) of Panel A,

¹⁵A potential concern is that the likelihood of promoting insider CEOs is boosted by the changes in NCA enforceability that make external hiring expensive. However, existing evidence shows that firms' hiring of CEOs is not affected by NCA frictions (Chen et al., 2022; Cziraki and Jenter, 2022). In our sample, we find similar results (untabulated), that is, either an increase or decrease in enforceability does not affect CEO hirings.

Table 5, compared to the bottom tercile sample, the top tercile sample shows a significantly lower change in pay gap in response to increases in NCA enforceability.

Similarly, a VP can become a CEO in the current firm (move vertically) or another one (move diagonally). However, if pay levels are not significantly different across firms, she may be less motivated to leave the current employer and indifferent to changes in NCA enforceability. We calculate the skewness of CEO pay at year t in a focal firm’s headquarter state (excluding the focal firm). Executives in states with a more skewed distribution of CEO pay are more likely to get higher compensation once they leave their current firm. In this test, we exclude the ever-relocated firms that are subject to opportunistic actions, however, the results are not sensitive to this restriction. In Columns (3) and (4) of Panel A, the top tercile sample based on CEO pay skewness shows a greater change in the pay gap when the enforceability gets stronger than the bottom tercile sample.¹⁶

We subsequently relax the assumption on the prevalence of within-state mobility and consider a firm-specific cross-sectional variable based on whether a CEO is also the founder. Founder CEOs are rarely forced to leave their firm given their significant voting power on average. Thus, the incentives of VPs working for founder CEOs mostly arise from external tournaments since within-firm promotion expectations are limited. We use job titles from ExecuComp to identify founder CEOs. CEOs older than 65 years old or with interim positions are excluded in this test because they are likely to depart shortly. In Columns (5) and (6) of Panel A, Table 5, we find that the increase in pay gap for firms with founder CEOs is significantly larger than that for the non-founder sample, showing that VPs working for a founder require more internal tournament incentives to compensate them for the lost outside opportunities.

We next consider the cross-sectional variation in three variables that reflect outside job opportunities. First, career concerns are associated with the age of executives. Younger VPs usually have more career prospects and are more sensitive to the lost outside options caused by the new rules. Career concerns are weaker when a VP is older because the short prospective career decreases the value of opportunities in the external job market (Gibbons and Murphy,

¹⁶We are interested in the state-level variations in the proportion of insider CEOs and skewness of CEO pay because the executive labor market is known to be geographically segmented. In untabulated results, however, we find that our results are qualitatively similar when we compute the above two variables at the industry level and use them as alternative conditional variables.

1992). Second, job opportunities depend on the talents and abilities of managers (Rajgopal, Shevlin, and Zamora, 2006). More able executives with excellent past performance are more welcome in the labor market. Third, when working in less monopolistic product markets, executives can easily transfer their existing industry-specific skills to the competitors.

Building on the above arguments, we augment our baseline specification with interactions of *NCA Enforceability Up* with the following three binary variables. *Young VPs* equals one if the average age of a firm’s VPs in a particular year is below the annual sample median.¹⁷ *High Ability* equals one if managerial ability is above the sample median. As it is practically difficult to distinguish the ability of an individual executive, we use the proxy from Demerjian, Lev, and McVay (2012) that models the ability of a whole top management team.¹⁸ *Low HHI* equals one if the HHI of sales within an industry is below the sample median. We access the HHI data developed through textual analysis of company filings by Hoberg and Phillips (2016).¹⁹

In this analysis, we add state-year FEs to remove potential time-varying omitted variables at the state level. We focus on the interaction term because the enforceability binary variable is absorbed. Panel B of Table 5 shows that the effects of increased NCA restrictions on the pay gap are more pronounced in firms with younger VPs, more able managers, and lower product market concentration. The findings are in line with our argument that exogenous changes in VP mobility drive the changes in pay gaps.

4.3.2 Tournament incentives versus pass-the-baton mechanisms

The purpose for a company to run a rank-order tournament is to select an internal talent as the future CEO. In contrast, pass-the-baton is an approach in which a successor is designated in advance and can get promoted immediately when the incumbent CEO leaves (Vancil, 1987). While the tournament implies an intensified competition among VPs, pass-the-baton reflects a stylized schedule. In our baseline regressions, we control for *Propensity of Relay Succession* and observe its negative impact on the executive pay gap. A potential reason is that firms

¹⁷We identify an individual VP’s age using various sources, including ExecuComp, BoardEx, 10-K files, and company’s official websites.

¹⁸The dataset is available on Peter Demerjian’s personal website.

¹⁹The dataset is available on Hoberg-Phillips Data Library.

do not need to spend time selecting “winners” from an internal tournament when there are already designated heirs.

An implication of the above argument is that the impact of an NCA shock on the executive pay gap should be larger in firms that tend to adopt a tournament model rather than a pass-the-baton mechanism. Distinguishing between these two types is challenging since a succession plan may not be made public (Cvijanovic et al., 2022). Also, CEO succession plans can lead to alternative outcomes since they do not necessarily end up with an internal succession and can result in external talent searching activities.

However, previous studies suggest that having a succession plan in place is helpful to reduce the possibility of forced CEO turnover and signals a smoother management transition (Cvijanovic et al., 2022; Naveen, 2006). In the spirit of this argument, we select a sub-sample of observations for the year of or before a CEO’s turnover. We use the dataset compiled by Jenter and Kanaan (2015) and Peters and Wagner (2014) to split this set of observations into forced and voluntary turnovers.²⁰ In Panel C of Table 5, we note that the positive impact of *NCA Enforceability Up* on the pay gap is considerably larger right before forced turnovers compared to voluntary ones. This result is consistent with our argument that firms that rely on tournament incentives to motivate VPs and internally select future CEO candidates are particularly likely to enlarge the executive pay gap when VPs’ potential labor mobility declines.

4.4 Asymmetric effects

We next turn our focus to declines in NCA enforceability. We replicate the baseline regressions in Table 2 and add the binary variable *NCA Enforceability Down* to capture state-level shocks that weaken NCA enforcement. In Panel A of Table 6, we observe a statistically significant negative effect of this test variable on the executive pay gap. However, the economic impacts on *Total Gap* and *LT Gap* caused by the downward shocks are generally smaller than the upward ones, suggesting asymmetric effects from variations in state-level enforceability.

In addition, we repeat the propensity score matching procedures as in Section 4.2.1 for the reduced enforceability shocks and obtain 140 matched pairs. Panel B of Table 6 shows that

²⁰The dataset is available on WRDS.

the means of covariates for the matched sample are very close. After matching, the coefficients on *NCA Enforceability Down* are still negative but no longer distinguishable from zero. This finding is consistent with firms being reluctant to reduce CEO pay (Dittmann et al., 2011) as well as recent findings that issues beyond incentives, such as, perception of fairness, affect CEO pay levels (Edmans et al., 2022).

4.5 Firm value implications

Recent studies highlight that strict mobility restrictions caused by NCA enforcement stifle profitability and productivity because they lower the effectiveness of talent reallocation (Anand et al., 2018; He and Wintoki, 2020; Shi, 2023). At the same time, a properly designed compensation system helps develop managerial talents in the internal executive market and create better performance (Kale et al., 2009; Lazear and Rosen, 1981). Such effects are potentially more evident in less-mobile labor markets in which executives are more likely to be active participants in rank-order tournaments. Thus, a trade-off emerges, and the impact of the change in the executive pay gap may counteract the negative impact in firm value from enforceability increases.

We examine changes in firm value in terms of monthly stock returns following increases in NCA enforcement distinguishing between treated firms with positive and treated firms with negative variations in pay gap. To remove some common trends, we adjust a year’s pay gap by subtracting the median value in that year. We consider the change in the pay gap either from year $t - 1$ to t or from year $t - 1$ to $t + 1$. Since 1996 is the earliest treated year in our sample, the newly constructed dataset of CRSP monthly returns starts from 1997. In each month, we build a portfolio return as follows: a long position is assumed to be taken in firms with expanded pay gaps and a short one in those with reduced pay gaps. The portfolio return is either equally-weighted or market-capitalization-weighted (the market capitalization is recorded at the end of the previous month). We use the Newey-West estimator with four lags to regress the monthly portfolio return on the respective Fama-French five factors.²¹ As shown in Table 7, the portfolios often generate significant positive alphas across different holding

²¹The dataset is available on Kenneth R. French’s Data Library.

periods, i.e., 12, 24, or 36 months. Overall, we report potential heterogeneous value effects when executive mobility is restrained. Firms that decide to enlarge their pay gaps perform significantly better on the stock market.

5 Does pay gap capture tournament incentives?

So far, we have assumed that the executive pay gap creates a tournament prize that is meant to incentivize and reward VPs and possibly compensate them for any lost outside employment opportunity. Nonetheless, other theories, mechanisms, and explanations have been put forward for the existence of a pay gap. Below, we provide some evidence that supports our contention that the pay gap likely captures tournament incentives in our context.

5.1 CEO power

Shocks that impose mobility restrictions likely hinder the efficiency of talent allocation (Anand et al., 2018; Marx et al., 2015), and shrink the talent pool while increasing firms' challenges to replace incumbent CEOs. Such shocks can be exploited by powerful CEOs to boost their own pay which will result in a widened pay gap (Bebchuk et al., 2011). We next list some tests that help us evaluate whether a CEO power mechanism can explain our findings.

5.1.1 Channels

First, we examine the effects of increased NCA enforceability on CEO and VP pay separately. Though we find that the executive pay gap expands, it may imply three scenarios: (1) increased pay for CEO and VPs (to different degrees); (2) increased pay for CEO but decreased pay for VPs; (3) decreased pay for CEO and VPs (to different degrees). Existing studies show mixed findings on the relation between NCA enforceability and the level of CEO pay (Garmaise, 2011; Kini et al., 2021). More importantly, if CEO power plays a prominent role in driving the pay gap, CEOs should merely set a higher pay for themselves, while other executives might hardly get compensated. In this case, we expect to see an insignificant, or even negative, impact on the level of average VP compensation.

Because the determinants of executive pay level and pay gap may not be the same, we follow the model settings in recent studies that specifically examine the executive pay level (e.g., Focke et al., 2017) and replace some control variables in the baseline model. Panel A of Table 8 corroborates the findings of Kini et al. (2021) who argue that the affected CEOs ask for higher compensations to reflect higher unemployment risks. We further find that VP pay levels also benefit from tightened mobility in the labor market, though VP pay growth is lower than that of the CEO. The evidence indicates that CEOs are not the only beneficiaries of restricted mobility in terms of higher compensation.

5.1.2 Different proxies

CEO pay slice is an indicator broadly used by existing studies to capture managerial power via executive compensation Bebchuk et al. (2011). We compute the pay slice as the ratio of the CEO pay scaled by the aggregated pay of the top five most highly-paid executives. In our sample, the correlation between the pay slice and the total pay gap among the top five executives is 0.56, which appears to be lower than expected.²² We use the pay slice as the dependent variable, re-run the baseline regressions, and report the results in Columns (1) and (2) of Panel B, Table 8. The coefficient on *NCA Enforceability Up* is not significant if controls are included. Therefore, CEOs do not manage to increase their pay slice when facing NCA shocks.

We further regress our pay gap measure on a set of variables directly associated with CEO power and build a dependent variable that captures the residuals from this regression. After purging the components related to CEO power, the residual is likely to be the part of the pay gap that is set through efficient contracting. Specifically, in the first stage, similar to Hasan et al. (2020), we regress the pay gap on dummies for CEO-Chair duality, highly tenured CEOs, and founder CEOs. We add industry and year FEs at this stage to capture potential shocks for different sectors and time-varying trends that may relate to CEO power. In the second

²²Assume the average VP's pay is P and CEO's pay is αP ($\alpha > 1, P > 0$) at time 0. The one-period increase rates in their compensations are δ and $\beta\delta$ respectively. Thus, at time 1, an average VP's pay is $(1 + \delta)P$ and CEO pay is $(1 + \beta\delta)\alpha P$. It is straightforward to show that the measures of pay gap and pay slice do not always synchronously change, but depend on the specific relations among δ , α , and β . For example, if $\delta > 0$ and $\frac{1}{\alpha} < \beta < 1$, the pay gap increases but the pay slice decreases. This may be one reason why the correlation between the two proxies is relatively low.

stage, we use the residual from stage 1 as the dependent variable and re-estimate the baseline specifications. In Columns (3) and (4) of Panel B, Table 8 we continue to find a significant positive impact of increased NCA enforceability on the pay gap.

5.1.3 Cross-sectional variation

We focus on one potential cross-sectional variation in terms of CEO power. Bertrand and Mullainathan (2003) show that CEO power relates to institutional factors, such as factors that deter takeovers. We use the takeover index developed by Cain, McKeon, and Solomon (2017) for the presence and extent of hostile takeovers.²³ We take the inverse of the original index so that a larger value of the variable is potentially associated with more entrenched CEOs due to lack of market discipline. The interaction between the transformed index and the enforceability test variable has a negative and statistically significant coefficient in Panel C of Table 8. Thus, when CEOs are likely to be more powerful and entrenched, the effect of an NCA shock on the pay gap actually becomes weaker, a result at odds with the explanation that powerful CEOs extract excessive compensation.

5.2 Talent differentials

The dispersion among executive pay can also be set to reflect talent differentials (Mueller et al., 2017; Terviö, 2008). Consequently, a larger pay gap may simply capture CEO talent or skill hierarchies rather than being set to incentivize executives.

However, assuming the composition of the top management team remains unchanged, the observed post-shock variation in compensation theoretically should not reflect time-varying talent differentials for two reasons. First, since the NCA shocks are sudden and exogenous, it is unlikely that the incumbent management team is able to acquire new skills quickly following the reforms, which could affect the distribution of talent across executives. Second, studies suggest that firms have worse performance when experiencing a strengthened enforceability (Anand et al., 2018; He and Wintoki, 2020). If managerial skills are evaluated based on firm performance and talent differentials drive pay gaps, we should probably not observe a post-

²³The dataset is available on Stephen B. McKeon’s personal website.

shock increase in pay gap given that the CEO is ultimately responsible for poor performance. To validate the conjectures, we follow the previous literature and consider three time-varying ability proxies: managerial ability score, adjusted ROA, and adjusted stock return (Demerjian et al., 2012; Rajgopal et al., 2006). ROA and stock return are adjusted by subtracting the median value in each industry-year. The three extra variables are significantly associated with the pay gap measure, but our main results are not affected by their inclusion in Panel A of Table 9.

The composition of top executives, however, often changes in practice, and this can drive variations in the pay gap. For example, replacing a particularly talented CEO with an average-ability one could lead to a reduced pay gap. To capture the talent differences between an individual VP and a CEO, we consider manager FEs to best describe the managers' latent traits and skills (Graham, Li, and Qiu, 2012). Specifically, we construct a pay gap proxy at the VP's level instead of the firm level. That is, we compute the compensation gap between each focal VP and her CEO in the focal firm. The large and rich VP-year sample provides us with the flexibility to incorporate either CEO-VP pair FEs or CEO-VP-Firm FEs. The former FEs allow us to control for the time-invariant difference within each CEO-VP pair, while the inclusion of the latter reflects the fact that such difference could vary across firms. In Panel B of Table 9, we include these FEs and re-estimate our baseline regression models using the new dependent variable measured at the VP level. The R-squared across different models is high (77%). We observe that the positive impact of increased NCA enforceability is still positive and significant.

5.3 CEO bargaining power

Kini et al. (2021) note that the presence of an NCA is the outcome of a bargaining game between the firm and the executive. The firm bargains to include the provision and protect its economic interests upon the possible departure of the executive, and the executive would argue for more considerations to compensate them for the incurred personal costs. As a result, executives can obtain higher compensation (Kini et al., 2021). In previous sections, we indeed find that the effects of the NCA shocks on the pay gap are more pronounced when

the top management members have more opportunities on the external job market. This finding lends itself to an alternative explanation: if NCAs become more enforceable, executives (especially those with significant bargaining power) are willing to accept them only in return for substantially increased pay. If the disutility attached to an NCA and/or the bargaining power are larger for CEOs than for VPs, this bargaining mechanism could lead to a post-shock widening of the pay gap that is unrelated to tournament incentives.

We consider a set of variables that are associated with a CEO’s outside job opportunities or bargaining power that are plausibly unrelated to the VPs’. If the bargaining activities of the CEO primarily drive the pay gap changes we report, we expect substantial heterogeneity in our main results that depend on these variables.

First, a retiring CEO is less sensitive to the loss of future career opportunities because her career concerns are lower (Gibbons and Murphy, 1992). Second, a generalist CEO with rich and diverse experiences should have more valuable future opportunities because her skills are more transferrable beyond certain firms or industries (Custódio, Ferreira, and Matos, 2013). A CEO is defined as generalist if the value of a generalist index is higher than the sample annual median.²⁴ Third, a more productive CEO likely has stronger bargaining power. We construct a CEO productivity factor by performing a principal component analysis based on the following variables: CEO duality dummy, tenure, age, number of outside directorships, and the average compensation growth over prior three years, in line with Masulis and Zhang (2014). We retain the two orthogonal factors with eigenvalues greater than one. A CEO is productive if both factors are above their respective sample medians.

In addition, assuming that a CEO often departs to take the same job in another firm offering a better compensation, the gap between her pay and that of the top-paid CEO in a given year is helpful to capture the focal CEO’s external tournament incentives. Following Coles et al. (2018), we calculate the pay differential between the focal CEO and the second-top-paid CEO in a specific industry. We do this because the first-top-paid compensation is often caused by certain transitory events, such as the exercise of accumulated options. To account for labor market segmentation, we also calculate a local pay gap, that is, a proxy for

²⁴We thank Cláudia Custódio for sharing the data of CEO generalist index.

the focal CEO and the second-top-paid CEO in a specific firm’s headquarters state (Ma et al., 2020). The concept is further generalized by computing the pay gap between the focal CEO and the universal second-top-paid one in each sample year. CEOs whose pay gaps are higher than the respective sample medians are those with more opportunities for external promotion.

Synergy theory posits that a CEO’s activities covering a broad range of firm business have enormous synergy potential to reduce other colleagues’ marginal efforts (Edmans, Goldstein, and Zhu, 2013). Because only a CEO can have such potential, she may have stronger power to bargain for a higher pay than subordinate executives. We identify the less synergistic firms as those with a diversified business (with more than one business segments), where different divisions likely operate independently (Edmans et al., 2013). CEOs could have more synergy impacts in non-diversified firms, and also a larger bargaining power.

Last, as documented by Kini et al. (2021), a new CEO coming from outside the firm or after the dismissal of the former CEO is in a more advantageous position to ask for more benefits from her employer. Thus, such CEO should receive a comparatively higher pay, which could result in a larger pay gap. Like before, we identify if the new CEO is an outsider according to ExecuComp and BoardEx, and if the prior CEO is fired following Jenter and Kanaan (2015) and Peters and Wagner (2014).

In untabulated analyses, we find that the effect of increased NCA enforceability on the pay gap is stronger when the CEOs are close to retirement, consistent with the notion that tournament incentives are very much needed in these cases (Kale et al., 2009). Such effect becomes significantly weaker when firms are non-diversified (Shi et al., 2016), in contrast to the possibility that CEOs get compensated for their larger bargaining power due to larger synergy potentials. Besides, no other instances present significant differences. These findings are not consistent with the argument that the expanded pay gaps we observe are driven by the bargaining power of CEOs.

6 Conclusion

We study how exogenous variations in non-compete agreement (NCA) enforceability affect a firm’s executive pay gap (i.e., the gap between CEO and VP pay), which the firm can use to

provide tournament incentives to VPs. We find that a positive shock to enforceability causes a significant decrease in executive turnover and, more importantly, an increase in the pay gap. The positive effect can be observed irrespective of whether short-term or long-term pay components are considered, but the lasting and persistent changes are mainly found for long-term pay. The implications of these findings are significant since many studies find evidence that income dispersion among top executives has substantial effects on financial decisions and other corporate outcomes (e.g., Kale et al., 2009; Kini and Williams, 2012).

Our baseline results are more pronounced for firms in states with a high proportion of outside-hired CEOs, a more skewed distribution of CEO pay, for firms with founder CEOs, younger VPs, and more capable top executives, as well as in industries with lower product market concentration. VPs in firms with these characteristics are expected to value external job opportunities more, and when these are curtailed, they require more significant internal tournament incentives.

We document that the potential adverse effects on firm performance due to increases in NCA enforceability vary significantly between firms with or without post-shock increases in pay gaps. A portfolio that goes long in treated firms with increased pay gaps and short in the remaining treated firms can generate positive abnormal returns. Thus, a widened pay gap can protect shareholder value from the negative effects of a less mobile managerial labor market.

References

- Abernethy, M. A., Y. Dong, Y. F. Kuang, B. Qin, and X. Yang (2022). Firm strategy and CEO-VP pay differentials in equity compensation. *European Accounting Review*, 1–27.
- Acharya, V., M. Gabarro, and P. Volpin (2021). Competition for managers and corporate governance. *Journal of Law, Finance, and Accounting* 6(1), 179–219.
- Anand, S., I. Hasan, P. Sharma, and H. Wang (2018). State enforceability of noncompete agreements: Regulations that stifle productivity! *Human Resource Management* 57, 341–354.
- Bai, J. J., A. Eldemire, and M. Serfling (2023). The effect of labor mobility on corporate investment and performance over the business cycle. Working Paper.
- Bai, J. J., D. Fairhurst, and M. Serfling (2020). Employment protection, investment, and firm growth. *Review of Financial Studies* 33, 644–688.
- Baker, A. C., D. F. Larcker, and C. C. Wang (2022). How much should we trust staggered difference-in-differences estimates? *Journal of Financial Economics* 144, 370–395.
- Bebchuk, L. A., K. J. Cremers, and U. C. Peyer (2011). The CEO pay slice. *Journal of Financial Economics* 102, 199–221.
- Belzil, C. and M. Bognanno (2008). Promotions, demotions, halo effects, and the earnings dynamics of American executives. *Journal of Labor Economics* 26, 287–310.
- Bertrand, M. and S. Mullainathan (2003). Enjoying the quiet life? Corporate governance and managerial preferences. *Journal of Political Economy* 111, 1043–1075.
- Bishara, N. D., K. J. Martin, and R. S. Thomas (2015). An empirical analysis of noncompetition clauses and other restrictive postemployment covenants. *Vand. L. Rev.* 68, 1–52.
- Bognanno, M. L. (2001). Corporate tournaments. *Journal of Labor Economics* 19, 290–315.
- Borusyak, K., X. Jaravel, and J. Spiess (2022). Revisiting event study designs: Robust and efficient estimation. Working Paper.
- Burns, N., K. Minnick, and L. Starks (2017). CEO tournaments: A cross-country analysis of causes, cultural influences, and consequences. *Journal of Financial and Quantitative Analysis* 52, 519–551.
- Cain, M. D., S. B. McKeon, and S. D. Solomon (2017). Do takeover laws matter? Evidence from five decades of hostile takeovers. *Journal of Financial Economics* 124(3), 464–485.
- Callaway, B. and P. H. Sant’Anna (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics* 225, 200–230.
- Chen, W., S. Jung, X. Peng, and I. X. Zhang (2022). Outside opportunities, managerial risk taking, and CEO compensation. *The Accounting Review* 97, 135–160.
- Colak, G., D. Gounopoulos, P. Loukopoulos, and G. Loukopoulos (2021). Tournament incentives and IPO failure risk. *Journal of Banking and Finance* 130, 106193.
- Coles, J. L., N. D. Daniel, and L. Naveen (2006). Managerial incentives and risk-taking. *Journal of Financial Economics* 79, 431–468.

- Coles, J. L., N. D. Daniel, and L. Naveen (2014). Co-opted boards. *Review of Financial Studies* 27(6), 1751–1796.
- Coles, J. L., Z. Li, and A. Y. Wang (2018). Industry tournament incentives. *Review of Financial Studies* 31, 1418–1459.
- Core, J. and W. Guay (2002). Estimating the value of employee stock option portfolios and their sensitivities to price and volatility. *Journal of Accounting Research* 40, 613–630.
- Cronqvist, H., F. Heyman, M. Nilsson, H. Svaleryd, and J. Vlachos (2009). Do entrenched managers pay their workers more? *Journal of Finance* 64, 309–339.
- Custódio, C., M. A. Ferreira, and P. Matos (2013). Generalists versus specialists: Lifetime work experience and chief executive officer pay. *Journal of Financial Economics* 108(2), 471–492.
- Cvijanovic, D., N. Gantchev, and S. Hwang (2022). CEO succession roulette. *Management Science*, forthcoming.
- Cziraki, P. and D. Jenter (2022). The market for CEOs. Working Paper.
- Dang, V. A., A. De Cesari, and H. V. Phan (2021). Employment protection and share repurchases: Evidence from wrongful discharge laws. *Journal of Corporate Finance* 69, 102036.
- Demerjian, P., B. Lev, and S. McVay (2012). Quantifying managerial ability: A new measure and validity tests. *Management Science* 58, 1229–1248.
- Dittmann, I., E. Maug, and D. Zhang (2011). Restricting CEO pay. *Journal of Corporate Finance* 17(4), 1200–1220.
- Edmans, A., I. Goldstein, and J. Y. Zhu (2013). Contracting with synergies. Working Paper.
- Edmans, A., T. Gosling, and D. Jenter (2022). CEO compensation: Evidence from the field. Working Paper.
- Ewens, M. and M. Marx (2018). Founder replacement and startup performance. *Review of Financial Studies* 31(4), 1532–1565.
- Focke, F., E. Maug, and A. Niessen-Ruenzi (2017). The impact of firm prestige on executive compensation. *Journal of Financial Economics* 123(2), 313–336.
- Gabaix, X. and A. Landier (2008). Why has CEO pay increased so much? *Quarterly Journal of Economics* 123, 49–100.
- Gabaix, X., A. Landier, and J. Sauvagnat (2014). CEO pay and firm size: An update after the crisis. *The Economic Journal* 124(574), F40–F59.
- Garmaise, M. J. (2011). Ties that truly bind: Noncompetition agreements, executive compensation, and firm investment. *Journal of Law, Economics, and Organization* 27, 376–425.
- Gibbons, R. and K. J. Murphy (1992). Optimal incentive contracts in the presence of career concerns: Theory and evidence. *Journal of Political Economy* 100, 468–505.
- Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics* 225(2), 254–277.
- Graham, J. R., D. Kim, and H. Kim (2020). Executive mobility in the United States, 1920 to

2011. Working Paper.
- Graham, J. R., S. Li, and J. Qiu (2012). Managerial attributes and executive compensation. *The Review of Financial Studies* 25(1), 144–186.
- Hasan, I., M. Navone, T. Y. To, and E. Wu (2020). Tournament incentives and acquisition performance. *Review of Corporate Finance Studies* 9, 384–419.
- Haß, L. H., M. A. Mller, and S. Vergauwe (2015). Tournament incentives and corporate fraud. *Journal of Corporate Finance* 34, 251–267.
- Hayes, R. M., M. Lemmon, and M. Qiu (2012). Stock options and managerial incentives for risk taking: Evidence from FAS 123R. *Journal of Financial Economics* 105, 174–190.
- He, Z. and M. B. Wintoki (2020). Who benefits from removing mobility restrictions? Working Paper.
- Henderson, A. D. and J. W. Fredrickson (2001). Top management team coordination needs and the CEO pay gap: A competitive test of economic and behavioral views. *Academy of Management Journal* 44(1), 96–117.
- Hoberg, G. and G. Phillips (2016). Text-based network industries and endogenous product differentiation. *Journal of Political Economy* 124, 1423–1465.
- Islam, E., L. Rahman, R. Sen, and J. Zein (2021). Eyes on the prize: Do industry tournament incentives shape the structure of executive compensation? *Journal of Financial and Quantitative Analysis* 57, 1–31.
- Jeffers, J. (2022). The impact of restricting labor mobility on corporate investment and entrepreneurship. Working Paper.
- Jenter, D. and F. Kanaan (2015). CEO turnover and relative performance evaluation. *Journal of Finance* 70, 2155–2184.
- Johnson, M. S., K. Lavetti, and M. Lipsitz (2021). The labor market effects of legal restrictions on worker mobility. Working Paper.
- Kale, J. R., E. Reis, and A. Venkateswaran (2009). Rank-order tournaments and incentive alignment: The effect on firm performance. *Journal of Finance* 64, 1479–1512.
- Kale, J. R., E. Reis, and A. Venkateswaran (2014). Pay inequalities and managerial turnover. *Journal of Empirical Finance* 27, 21–39.
- Kini, O. and R. Williams (2012). Tournament incentives, firm risk, and corporate policies. *Journal of Financial Economics* 103, 350–376.
- Kini, O., R. Williams, and S. Yin (2021). CEO noncompete agreements, job risk, and compensation. *Review of Financial Studies* 34, 4701–4744.
- Klasa, S., H. Ortiz-Molina, M. Serfling, and S. Srinivasan (2018). Protection of trade secrets and capital structure decisions. *Journal of Financial Economics* 128, 266–286.
- Kubick, T. R. and A. N. Masli (2016). Firm-level tournament incentives and corporate tax aggressiveness. *Journal of Accounting and Public Policy* 35, 66–83.
- Lazear, E. and S. Rosen (1981). Rank-order tournaments as optimum labor contracts. *Journal of Political Economy* 89(5), 841–864.

- Lazear, E. P. (2018). Compensation and incentives in the workplace. *Journal of Economic Perspectives* 32(3), 195–214.
- Lin, Y., F. Peters, and H. Seo (2022). Enforceability of noncompetition agreements and forced turnovers of chief executive officers. *Journal of Law and Economics* 65, 177–209.
- Ma, M., J. Pan, and S. R. Stubben (2020). The effect of local tournament incentives on firms’ performance, risk-taking decisions, and financial reporting decisions. *The Accounting Review* 95(2), 283–309.
- Main, B. G. M., C. A. O’Reilly, and J. Wade (1993). Top executive pay: Tournament or teamwork? *Journal of Labor Economics* 11, 606–628.
- Malsberger, B. M. (1996). Covenants not to compete: A state-by-state survey. Washington DC: BNA Books.
- Marx, M., J. Singh, and L. Fleming (2015). Regional disadvantage? Employee non-compete agreements and brain drain. *Research Policy* 44(2), 394–404.
- Masulis, R. W. and S. Zhang (2014). Compensation gaps among top corporate executives. Working Paper.
- Mueller, H. M., P. P. Ouimet, and E. Simintzi (2017). Within-firm pay inequality. *Review of Financial Studies* 30(10), 3605–3635.
- Naveen, L. (2006). Organizational complexity and succession planning. *Journal of Financial and Quantitative Analysis* 41, 661–683.
- Parrino, R. (1997). CEO turnover and outside succession: A cross-sectional analysis. *Journal of Financial Economics* 46, 165–197.
- Peters, F. S. and A. F. Wagner (2014). The executive turnover risk premium. *Journal of Finance* 69, 1529–1563.
- Phan, H. V., T. Simpson, and H. T. Nguyen (2017). Tournament-based incentives, corporate cash holdings, and the value of cash. *Journal of Financial and Quantitative Analysis* 52(4), 1519–1550.
- Rajgopal, S., T. Shevlin, and V. Zamora (2006). CEOs’ outside employment opportunities and the lack of relative performance evaluation in compensation contracts. *Journal of Finance* 61(4), 1813–1844.
- Shi, L. (2023). Optimal regulation of noncompete contracts. *Econometrica* 91(2), 425–463.
- Shi, W., B. L. Connelly, and W. G. Sanders (2016). Buying bad behavior: Tournament incentives and securities class action lawsuits. *Strategic Management Journal* 37, 1354–1378.
- Starr, E. P., J. J. Prescott, and N. D. Bishara (2021). Noncompete agreements in the US labor force. *Journal of Law and Economics* 64, 53–84.
- Sun, L. and S. Abraham (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics* 225, 175–199.
- Terviö, M. (2008). The difference that CEOs make: An assignment model approach. *American Economic Review* 98, 642–668.

- Vancil, R. F. (1987). *Passing the baton: Managing the process of CEO succession*. Boston MA: Harvard Business School Press.
- Vanko, K. J. (2002). “You’re fired! And don’t forget your non-compete...”: The enforceability of restrictive covenants in involuntary discharge cases. *DePaul Bus. & Comm. LJ* 1, 1.
- Walker, D. I. (2011). Evolving executive equity compensation and the limits of optimal contracting. *Vand. L. Rev.* 64, 609.
- Yonker, S. E. (2017). Geography and the market for CEOs. *Management Science* 63, 609–630.

Figures and Tables

Figure 1: The effect of increases in NCA enforceability on executive pay gaps

This figure shows the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. We report the lags and leads of a binary variable capturing an increase in NCA enforceability (*NCA Enforceability Up*) over a 21-year period around the event. The graph presents the coefficients from year -10 to year +10 based on a regression of executive pay gaps ($\ln(\text{Total Gap})$ measured at $t + 1$) on such lags and leads, controlling for firm, year, and headquarter state fixed effects. The dummy for year -1 is omitted in the regression, as in Eq.(2). The y -axis plots coefficients for each dummy variable. The x -axis shows the year relative to the increase in NCA enforceability. The dashed lines are the 90% confidence intervals of the estimated coefficients, which are calculated from standard errors clustered by headquarter state.

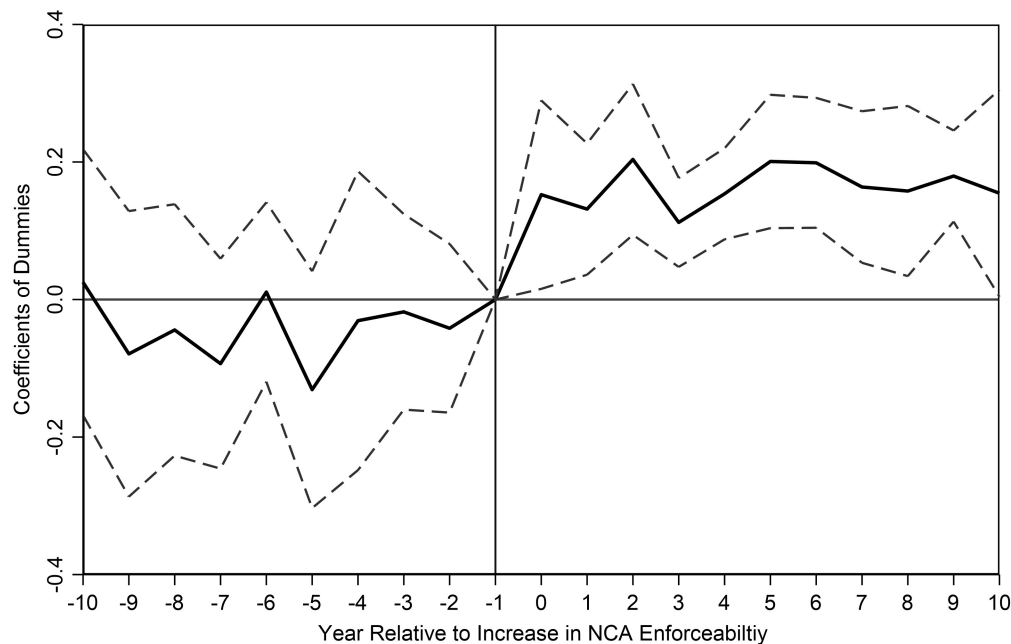


Figure 2: Distribution of estimated coefficients from placebo tests

This figure shows the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap in falsification tests. The graph presents the probability density of the estimated coefficients on the pseudo increase in NCA enforceability (*NCA Enforceability Up*) from 1,000 placebo tests. In each iteration, the real distribution of the event years is kept, and the never-treated states are randomly assigned into each of those years (without replacement). The vertical line represents the true coefficient from the baseline regression (the coefficient of *NCA Enforceability Up* of Column (2) in Table 2).

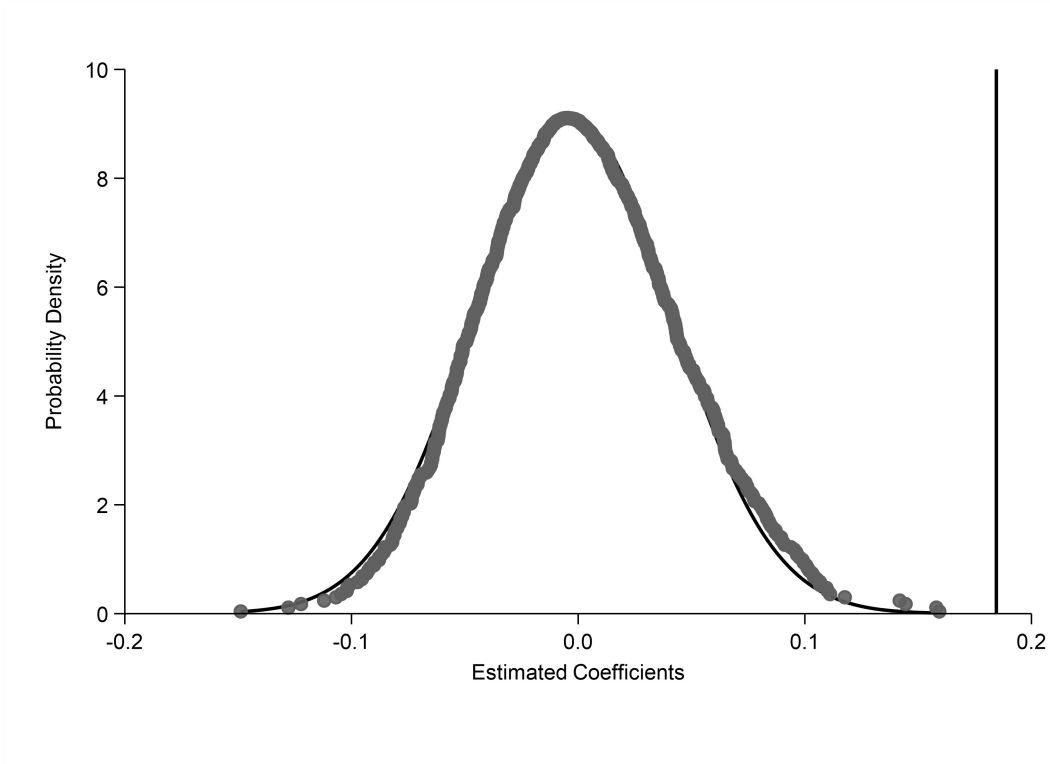


Table 1: Summary statistics

This table reports the descriptive statistics (including number of observations, mean, lower quartile, median, and upper quartile) for the variables used in the baseline regression models. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. Detailed variable definitions can be found in Appendix B.

	Obs.	Mean	Lower Quartile	Median	Upper Quartile
<i>Compensation variables</i>					
Total Gap (in 000s)	28,449	3,441.16	786.08	1,966.32	4,361.88
ST Gap (in 000s)	27,822	625.83	269.13	445.49	701.37
LT Gap (in 000s)	24,597	2,885.18	604.29	1,692.89	3,900.65
Median Industry Gap (in 000s)	28,449	2,528.21	824.65	1,741.98	3,566.68
Median Industry ST Gap (in 000s)	27,822	520.10	297.42	436.43	596.16
Median Industry LT Gap (in 000s)	24,597	2,097.91	564.21	1,400.93	3,096.13
<i>Executive characteristics</i>					
CEO Age	28,449	55.72	51.00	56.00	60.00
CEO Tenure	28,449	7.07	2.00	5.00	10.00
New CEO	28,449	0.10	0.00	0.00	0.00
CEO Is Insider	28,449	0.67	0.00	1.00	1.00
Retiring CEO	28,449	0.10	0.00	0.00	0.00
Duality	28,449	0.55	0.00	1.00	1.00
No. of VPs	28,449	4.77	4.00	5.00	5.00
Propensity of Relay Succession	28,449	0.54	0.00	1.00	1.00
CFO Is VP	28,449	0.89	1.00	1.00	1.00
<i>Firm/Industry Characteristics</i>					
Ln (Total Asset)	28,449	7.26	6.11	7.15	8.33
Industry Homogeneity	28,449	0.11	0.07	0.10	0.14
Stk. Return Volatility	28,449	0.45	0.30	0.40	0.54
No. of Segments	28,449	2.53	1.00	2.00	4.00

Table 2: Baseline regressions

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variables reflect alternative definitions of the pay gap and are measured in year $t + 1$. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. Control variables related to executive characteristics (*New CEO*, *CEO Is Insider*, *Retiring CEO*, *Duality*, *No. of VPs*, *Propensity of Relay Succession*, *CFO is VP*, *Ln (CEO Age)*, *Ln (CEO Tenure)*) are recorded in year $t + 1$ while other controls in year t . All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)		Ln (ST Gap)		Ln (LT Gap)	
	(1)	(2)	(3)	(4)	(5)	(6)
NCA Enforceability Up	0.184*** (5.06)	0.185*** (5.13)	0.057** (2.18)	0.053** (2.31)	0.214*** (3.20)	0.198*** (2.85)
New CEO		0.056 (1.37)		-0.082*** (-4.52)		0.113*** (3.23)
CEO Is Insider		-0.168*** (-5.89)		-0.142*** (-7.74)		-0.195*** (-5.70)
Industry Homogeneity		0.168* (1.76)		-0.177* (-1.87)		0.275** (2.22)
Retiring CEO		-0.095** (-2.32)		-0.047* (-1.88)		-0.089* (-1.81)
Duality		0.097*** (4.15)		0.095*** (4.54)		0.128*** (3.94)
No. of VPs		0.022*** (2.83)		0.026*** (3.85)		0.024*** (3.18)
Propensity of Relay Succession		-0.054*** (-3.68)		-0.058*** (-4.92)		-0.052*** (-3.21)
Ln (Median Industry Gap)		0.074*** (3.80)				
Ln (Median Industry ST Gap)				0.218*** (7.53)		
Ln (Median Industry LT Gap)						0.081*** (5.99)
CFO Is VP		0.043 (1.47)		0.027 (1.15)		0.030 (0.88)
Ln (CEO Age)		-0.291*** (-3.06)		0.310*** (2.80)		-0.511*** (-4.62)
Ln (CEO Tenure)		0.065*** (3.77)		0.052*** (4.45)		0.048*** (2.73)
Ln (Total Asset)		0.286*** (15.42)		0.079*** (5.49)		0.299*** (10.07)
Stk. Return Volatility		0.049 (0.93)		-0.070* (-1.69)		0.209*** (3.17)
No. of Segments		-0.005 (-0.55)		0.005 (0.85)		-0.003 (-0.32)
Observations	28,449	28,449	27,822	27,822	24,597	24,597
R-squared	0.620	0.637	0.595	0.619	0.627	0.643
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: Dynamic effects

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The regressions of Columns (2), (4), and (6) of Table 2 are re-estimated by replacing the test variable *NCA Enforceability Up* with a set of binary variables that identify periods preceding and following an increase in NCA enforceability. These binary variables are equal to one if the firm is headquartered in a state that (i) experiences an increase in enforceability in either three or four years in the future (*NCA Enforceability Up*^{-3,-4}); (ii) experiences an increase in enforceability in either one or two years in the future (*NCA Enforceability Up*^{-1,-2}); (iii) has experienced an increase in enforceability in either the current or previous year (*NCA Enforceability Up*^{0,+1}); (iv) has experienced an increase in enforceability either two or three years ago (*NCA Enforceability Up*^{+2,+3}); (v) has experienced an increase in enforceability four or more years ago (*NCA Enforceability Up*^{>=+4}). All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The *t*-stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)	Ln (ST Gap)	Ln (LT Gap)
	(1)	(2)	(3)
NCA Enforceability Up ^{-3,-4}	0.021 (0.20)	0.030 (0.66)	0.055 (0.63)
NCA Enforceability Up ^{-1,-2}	0.023 (0.41)	0.006 (0.16)	0.071 (0.79)
NCA Enforceability Up ^{0,+1}	0.177*** (2.85)	0.085** (2.02)	0.168* (2.00)
NCA Enforceability Up ^{+2,+3}	0.187*** (3.95)	0.057* (1.99)	0.255*** (3.67)
NCA Enforceability Up ^{>=+4}	0.212*** (4.16)	0.050 (1.44)	0.256*** (2.71)
Observations	28,449	27,822	24,597
R-squared	0.637	0.619	0.643
Controls from Table 2	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes

Table 4: Matched sample and alternative specifications

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The regressions of Columns (1) and (2) of Table 2 are re-estimated using different econometric specifications. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. In Panels A and B, a propensity-score-matching method is used to estimate the coefficient on *NCA Enforceability Up*. A matched sample is obtained based on one-to-one matching (with replacement) between treated firms (firms headquartered in states with an increase in NCA enforceability in year t) and non-treated firms (never-treated firms in the same year t , or treated outside a window of $t \pm 10$). Treated firms are required not to relocate during the test window. For all treated and non-treated firms, propensity scores are estimated using the values of the covariates in Eq. (1) for the year $t - 1$ prior to a change in NCA enforceability. In the matched sample, the control firm for a particular treated firm is the non-treated firm from the same year t as the control firm with the most similar propensity score (within a caliper of 5%). Both the treated and control firms are required to have available data in at least one year in both the pre- and post-treatment periods. If an ever-treated firm is matched as a control firm, the firm-years that overlap the period of $t \pm 10$ around its own treatment are excluded. Panel A reports the means of the covariates for 191 pairs of matched treated and control firms, together with t -stats of tests of equality of means between the two types of firms. Panel B reports regression results based on the matched sample. The dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. In Panel C, the dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. The coefficient on *NCA Enforceability Up* is estimated using Callaway and Sant’Anna (2021) estimator for a test window of $t \pm 10$ (consistent with Figure 1), using never or not-yet-treated observations as “clean” controls and without or with covariates. The regressions with the Callaway and Sant’Anna estimator include firm-cohort and year-cohort fixed effects. The z -stats in parentheses are computed using standard errors clustered at the headquarter-state level. In Panel D, the dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. The coefficient on *NCA Enforceability Up* is estimated using the stacked-regression method by Baker et al. (2022) for a test window of $t \pm 10$ (consistent with Figure 1), using never or not-yet-treated observations as “clean” controls and without or with covariates. The stacked regressions include firm-cohort and year-cohort fixed effects. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. Detailed variable definitions can be found in Appendix B. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

Panel A: Characteristics of means for matched treated and control firms

	Treated	Control	Dif. (Control-Treated)	t -stats
Propensity Score	0.066	0.066	-0.000	(-0.00)
New CEO	0.110	0.147	0.037	(1.07)
CEO Is Insider	0.691	0.733	0.042	(0.90)
Industry Homogeneity	0.113	0.114	0.001	(0.19)
Retiring CEO	0.105	0.058	-0.047	(-1.69)
Duality	0.555	0.534	-0.021	(-0.41)
No. of VPs	4.838	4.885	0.047	(0.34)
Propensity of Relay Succession	0.581	0.508	-0.073	(-1.44)
$\ln(\text{Median Industry Gap})$	7.356	7.328	-0.027	(-0.30)
CFO Is VP	0.827	0.869	0.042	(1.14)
$\ln(\text{CEO Age})$	4.012	3.998	-0.014	(-1.01)
$\ln(\text{CEO Tenure})$	1.632	1.557	-0.074	(-0.77)
$\ln(\text{Total Asset})$	7.080	7.048	-0.032	(-0.21)
Stk. Return Volatility	0.479	0.467	-0.012	(-0.51)
No. of Segments	2.419	2.503	0.084	(0.50)

Panel B: Regression using matched sample

	Ln (Total Gap)	
	(1)	(2)
NCA Enforceability Up	0.194*** (3.21)	0.194*** (3.65)
Observations	4,902	4,902
R-squared	0.631	0.646
Controls from Table 2	No	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
State FE	Yes	Yes

Panel C: Regression using Callaway and Sant'Anna (2021) estimator

	Ln (Total Gap)			
	Never treated as controls		Not yet treated as controls	
	(1)	(2)	(3)	(4)
NCA Enforceability Up	0.175*** (2.74)	0.184*** (2.79)	0.172*** (2.70)	0.180*** (2.74)
Controls from Table 2	No	Yes	No	Yes
Firm-Cohort FE	Yes	Yes	Yes	Yes
Year-Cohort FE	Yes	Yes	Yes	Yes

Panel D: Stacked regressions

	Ln (Total Gap)			
	Never treated as controls		Not yet treated as controls	
	(1)	(2)	(3)	(4)
NCA Enforceability Up	0.194*** (5.91)	0.191*** (5.66)	0.191*** (5.83)	0.188*** (5.50)
Observations	106,213	106,213	109,988	109,988
R-squared	0.642	0.654	0.643	0.655
Controls from Table 2	No	Yes	No	Yes
Firm-Cohort FE	Yes	Yes	Yes	Yes
Year-Cohort FE	Yes	Yes	Yes	Yes

Table 5: Mechanisms underlying baseline findings

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The regression of Column (2) of Table 2 is re-estimated by using sub-sets of observations or adding interaction terms for the test variable *NCA Enforceability Up*. The dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. In Panel A, Columns (1) and (2) report the results for the top and the bottom tercile of the fraction of insider CEOs for the state the firm belongs to, Columns (3) and (4) report the results for the top and the bottom tercile of the skewness of CEO pay for the state the firm belongs to, while in Columns (5) and (6) the split is based on whether the CEO is also the founder of the firm. The founders are also required not to be retiring or interim CEOs. All the models include firm, year, and state fixed effects. Panel A also reports the p -values of F -stats testing the differences in coefficients on *NCA Enforceability Up* between the respective partitioned subsamples. In Panel B, *NCA Enforceability Up* is interacted with measures of average VP age, managerial ability score (Demerjian et al., 2012), and product market HHI (Hoberg and Phillips, 2014). *Young VPs* equals one if the average age of VPs is below the sample annual median; *High Ability* equals one if managerial ability is above the sample median; *Low HHI* equals one if the HHI is below the sample median. All the models include firm and state-year fixed effects. In Panel C, Columns (1) and (2) report the results for the year of and the year before CEO forced or voluntary turnover. CEO forced turnover is defined following Jenter and Kanaan (2015) and Peters and Wagner (2014). Panel C also reports the p -values of F -stats testing the differences in coefficients on *NCA Enforceability Up* between the respective partitioned subsamples. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

Panel A: State insider, skewness of CEO pay, and founder CEOs

	Ln (Total Gap)					
	Fraction of insider CEOs		Skewness of CEO pay		CEO is founder	
	Top tercile (1)	Bottom tercile (2)	Top tercile (3)	Bottom tercile (4)	Founder (5)	Non- founder (6)
NCA Enforceability Up	0.083** (2.54)	0.278*** (3.69)	0.416*** (6.29)	0.098** (2.37)	0.404*** (3.47)	0.177*** (3.51)
p -value (equal coefficient estimates)	(0.01)		(0.00)		(0.02)	
Observations	7,810	8,045	7,827	7,966	1,495	23,709
R-squared	0.704	0.640	0.656	0.705	0.673	0.639
Controls from Table 2	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Average age of VPs, managerial ability, and product market HHI

	Ln (Total Gap)		
	(1)	(2)	(3)
NCA Enforceability Up $\times$ Young VPs	0.052** (2.40)		
Young VPs	0.005 (0.34)		
NCA Enforceability Up $\times$ High Ability		0.040** (2.04)	
High Ability		0.050*** (3.39)	
NCA Enforceability Up $\times$ Low HHI			0.070** (2.35)
Low HHI			-0.012 (-0.64)
Observations	28,244	27,937	27,641
R-squared	0.654	0.653	0.655
Controls from Table 2	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes

Panel C: Sample before CEO turnover

	Ln (Total Gap)	
	Forced Turnover (1)	Voluntary Turnover (2)
NCA Enforceability Up	0.642** (2.59)	0.290*** (2.89)
<i>p</i> -value (equal coefficient estimates)		(0.05)
Observations	1,124	4,398
R-squared	0.726	0.664
Controls from Table 2	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
State FE	Yes	Yes

Table 6: Asymmetric effects

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. *NCA Enforceability Up (Down)* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase (decrease) in NCA enforceability over the current or previous years. In Panel A, the dependent variables reflect alternative definitions of the pay gap and are measured in year $t + 1$. Panel A also reports the p -values of F -stats testing whether the sum of the coefficients on *NCA Enforceability Up* and *NCA Enforceability Down* is significantly different from zero in the same model. In Panels B and C, a propensity-score-matching method is used to estimate the coefficient on *NCA Enforceability Down*. A matched sample is obtained based on one-to-one matching (with replacement) between treated firms (firms headquartered in states with a decrease in NCA enforceability in year t) and non-treated firms (never-treated firms in the same year t , or treated outside a window of $t \pm 10$). Treated firms are required not to relocate during the test window. For all treated and non-treated firms, propensity scores are estimated using the values of the covariates in Eq. (1) for the year $t - 1$ prior to a change in NCA enforceability. In the matched sample, the control firm for a particular treated firm is the non-treated firm from the same year t as the control firm with the most similar propensity score (within a caliper of 5%). Both the treated and control firms are required to have available data for at least one year in both the pre- and post-treatment periods. If an ever-treated firm is matched as a control firm, the firm-years that overlap the period of $t \pm 10$ around its own treatment are excluded. Panel B reports the means of the covariates for 140 pairs of matched treated and control firms, together with t -stats of tests of equality of means between the two types of firms. Panel C reports regression results based on the matched sample. The dependent variable is $\text{Ln}(\text{Total Gap})$ measured at $t + 1$. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

Panel A: Asymmetric effects

	Ln (Total Gap)		Ln (ST Gap)		Ln (LT Gap)	
	(1)	(2)	(3)	(4)	(5)	(6)
NCA Enforceability Up (a)	0.185*** (5.09)	0.185*** (5.10)	0.058** (2.28)	0.053** (2.40)	0.214*** (3.21)	0.198*** (2.84)
NCA Enforceability Down (b)	-0.082** (-2.63)	-0.060** (-2.28)	-0.056*** (-4.05)	-0.049** (-2.67)	-0.077** (-2.12)	-0.049 (-1.49)
p -value ($a + b = 0$)	(0.04)	(0.01)	(0.94)	(0.88)	(0.07)	(0.05)
Observations	28,449	28,449	27,822	27,822	24,597	24,597
R-squared	0.620	0.637	0.595	0.619	0.627	0.643
Controls from Table 2	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Characteristics of means for matched treated and control firms

	Treated	Control	Dif. (Control-Treated)	<i>t</i> -stats
Propensity Score	0.074	0.074	0.000	(0.01)
New CEO	0.057	0.071	0.014	(0.49)
CEO Is Insider	0.693	0.736	0.043	(0.79)
Industry Homogeneity	0.097	0.092	-0.005	(-0.78)
Retiring CEO	0.071	0.121	0.050	(1.42)
Duality	0.650	0.650	0.000	(0.00)
No. of VPs	4.793	4.807	0.014	(0.10)
Propensity of Relay Succession	0.493	0.550	0.057	(0.96)
Ln (Median Industry Gap)	7.255	7.404	0.149	(1.27)
CFO Is VP	0.857	0.864	0.007	(0.17)
Ln (CEO Age)	4.023	4.032	0.010	(0.61)
Ln (CEO Tenure)	1.774	1.720	-0.054	(-0.52)
Ln (Total Asset)	7.395	7.666	0.271	(1.31)
Stk. Return Volatility	0.395	0.387	-0.008	(-0.44)
No. of Segments	2.629	2.757	0.129	(0.55)

Panel C: Regression using matched sample

	Ln (Total Gap)	
	(1)	(2)
NCA Enforceability Down	-0.136 (-1.29)	-0.108 (-1.16)
Observations	3,062	3,062
R-squared	0.673	0.690
Controls from Table 2	No	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
State FE	Yes	Yes

Table 7: Firm value implications

This table documents the firm value implications of a state-level increase in the enforceability of non-compete agreements (NCAs) conditional on the change in the executive pay gap. We consider the change in the pay gap net of the annual median value of the gap. Panel A (B) considers the change from $t - 1$ to t ($t + 1$). Observations for all the treated firms are retained starting from the year following that of an increase in NCA enforceability to build portfolios of treated stocks. In each monthly portfolio, we take a long (short) position in the subsample with (without) increases in the pay gap. The monthly portfolio returns are computed as equally-weighted (Column 1) or market-capitalization-weighted (market capitalization measured at the end of the previous month) (Column 2) average monthly stock returns. The reported alphas are from time-series regressions over several sample periods of portfolio returns on Fama-French five factors. The t -stats in parentheses are computed using the Newey-West estimators for 4 lags. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

Panel A: Pay gap change from year $t - 1$ to year t

	Equally Weighted Portfolio (1)	Weighted Average Portfolio (2)
Alpha for holding 12 months	1.140%* (1.77)	1.365%* (1.85)
Alpha for holding 24 months	0.907%** (2.07)	0.931%* (1.84)
Alpha for holding 36 months	0.913%*** (2.61)	0.842%** (2.09)
Observations	264	

Panel B. Pay gap change from year $t - 1$ to year $t + 1$

	Equally Weighted Portfolio (1)	Weighted Average Portfolio (2)
Alpha for holding 12 months	0.837% (1.13)	1.214%* (1.87)
Alpha for holding 24 months	1.015%** (2.23)	1.081%** (1.99)
Alpha for holding 36 months	0.832%** (2.59)	1.180%*** (2.83)
Observations	252	

Table 8: Alternative mechanisms: CEO power

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the CEO and VP compensation, alternative measures of executive pay gap, and on pay gap conditional on the likelihood of hostile takeovers. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. In Panel A, the dependent variables are CEO compensation ($\ln(\text{CEO Pay})$) and VP compensation ($\ln(\text{VP Pay})$) measured in year $t + 1$. All controls are measured in year t . The set of controls include firm, year, and state fixed effects. In Panels B and C, we re-estimate the specification of Column (2) of Table 2 with some variations. In Panel B, we consider alternative measures of executive pay gap (*CEO Pay Slice* and *Gap Residual*) in year $t + 1$. In Panel C, the dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. We include the interaction between *NCA Enforceability Up* and the inverse of the hostile takeover index created by Cain et al. (2017), while controlling for the index and firm and state-year fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

Panel A. CEO and VP compensation

	Ln (CEO Pay)		Ln (VP Pay)	
	(1)	(2)	(3)	(4)
NCA Enforceability Up	0.139*** (4.68)	0.143*** (5.28)	0.080*** (2.95)	0.083*** (3.63)
Industry Homogeneity		0.141* (1.85)		0.091 (1.10)
ROA		0.195*** (3.77)		0.166*** (4.47)
Ln (Total Asset)		0.329*** (24.59)		0.291*** (33.19)
Market-to-Book		0.127*** (18.23)		0.112*** (18.38)
Leverage		-0.250*** (-3.72)		-0.233*** (-4.85)
Ln (Median Industry CEO Pay)		0.051*** (3.79)		
Ln (Median Industry VP Pay)				0.055*** (4.19)
Cash Ratio		-0.014 (-0.17)		-0.032 (-0.59)
Dividend Payer		-0.056*** (-2.90)		-0.031 (-1.65)
Stk. Return Volatility		0.053 (1.35)		0.091*** (3.86)
Observations	26,764	26,764	26,764	26,764
R-squared	0.729	0.758	0.771	0.803
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Panel B. Alternative pay gap measures

	CEO Pay Slice		Gap Residual	
	(1)	(2)	(3)	(4)
NCA Enforceability Up	0.008* (1.71)	0.008 (1.62)	0.154*** (4.22)	0.179*** (4.92)
Observations	27,570	27,570	28,424	28,424
R-squared	0.341	0.360	0.553	0.581
Controls from Table 2	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Panel C. Hostile takeover

	Ln (Total Gap)
NCA Enforceability Up $\times$ Inv. Takeover Index	-0.011*** (-3.72)
Inv. Takeover Index	0.006 (1.62)
Observations	23,665
R-squared	0.663
Controls from Table 2	Yes
Firm FE	Yes
State-Year FE	Yes

Table 9: Alternative mechanisms: Talent differentials

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the overall executive pay gap while controlling for managerial ability and on the pay gap for each individual VP. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. In Panels A and B we re-estimate the specification of Column (2) of Table 2 with some variations. In Panel A, the dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. We add controls for managerial ability: the managerial ability score (Demerjian et al., 2012), the industry-adjusted ROA, and the industry-adjusted stock return. In Panel B, we replace the overall firm-level executive pay gap $\ln(\text{Total Gap})$ with a similar pay gap at the firm-VP-level for each individual VP ($\ln(\text{VP Total Gap})$) in year $t + 1$. We control for combinations of firm, year, CEO-VP, or CEO-VP-firm fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

Panel A. Managerial ability

	Ln (Total Gap)			
	(1)	(2)	(3)	(4)
NCA Enforceability Up	0.185*** (5.00)	0.183*** (5.24)	0.182*** (5.06)	0.183*** (5.14)
Managerial Ability Score	0.316*** (3.67)			0.196** (2.39)
Adj. ROA		0.656*** (12.33)		0.503*** (8.46)
Adj. Stk. Return			0.171*** (10.80)	0.133*** (8.10)
Observations	28,001	28,449	28,449	28,001
R-squared	0.636	0.639	0.639	0.639
Controls from Table 2	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Panel B. Pay gap at the firm-VP-level

	Ln (VP Total Gap)			
	(1)	(2)	(3)	(4)
NCA Enforceability Up	0.069** (2.21)	0.074** (2.48)	0.070** (2.24)	0.074** (2.51)
Observations	92,640	92,640	92,575	92,575
R-squared	0.765	0.769	0.765	0.768
Controls from Table 2	No	Yes	No	Yes
Firm FE	Yes	Yes	No	No
Year FE	Yes	Yes	Yes	Yes
CEO-VP FE	Yes	Yes	No	No
CEO-VP-Firm FE	No	No	Yes	Yes

Appendix A

A.1 Questions and Thresholds

Garmaise (2011) considers twelve questions analyzed by Malsberger (1996) to evaluate the change of non-compete status in each jurisdiction. The following are Garmaise’s questions and respective thresholds. When relevant events, including court cases or legislative actions, cause the level of the state-level NCA enforcement to move above or below the threshold, we conclude that NCA enforceability increases or decreases accordingly.

Question 1. Is there a state statute of general application that governs the enforceability of covenants not to compete?

Threshold 1. States that enforce non-competition agreements outside a sale-of-business context are above the threshold.

Question 2. What is an employer’s protectable interest and how is it defined?

Threshold 2. States in which the employer can prevent the employee from future independent dealings with all the firm’s customers, not merely with the customers with whom the employee had direct contact, are above the threshold.

Question 3. What must the plaintiff be able to show to prove the existence of an enforceable covenant not to compete?

Threshold 3. Laws that place greater weight on the interests of the firm relative to those of the former employee are above the threshold.

Question 4. Does the signing of a covenant not to compete at the inception of the employment relationship provide sufficient consideration to support the covenant?

Threshold 4. States for which the answer to Question 4 is clearly “Yes” are above the threshold.

Question 5. Will a change in the terms and conditions of employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun?

Threshold 5. States for which the answer to Question 5 is clearly “Yes” are above the threshold.

Question 6. Will continued employment provide sufficient consideration to support a covenant not to compete entered into after the employment relationship has begun?

Threshold 6. States for which the answer to Question 6 is clearly “Yes” are above the threshold.

Question 7. What factors will the court consider in determining whether time and geographic restrictions in the covenant are reasonable?

Threshold 7. Jurisdictions in which courts are instructed not to consider economic or other hardships faced by the employee are above the threshold.

Question 8. Who has the burden of proving the reasonableness or unreasonableness of the covenant not to compete?

Threshold 8. States in which the burden of proof is clearly placed on the employee are above the threshold.

Question 9. What type of time or geographic restrictions has the court found to be reasonable? Unreasonable?

Threshold 9. Jurisdictions in which 3-year state-wide restrictions have been upheld are above the threshold.

Question 10. If the restrictions in the covenant not to compete are unenforceable because they are overbroad, are the courts permitted to modify the covenant to make the restrictions narrower and to make the covenants enforceable?

Threshold 10. States for which the answer to Question 10 is clearly “Yes” are above the threshold.

Question 11. If the employer terminates the employment relationship, is the covenant enforceable?

Threshold 11. States for which the answer to Question 11 is clearly “Yes” are above the threshold.

Question 12. What damages may an employer recover and from whom for breach of a covenant not to compete?

Threshold 12. If, in addition to lost profits, there is a potential for punitive damages against the former employee, the state is above the threshold. States that explicitly exclude consideration of the reasonableness of the contract from the calculation of damages are also above the threshold.

A.2 Events that led to the variations in NCA enforceability

The following table summarizes the court cases or legislative actions that led to variations in NCA enforceability during our study period, 1993 to 2018. The events are identified based on the thresholds and questions by Garmaise (2011). Specific details are in Appendix A.1.

Events that led to the increase in NCA enforceability		
Florida	1996	Florida Legislature
Georgia	2004	<i>Bellsouth Corporation v. Forsee</i>
Ohio	2004	<i>Lake Land v. Columber</i>
Vermont	2005	<i>Summits 7 v. Kelly</i>
Idaho	2008	Idaho Legislature
Wisconsin	2009	<i>Star Direct v. Dal Pra</i>
Georgia	2010	Georgia Legislature
Colorado	2011	<i>Lucht's Concrete Pumping, Inc. v. Horner</i>
Texas	2011	<i>Marsh v. Cook</i>
Virginia	2013	<i>Assurance Data Inc. v. Malyevac</i>
Events that led to the decrease in NCA enforceability		
Texas	1994	<i>Light v. Centel Cellular Co.</i>
Louisiana	2001	<i>Shreveport Bossier, Inc. v. Bond</i> (Undone in 2003)
Oregon	2008	Oregon Legislature
New Hampshire	2012	New Hampshire Legislature
Illinois	2013	<i>Fifield v. Premier Dealership Servs.</i>
Kentucky	2014	<i>Creech v. Brown</i>

Note that we code that Illinois experienced decreased enforceability in 2013, but do not follow Ewens and Marx (2018) who label Illinois as one state with increased enforceability in 2011. As mentioned in Ewens and Marx (2018), in *Fire Equipment v. Arredondo et al.*, the Supreme Court of Illinois altered its definition of “protectable legitimate business interests” in deciding on NCA enforcement in 2011. Previously, Illinois had recognized fixed conditions to identify such business interests (for instance, *Outsource Int'l, Inc. v. Barton* 1999), while starting in 2011 the restrictions were relaxed by introducing more flexible standards. However, the Court also “expressly observe(s) that appellate court precedent for the past three decades remains intact”.

As indicated by Garmaise’s twelve questions, the second question to evaluate the change of NCA enforceability is “What is an employer’s protectable interest and how is it defined?”. States that meet the threshold should be “States in which the employer can prevent the employee from future independent dealings with all the firm’s customers”. The answer to this question for Illinois was already “yes” before 2011. As a result of the Supreme Court ruling, the practical enforceability in Illinois exceeded the threshold even more since then. Importantly, even though we argue that Illinois did not substantially increase its state-level enforceability in 2011, our main results are robust to the inclusion of this event. More details can be found in Section OA.4.

We also notice some other inconclusive opinions raised in recent studies when identifying the variations of NCA enforceability, although the methodologies are all consistent with Garmaise (2011). In *Poynter Investments v. Century Builders of Piedmont* 2010, the Supreme Court of South Carolina ruled against the use of “blue pencil” provisions whereby a court can soften the terms of an unenforceable

non-compete, but meanwhile, made it easier for firms to obtain a preliminary injunction against former employees. Given the unclear implications of the Supreme Court’s decisions, we follow Ewens and Marx (2018) and treat South Carolina as a control state in the baseline models. Besides, Bai et al. (2023) and Ewens and Marx (2018) denote that Oregon experienced a decreased enforceability in 2008, while Kini et al. (2021) claim a change in the opposite direction from the same event. Untabulated results show our main results are not affected by treating the non-compete status in South Carolina, or Oregon, as increase, decrease, or no-change.

Appendix B

Variable	Definition
<i>Compensation variables</i>	
Total Gap	The difference between the CEO's total compensation and the average compensation of the VPs. To mitigate the data inconsistency caused by the FAS 123R, total compensation data is adjusted following Walker (2011) and Gabaix et al. (2014). (<i>Source</i> : ExecuComp)
ST Gap	The difference between the CEO's short-term (ST) compensation and the average ST compensation of the VPs. ST compensation is the sum of salary and bonus. (<i>Source</i> : ExecuComp)
LT Gap	The difference between the CEO's long-term (LT) compensation and the average LT compensation of the VPs. Before the FAS 123R, LT compensation is the total value of the product of SHRTARG and stock price, restricted stock granted, and options granted. After the FAS 123R, LT compensation is the total value of the non-equity incentive pay, fair value of stocks, and fair value of options granted (we hypothesize that the cash payment of formulaic multiyear plans in the non-equity incentive pay is nonnegligible). (<i>Source</i> : ExecuComp)
Median Industry Gap	The median <i>Total Gap</i> for firms in the same the Fama-French 30 industry, year, and quartile of <i>Total Asset</i> (excluding the focal firm). (<i>Source</i> : ExecuComp)
Median ST Industry Gap	The median <i>ST Gap</i> for firms in the same the Fama-French 30 industry, year, and quartile of <i>Total Asset</i> (excluding the focal firm). (<i>Source</i> : ExecuComp)
Median LT Industry Gap	The median <i>LT Gap</i> for firms in the same the Fama-French 30 industry, year, and quartile of <i>Total Asset</i> (excluding the focal firm). (<i>Source</i> : ExecuComp)
Ln (Total Gap)	Natural logarithm of <i>Total Gap</i> .
Ln (ST Gap)	Natural logarithm of <i>ST Gap</i> .
Ln (LT Gap)	Natural logarithm of <i>LT Gap</i> .
Ln (Median Industry Gap)	Natural logarithm of <i>Median Industry Gap</i> .
Ln (Median ST Industry Gap)	Natural logarithm of <i>Median ST Industry Gap</i> .
Ln (Median LT Industry Gap)	Natural logarithm of <i>Median LT Industry Gap</i> .
Ln (CEO Pay)	Natural logarithm of the total compensation of the CEO. (<i>Source</i> : ExecuComp)
Ln (VP Pay)	Natural logarithm of the average compensation of the VPs. (<i>Source</i> : ExecuComp)
Ln (Median Industry CEO Pay)	Natural logarithm of the median <i>CEO Pay</i> for firms in the same the Fama-French 30 industry, year, and quartile of <i>Total Asset</i> (excluding the focal firm). (<i>Source</i> : ExecuComp)
Ln (Median Industry VP Pay)	Natural logarithm of the median <i>VP Pay</i> for firms in the same the Fama-French 30 industry, year, and quartile of <i>Total Asset</i> (excluding the focal firm). (<i>Source</i> : ExecuComp)

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Variable	Definition
CEO Pay Slice	The total compensation of the CEO over the aggregated compensation of the top five most highly-paid executives. (<i>Source</i> : ExecuComp)
Gap Residual	The residuals from the regression of Ln (<i>Total Gap</i>) on dummies for CEO-Chair duality, highly tenured CEOs, founder CEOs, and industry and year fixed effects. Highly tenured CEOs is a dummy that equals one if the <i>CEO Tenure</i> is in the distribution of the top quartile in the same industry-year, zero otherwise. Industry is defined as the Fama-French 30 industry. (<i>Source</i> : ExecuComp, BoardEx)
Ln (VP Total Gap)	Natural logarithm of the difference between the focal VP's total compensation and that of her CEO in the focal firm. (<i>Source</i> : ExecuComp)
<i>Executive characteristics</i>	
CEO Age	Age of CEO. (<i>Source</i> : ExecuComp)
CEO Tenure	Number of years as CEO. (<i>Source</i> : ExecuComp, BoardEx)
Ln (CEO Age)	Natural logarithm of <i>CEO Age</i> .
Ln (CEO Tenure)	Natural logarithm of <i>CEO Tenure</i> .
New CEO	Dummy that equals one if the CEO is in her first year in the role, zero otherwise. (<i>Source</i> : ExecuComp, BoardEx)
CEO Is Insider	Dummy that equals one if the CEO has worked in the firm for at least 12 months prior to becoming CEO, zero otherwise. (<i>Source</i> : ExecuComp, BoardEx)
Retiring CEO	Dummy that equals one if CEO Age is 65 or more, zero otherwise. (<i>Source</i> : ExecuComp)
Duality	Dummy that equals one if the CEO is also chairman in the same firm, zero otherwise. (<i>Source</i> : ExecuComp)
No. of VPs	Number of VPs. (<i>Source</i> : ExecuComp)
Propensity of Relay Succession	Dummy that equals one if a president or COO is distinct from the CEO or Chair, zero otherwise, following Naveen (2006). (<i>Source</i> : ExecuComp)
CFO Is VP	Dummy that equals one if one of the VPs is the CFO, zero otherwise. An executive is identified to be a CFO according to the Execucomp variable "CFO annual flag" (CFOANN = CFO). Considering that the variable is incomplete prior to 2007, we follow Kubick and Masli (2016) and classify an executive as CFO if the executive's job title includes any variants of "CFO, financial, finance, treasurer, or controller". (<i>Source</i> : ExecuComp)
<i>Firm/Industry characteristics</i>	
Ln (Total Asset)	Natural logarithm of total assets. (<i>Source</i> : Compustat)
Industry Homogeneity	Mean partial correlations between the returns on firms from a particular industry and the return on an equally weighted index constructed by using all the firms from the same industry, holding the market return constant (Parrino, 1997). Estimated based on 36 monthly returns. Industry is defined as the Fama-French 30 industry. (<i>Source</i> : CRSP)
Stk. Return Volatility	Volatility of past 36 monthly returns. (<i>Source</i> : CRSP)
No. of Segments	Number of business segments in which a firm operates. (<i>Source</i> : Compustat)
ROA	Net income over total assets. (<i>Source</i> : Compustat)

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Variable	Definition
Leverage	Long-term debt plus debt in current liabilities, scaled by total assets. (<i>Source</i> : Compustat)
Market-to-Book	Total assets minus the book value of equity plus the market value of equity, scaled by total assets. Book value of equity is book common equity minus preferred stock and plus deferred taxes. (<i>Source</i> : Compustat)
Cash Ratio	Cash over total assets. (<i>Source</i> : Compustat)
Dividend Payer	Dummy that equals one if the firm has paid dividends in a year, zero otherwise. (<i>Source</i> : Compustat)
<i>Variables used in Online Appendix</i>	
VP mobility	Dummy that equals one if the focal VP is not at the same firm at year $t+1$ compared to year t , zero otherwise. (<i>Source</i> : ExecuComp)
Ln (Firm Age)	Natural logarithm of the difference between the current year and the first year that the focal firm appears in the Compustat. (<i>Source</i> : Compustat)
GDP Growth	The state-level annual GDP growth rate. (<i>Source</i> : Bureau of Economic Analysis)
Unemployment	The state-level annual unemployment rate. (<i>Source</i> : Bureau of Labor Statistics)
Ln (Total Gap Median VP)	Natural logarithm of the difference between the CEO's total compensation and that of the median VP. (<i>Source</i> : ExecuComp)
Ln (Total Gap Max VP)	Natural logarithm of the difference between the CEO's total compensation and the maximum total compensation among VPs. (<i>Source</i> : ExecuComp)
Gini Coefficient	$1 + \frac{1}{n} - \frac{2}{n^2 \bar{y}}(y_1 + 2y_2 + \dots + ny_n)$, where n is the number of executives (including the CEO), $y_1 \dots y_n$ are the executives' total compensations in decreasing order of size, and $\bar{y}$ is the average compensation. (<i>Source</i> : ExecuComp)
Rank (Total Gap)	Rank of the firm's <i>Total Gap</i> minus one for a particular year, scaled by the total number of firms minus one in the same year. (<i>Source</i> : ExecuComp)
Ln (Total Gap) Adj.	Natural logarithm of the difference between the CEO's total compensation and the average compensation of the VPs. To mitigate the data inconsistency caused by the FAS 123R, total compensation is adjusted following Kini and Williams (2012). (<i>Source</i> : ExecuComp)

Appendix C Online Appendix

OA.1 Mobility effects of non-compete enforceability

Our experiment relies on the notion that a variation in NCA enforceability generates or removes barriers to top executive mobility. Though existing studies note that executives are restrained by the prevalent use of NCAs and enhanced NCA enforceability (Garmaise, 2011; Graham et al., 2020), it is necessary to check if the shifts in enforcement constitute valid shocks to VP mobility in our studied sample window. We start with the firms covered in ExecuComp during 1993 to 2018. Since VPs are our primary focus, we exclude CEO information from the sample. The mobility indicator takes the value of one if the focal executive is not anymore at the same firm at year $t + 1$ relative to t . Similar to Islam, Rahman, Sen, and Zein (2021), we do not require an executive to re-appear at another sample firm because they may move to firms outside S&P (without coverage in ExecuComp). We exclude the departures of executives aged above 65 that are likely to be caused by retirements. In our sample, around 14.8% of VPs terminate their role at the focal firm in the following year.

In Table OA.1, we use a linear probability model to gauge the effects of changes in NCA enforceability on executive turnover. We find that increases and decreases in NCA enforceability lead to effects in opposite directions. Stronger (weaker) enforceability decreases (increases) mobility by about 29.7% ($= -0.044/0.148$) (18.9% ($= 0.028/0.148$)). Therefore, we confirm that the ability of executives to join external tournaments is indeed affected by the enforceability shocks.

OA.2 Alternative proxies

We follow prior research and use several alternative measures as proxies for the executive pay gap: pay gap as the difference between the total pay of the CEO and that of the median ($\ln(\text{Total Gap Median VP})$) or highest-paid VP in a firm-year ($\ln(\text{Total Gap Max VP})$); Gini coefficient as the income dispersion among the whole top executive team (*Gini Coefficient*); relative annual rank of total gap ($\text{Rank}(\text{Total Gap})$). We also follow the procedures to recalculate the Black-Scholes values for the stock options in the post-FAS 123R period (details

discussed below) and build an adjusted version of the executive pay gap ($\ln(Total\ Gap)\ Adj.$). The proxies of *Median Industry Gap* are all re-calculated in line with the respective dependent variables. Table OA.2 indicates our main finding does not differ when using the alternative measures of the executive pay gap.

In the main text, we follow the approach by Walker (2011) and Gabaix et al. (2014) to adjust the pre-reform data and get the proxy of $\ln(Total\ Gap)$. We next follow the procedures by Kini and Williams (2012) to recalculate the values of stock option awards using the Black-Scholes model for the post-reform period for an alternative proxy, $\ln(Total\ Gap)\ Adj.$. For fiscal years before (after) 2006, all ExecuComp firms report the compensation data using the old (new) reporting format. In 2006, a small fraction of firms still appears with the old format. We also calculate the Black-Scholes values for those firms. The Black-Scholes model to value an executive stock option per share, P , is as follows:

$$P = Se^{-dT}N(d_1) - Xe^{-rT}N(d_2)$$

$$d_1 = \frac{\ln(\frac{S}{X}) + (r - d + \frac{\sigma^2}{2})T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln(\frac{S}{X}) + (r - d - \frac{\sigma^2}{2})T}{\sigma\sqrt{T}}$$

Following Coles, Daniel, and Naveen (2006), Hayes et al. (2012), Kini and Williams (2012), and the routines of ExecuComp, we estimate the inputs as follows:

S , underlying stock price, measured as the market price at end of fiscal year.

d , expected future dividend yield, calculated as the average of the dividend yields over the previous three years.

T , 70% of the nominal option term, which is the difference between the actual expiration date and 1st July (assumed grant date) of the grant year.

X , exercise price.

r , risk-free rate, measured as the average yield on a seven-year term U.S. Treasury bond.

σ , expected stock return volatility, measured as the volatility over the previous five years.

The correlation between our calculated Black-Scholes values and ExecuComp reported val-

ues for options (ExecuComp item: OPTION_AWARDS_FV) is 93.6% pre-regulation, indicating that our procedures of estimation are comparable to ExecuComp’s. Therefore, we can ensure the consistency of the re-estimated data across the sample period.

OA.3 Sample surrounding the increase in NCA enforceability

In Table OA.3, we restrict the window to $t \pm 1$, $t \pm 3$, $t \pm 5$, or $t \pm 10$ around the event year t for the treated companies. The test serves two purposes. First, as discussed in the main body of the paper, the estimation of staggered DID effects may be biased because it uses the earlier-treated observations as controls for the later-treated ones (Baker et al., 2022; Goodman-Bacon, 2021; Sun and Abraham, 2021). This issue may be significant in our setting, because the timing of the treatment effect of enhanced enforceability varies across a long sample period. By truncating the treatment effects to vary in a short timeframe, the possibility that the already treated sample acts as future controls is reduced to a large extent. Second, setting a short test window is helpful to exclude confounding factors that are correlated with the shifts in non-compete enforcements. We show that the new results are consistent with the baseline regressions.

OA.4 Different coding schemes

In Table OA.4, we alter the coding schemes for enhanced NCA enforceability in four ways.

First, as discussed in Appendix A, in our baseline tests, we do not treat Illinois as a treated state in 2011 because we argue that, according to Garmaise’s twelve questions, the relevant court case does not move state-level enforceability above the threshold and substantially increases it. Here, we modify the coding by labelling Illinois as a state that has enhanced the enforcement in 2011. After 2013, the enforceability again decreases, so the indicator goes back to zero. In Column (1), our results persist with this coding modification.

Second, in our baseline model we focus on the first occurrence of variations of non-compete status, which does not capture the fact that Georgia further increases its enforceability in 2010. Therefore, we split our sample period into two parts to study both shocks affecting Georgia. We select 2006 as the dividing point so that the lengths of the two subsamples

are balanced. Considering that 2006 is also the year that changed the reporting formats of executive compensation, we do not arbitrarily divide the sample according to the time variable, but divide it according to the data reporting format (a small number of ExecuComp firms report in the old format in 2006). One side benefit is that we can use the raw data provided in ExecuComp to estimate the models separately and avoid the potential biases due to adjustments to the original compensation data. For the more recent subsample, we classify the firms headquartered in Georgia after 2010 as treated firms. In Columns (2) and (3), the effect of NCA enforceability is still significantly positive in the two windows.

Third, in our studied period, legislative actions caused two states, Florida and Idaho, to change their NCA enforceability. Their occurrences may be associated with state-level political conditions or lobbying activities (Klasa et al., 2018). We only retain the treated states where the enhanced NCA enforceability is caused by court rulings, which is unlikely to be anticipated by firms. In Column (4), after dropping the observations for Florida and Idaho, our results are not affected.

Finally, we directly use the NCA Index from Bai et al. (2020). We use Bai et al.’s version of the NCA enforcement score because their data period overlaps with ours. Using the discrete NCA Index as the test variable, the model is not set as a standard DID, but the results remain qualitatively similar in Column (5).

OA.5 Omitted variables

We discuss here some potential sources of omitted variables that may confound our results and control for sets of such variables in Table OA.5.

First, the expected utility for each VP from a tournament depends on the prize size and the likelihood of prevailing in the tournament (Kale et al., 2009). When outside opportunities decline for an average VP, a related concern is whether the firm inherently favors particular candidates. In a biased tournament, the promotion possibility decreases to some degree. Rational managers would always weigh the benefits and costs when deciding whether to engage in the contest and thus force firms to expand the tournament prize to rebalance the utility. As a result, the observed change in the pay gap may be a direct response to variations in

tournament opportunities for VPs instead of the non-compete regulation. Similarly, Kini et al. (2021) find that delta and vega in executive compensation are affected by the increase in NCA enforceability. We follow Kale et al. (2009) and calculate the standard deviation of VP compensation as the proxy of tournament opportunities for an average VP. We also follow Core and Guay (2002) and Coles et al. (2006) to compute delta and vega. These variables are included as controls in Columns (1), (2), and (3) and the findings for *NCA Enforceability Up* remain robust.

Second, Abernethy, Dong, Kuang, Qin, and Yang (2022) argue that the executive pay gap can also be explained by variations in a firm’s time-varying strategies. According to their classification, a firm can be either a prospector or a defender. Prospectors prefer a competitive strategy that focuses on product innovation and emphasize the ability to seize new market opportunities, while defenders concentrate on existing products in the current niche industry and have less demand for quick decision-making (Abernethy et al., 2022). Prospector-type firms need CEOs to be more authoritative and dominating and make more timely decisions. Therefore, those firms would like to award more compensation and also larger executive pay gaps to their CEOs than the defender-type ones (Abernethy et al., 2022). To account for this dimension that could confound our findings, we follow Abernethy et al. and construct an indicator of a firm’s strategic priority through six accounting numbers, including the R&D expenses (over sales), marketing expense (over sales), one-year sales growth, net PPE (over total assets) (multiplied by -1), total employees (over total assets), and the standard deviation of total employees over the past five years. All the indicators are averaged for a two-year rolling window and then ranked into quintiles in each industry-year. A measure of a firm’s strategy is built by summing all the ranks, with higher value of the measure representing a higher propensity to pursue prospector-type strategies. The measure is included in the regression of Column (4) in which we observe that our main findings are unaffected.

Finally, in Column (5) we further control for a set of accounting variables that are frequently examined as determinants of executive pay level in existing studies (e.g., Focke et al., 2017), including *ROA*, *Market-to-Book*, *Leverage*, *Cash Ratio*, and *Dividend Payer*, while in Column (6) we consider a specification in which all the additional controls mentioned above

are included. Overall, in all the columns of Table OA.5, we find that the explanatory power of non-compete shocks is robust.

OA.6 Additional FEs

In Table OA.6, we control for a set of high-dimensional FEs to mitigate concerns for omitted variables that may relate to the executive pay gap. We consider the time-varying heterogeneity across industries (Bai et al., 2020) (Column (1)), firm size quartiles (Column (2)), four census tract regions (Column (3)), or states of incorporation (Dang et al., 2021) (Column (4)). We also add firm age fixed effects to rule out the possibility that the design of the pay gap may correlate with the firm’s business cycle (Column (5)). We finally control for all these FEs (Column (6)). Some of the control variables in Eq. (1) are absorbed due to collinearity, but our variable of interest, *NCA Enforceability Up*, is significantly positive in all cases.

OA.7 CEO turnover

In Table OA.7, we verify if the effect of enforceability on the pay gap is still present when the existing CEO departs. We remove the observations that coincide with CEO turnover at year t (Column (1)), the two years since turnover (Column (2)), or the five years since turnover (Column (3)). We also distinguish between the categories of CEO departures and follow Jenter and Kanaan (2015) and Peters and Wagner (2014) to identify forced CEO turnovers. Following these classifications, we remove firms that have ever fired CEOs (Column (4)). The coefficients of interest are always highly significant and, in general, get stronger after excluding the sample in relation to CEO turnover events.

OA.8 Additional robustness tests

In Table OA.8, we examine a battery of additional tests, including: (i) examine the full sample including financial and utility firms (Column (1)); (ii) exclude observations for the financial crisis period 2008-2009 (Column (2)); (iii) restrict the sample to companies with at least two or three VPs (Columns (3) and (4)); (iv) exclude the sample of CEOs identified

through BoardEx (Column (5)); (v) examine only the sample with available historical headquarter data from 10-X Header Data (from 1994 to 2018) (Column (6)); (vi) exclude relocated firms (Column (7)); (vii) exclude states that have experienced changes in NCA enforceability during the period from 1980 to 1993 (Columns (8), (9), and (10)); (viii) exclude firms headquartered in Florida and/or Ohio that constitute 46.6% of the treated sample (Columns (11), (12), and (13)); (ix) construct industry-level financials based on the SIC-2 or NAICS-3 industry classification (Columns (14) and (15)).

Table OA.1: Executive mobility

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the VP mobility. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variable, *VP Mobility*, is a mobility indicator, which takes the value of one if the focal executive is not at the same firm at year $t + 1$ relative to t . The departures of executives aged above 65 that are likely to be caused by retirements are excluded. *NCA Enforceability Up (Down)* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase (decrease) in NCA enforceability over the current or previous years. All models include executive, industry-year, and region-year fixed effects. This table also reports the p -values of F -stats testing whether the sum of the coefficients on *NCA Enforceability Up* and *NCA Enforceability Down* is significantly different from zero in Column (3). Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	VP Mobility		
	(1)	(2)	(3)
NCA Enforceability Up (a)	-0.044** (-2.06)		-0.044** (-2.03)
NCA Enforceability Down (b)		0.028** (2.03)	0.027** (2.02)
No. of VPs	0.034*** (15.86)	0.034*** (16.03)	0.034*** (16.00)
Propensity of Relay Succession	0.002 (0.56)	0.002 (0.52)	0.002 (0.57)
ROA	-0.061** (-2.07)	-0.062** (-2.09)	-0.061** (-2.07)
Leverage	0.088*** (4.22)	0.088*** (4.27)	0.088*** (4.28)
Market-to-Book	-0.018*** (-5.53)	-0.018*** (-5.50)	-0.018*** (-5.53)
Cash Ratio	0.012 (0.61)	0.014 (0.69)	0.012 (0.59)
Stk. Return Volatility	0.034** (2.66)	0.033** (2.64)	0.034** (2.67)
Ln (Total Asset)	-0.044*** (-5.67)	-0.044*** (-5.65)	-0.044*** (-5.67)
Ln (Firm Age)	0.111*** (4.57)	0.111*** (4.58)	0.112*** (4.59)
GDP Growth	-0.161 (-1.67)	-0.147 (-1.50)	-0.157 (-1.64)
Unemployment	0.003 (0.68)	0.002 (0.57)	0.003 (0.70)
p -value ($a + b = 0$)			(0.53)
Observations	116,960	116,960	116,960
R-squared	0.362	0.362	0.362
Executive FE	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Region-Year FE	Yes	Yes	Yes

Table OA.2: Alternative measures

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The regression of Column (2) of Table 2 is re-estimated by using different dependent variables measured at $t + 1$. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap Median VP) (1)	Ln (Total Gap Max VP) (2)	Gini Coefficient (3)	Rank (Total Gap) (4)	Ln (Total Gap) Adj. (5)
NCA Enforceability Up	0.176*** (4.93)	0.196*** (3.97)	0.014*** (3.21)	0.035*** (4.35)	0.183*** (4.49)
Observations	28,392	25,295	28,449	28,449	28,449
R-squared	0.665	0.606	0.414	0.637	0.627
Controls from Table 2	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes

Table OA.3: Sample surrounding the increase in NCA enforceability

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variable is $\text{Ln}(\text{Total Gap})$ measured at $t + 1$. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. The regression of Column (2) of Table 2 is re-estimated by truncating the windows of 1, 3, 5, or 10 years around the event year t for treated companies. All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)			
	$t \pm 1$ (1)	$t \pm 3$ (2)	$t \pm 5$ (3)	$t \pm 10$ (4)
NCA Enforceability Up	0.122*** (2.74)	0.140*** (4.07)	0.189*** (3.28)	0.200*** (5.12)
Observations	23,913	24,799	25,582	27,141
R-squared	0.642	0.641	0.639	0.637
Controls from Table 2	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Table OA.4: Different coding schemes

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variable is $\ln(\text{Total Gap})$ measured at $t+1$. The regression of Column (2) of Table 2 is re-estimated by using different coding schemes of the variations in NCA enforcement. All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)				
	Coding Illinois as treated (1)	Pre-FAS 123R (2)	Post-FAS 123R (3)	Excluding Florida & Idaho (4)	NCA Index (5)
NCA Enforceability Up	0.156*** (3.52)	0.240*** (3.27)	0.121** (2.28)	0.184*** (4.78)	
NCA Index					0.060** (2.42)
Observations	28,449	12,314	16,042	27,298	28,449
R-squared	0.637	0.648	0.699	0.638	0.637
Controls from Table 2	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes

Table OA.5: Omitted variables

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. $\text{NCA Enforceability Up}$ is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. The regression of Column (2) of Table 2 is re-estimated by controlling for additional variables, including $\ln(\sigma \text{ VP Pay})$, $\ln(\text{CEO Delta})$, $\ln(\text{VP Delta})$, $\ln(\text{CEO Vega})$, $\ln(\text{VP Vega})$ measured at $t + 1$, *Strategy* (Abernethy et al., 2022), and accounting variables, including *ROA*, *Market-to-Book*, *Leverage*, *Cash Ratio*, and *Dividend Payer*, measured at t . All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)					
	$\sigma \text{ VP Pay}$	CEO and VP Delta	CEO and VP Vega	Strategy	Accounting variables	All
	(1)	(2)	(3)	(4)	(5)	(6)
NCA Enforceability Up	0.162*** (4.88)	0.139*** (4.16)	0.174*** (4.95)	0.203*** (5.09)	0.179*** (4.93)	0.177*** (4.67)
Observations	28,449	25,842	23,285	23,575	26,764	18,190
R-squared	0.659	0.658	0.645	0.653	0.656	0.700
Controls from Table 2	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes

Table OA.6: Additional FEs

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variable is $\ln(\text{Total Gap})$ measured at $t + 1$. $\text{NCA Enforceability Up}$ is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. The regression of Column (2) of Table 2 is re-estimated using different fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)					
	(1)	(2)	(3)	(4)	(5)	(6)
NCA Enforceability Up	0.152*** (4.83)	0.182*** (5.01)	0.143*** (4.18)	0.148*** (3.00)	0.180*** (5.20)	0.110** (2.13)
Observations	28,446	28,449	28,449	28,255	28,449	28,252
R-squared	0.650	0.640	0.639	0.649	0.639	0.666
Controls from Table 2	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	Yes	No
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	No	No	No	No	Yes
Size-Year FE	No	Yes	No	No	No	Yes
Region-Year FE	No	No	Yes	No	No	Yes
State Inc.-Year FE	No	No	No	Yes	No	Yes
Firm Age FE	No	No	No	No	Yes	Yes

Table OA.7: Exclusion of CEO turnovers

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variable is Ln (*Total Gap*) measured at $t + 1$. *NCA Enforceability Up* is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. We remove the observations that coincide with CEO turnover at year t (Column (1)), the two years since turnover (Column (2)), or the five years since turnover (Column (3)). We also follow Jenter and Kanaan (2015) and Peters and Wagner (2014) to identify forced CEO turnover. Following these classifications, we remove firms that have ever fired CEOs (Column (4)). All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)			
	Exclude turnover year (1)	Exclude two years since turnover (2)	Exclude five years since turnover (3)	Exclude firms ever fired CEOs (4)
NCA Enforceability Up	0.173*** (4.07)	0.185*** (4.25)	0.263** (2.54)	0.195*** (4.11)
Observations	25,566	22,653	11,582	18,236
R-squared	0.659	0.671	0.717	0.663
Controls from Table 2	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Table OA.8: Additional robustness tests

This table reports the effect of a state-level increase in the enforceability of non-compete agreements (NCAs) on the executive pay gap. The sample covers the S&P ExecuComp firms (financial and utility firms are excluded) and is from 1993-2018. The dependent variable is $\ln(\text{Total Gap})$ measured at $t+1$. $\text{NCA Enforceability Up}$ is measured in year t and is a binary variable that is set to one if a firm is headquartered in a state that has experienced an increase in NCA enforceability over the current or previous years. All models include firm, year, and headquarter-state fixed effects. Detailed variable definitions can be found in Appendix B. The t -stats in parentheses are computed using standard errors clustered at the headquarter-state level. The coefficients on constants are not reported. ***, **, * correspond to the significant levels of 1%, 5%, and 10% respectively.

	Ln (Total Gap)														
	Full Sample (1)	Exclude Crisis (2)	At Least Two VPs (3)	At Least Three VPs (4)	ExecuComp Sample (5)	10-X Header State (6)	Exclude Relocation (7)	Decrease Before (8)	Increase Before (9)	Change Before (10)	Exclude Florida (11)	Exclude Ohio (12)	Exclude FL & OH (13)	SIC-2 Industry (14)	NAICS-3 Industry (15)
NCA Enforceability Up	0.141*** (3.67)	0.167*** (4.79)	0.174*** (5.04)	0.161*** (4.68)	0.180*** (4.80)	0.178*** (4.39)	0.210*** (5.90)	0.203*** (5.39)	0.167*** (3.30)	0.209*** (3.95)	0.182*** (4.77)	0.177*** (4.15)	0.174*** (3.74)	0.199*** (5.80)	0.184*** (5.50)
Observations	34,585	25,652	28,292	27,462	27,634	25,525	24,448	26,887	26,180	24,618	27,434	27,026	26,011	27,780	27,149
R-squared	0.638	0.636	0.637	0.633	0.639	0.638	0.639	0.637	0.636	0.636	0.639	0.638	0.640	0.639	0.641
Controls from Table 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The Impact of Influence Tactics on Sharing Behavior in Brand Messaging

ABSTRACT

As social media platforms increasingly supplant traditional marketing methods, a major challenge for firms is to develop attractive brand messages that effectively engage more sharing. Previous studies on how brand message characteristics influence sharing behavior have primarily drawn on affective and linguistic literature, leaving an investigation of sales literature in this context still lacking. This study extends influence tactics from sales literature to brand messaging in social media. We develop a machine learning framework to analyze a dataset of 893,222 brand-related tweets, empirically showing that internalization, compliance, and ingratiation tactics can enhance consumer sharing behavior. Specially, a high level of consistency or a high level of variation of cross-message compositions boost sharing behavior the most. Utilizing ingratiation tactic and compliance tactic for the feminine brand name and the masculine brand name could enhance the effectiveness for brand message sharing respectively. Our findings offer practical guidance for content managers on creating more attractive brand messages that are more likely to be shared utilizing influence tactics.

1. INTRODUCTION

Social media platforms have become essential bridges between brands and their consumers (Hudson et al., 2016; Lemon & Verhoef, 2016), increasingly supplanting conventional marketing methods in fulfilling marketing goals (Villarroel Ordenes et al., 2019). In 2023, companies' expenditure on social media marketing was around \$270 billion, and it is anticipated to exceed \$300 billion by 2024 (Statista, 2023). Despite the increasing number of messages generated by brands, consumers often get lost in the immense volume of information (Horst & Duboff, 2015) and their impact on consumers remains low (Villarroel Ordenes et al., 2019). For brand messages, sharing content created by the brand can strengthen the connection between the brands and consumers (Fletcher-Brown et al., 2021; Hollebeek & Chen, 2014), enhance the virality and popularity of messages and raise consumer's awareness of the brand (Dhaoui & Webster, 2021; Weismueller et al., 2022; Zadeh & Sharda, 2022). Hence, it is widely acknowledged that social media's return on investment is intimately connected to its ability to go viral (Han et al., 2020; Kumar & Mirchandani, 2013). Therefore, a major challenge for firms is to develop attractive brand messages with content that is less prone to being overlooked and more likely to be shared by consumers, thereby reaching to a wider audience (Villarroel Ordenes et al., 2019; Zadeh & Sharda, 2022; Zhang et al., 2017).

Just as sellers employ different communication tactics to persuade buyers to adopt positive behaviors, brands utilize various communication tactics on social media platforms to influence consumer actions, including increasing sales (Fei Ren et al., 2023), eliciting positive behavior such as green initiatives (Kronrod et al., 2012), and particularly sharing brand messages (Ordenes et al., 2019). Online sharing behavior, defined as the act of sharing content found online with social peers (Zhang et al., 2017), plays a crucial role in amplifying brand messages, enhancing brand awareness, and potentially contributing to brand value and firm performance (Fei Ren et al., 2023; Lambrecht et al., 2018; Zhang et al., 2017). Recognizing the significance of sharing behavior, prior studies have investigated various attributes of brand messages that

potentially influence sharing behavior. Those attributes (see Table 1) include for example vividness (Xu et al., 2023), sentiments (Mallipeddi et al., 2021), certainty language (Pezzuti et al., 2021), negations language (Pezzuti & Leonhardt, 2023), speech acts (Villarroel Ordenes et al., 2019), discrepancies language (Pezzuti, 2023), or second person pronouns (Cruz et al., 2017). Nevertheless, a notable gap exists in the literature concerning the application of insights derived from selling literature to the realm of online brand communication (Singh et al., 2020).

While both brands and sellers strive to communicate effectively with consumers to elicit positive behavioral responses, communication on social media platforms poses unique challenges compared to traditional seller interactions (Singh et al. 2020; Ordenes et al. 2019). Unlike the typically lengthy and detailed exchanges in traditional settings, social media communication is constrained by limited space. Consequently, firms face additional challenges in capturing consumers' attention and conveying their messages effectively.

Recent research in seller communication via email has delved into various influence tactics aimed at capturing consumers' attention (Singh et al., 2020). Influence tactics refer to the various communication methods that can be used in their efforts to persuade (Frazier & Rody, 1991). Although the use of influence tactics differs across various contexts, they can be categorized into three principal groups: internalization, compliance, and ingratiation (McFarland et al., 2006; Singh et al., 2020; Venkatesh et al., 1995). Internalization aims to change a people's perceptions, compliance attempts to alter the consumer's motivation and ingratiation seeks to meet the psychological needs of the target (Frazier & Summers, 1984; Singh et al., 2020; McFarland et al., 2006). Several components of influence tactics have been identified as relevant to brand messages on social media, including offering objective information (internalization), exerting demands (compliance), and conveying emotions (ingratiation) (Ordenes et al. 2017; 2019). Our study therefore draws upon selling literature, particularly focusing on the concept of influence tactics (McFarland et al., 2006; Singh et al. 2020), to examine the impact of employing diverse

influence tactics in brand communication on social media on stimulating brand message sharing behavior.

Previous communication research has highlighted that the effectiveness of communication depends not only on what is being communicated, but also on how it is communicated and by whom (Batra and Keller 2016). Therefore, in addition to examine the effectiveness of influence tactics (internalization, compliance, and ingratiation) on brand message sharing behavior, we also seek to investigate how to utilize these tactics effectively and who should use them to enhance brand message sharing behavior. First, consumers do not consider social media posts in isolation but interdependently. The composition of content across a sequence of social media posts thus influences their virality (Batra & Keller, 2016a; Ordenes et al., 2019). The exploration of how firms effectively utilize influence tactics across their social media posts remains unknown. Therefore, for the “How” question, we explore whether firms should vary their influence tactics across posts, consistently use the same tactic, or strive to achieve an optimal balance by mix of various tactics. Second, one of the most important and underestimated aspects of a brand is its name (Pogacar et al. 2021). Emerging research has indicated that the linguistic features of a brand name communicate brand qualities beyond the name's literal meaning and gender (femininity vs. masculinity) of brand name could influence the consumer's perceptions and attitudes towards the brand (Carnevale et al., 2017; Pogacar et al., 2021). However, insights on how brands with names associated with different gender could influence the effectiveness of brand communications are still under explored. Therefore, for the “Who” question we aim to investigate whether the gender (femininity vs. masculinity) of brand name could influence effects of employing the influence tactics on the brand message sharing behavior.

To achieve the research objectives, we analyzed the data of 893,222 Twitter posts from 122 USA brands from 2007 to 2021 and utilized the advanced language model BERT to extract the influence tactics that each post employed, thereby offering four main contributions. First, we contribute to the brand message sharing literature. Previous research is mainly based on affect

and linguist literature to study the message sharing behavior (Table 1), we introduce influence tactics from selling literature and empirically examined the impact of internalization, compliance, and ingratiation on sharing behavior. This examination is facilitated by advance language model, BERT and machine learning technique.

Second, this study advances the literature on influence tactics by extending its application to the context of social media brand messaging. Originally designed for firm-to-firm channels (Boyle et al., 1992; Frazier & Rody, 1991) and later expanded to personal sales (McFarland et al., 2006) and online email communication (Singh et al., 2020), we empirically explored its effectiveness for brand message sharing on social media platform. Investigating the effectiveness of influence tactics on social media platform is crucial, as it allows for persuading broader audiences to take desired actions, potentially leading to a more significant impact.

Third, we augment research on the effective level of consistency or variation in social media posts (e.g., Batra and Keller 2016; Ordenes et al. 2019) by showing that greater level of consistency or greater level of variation in the content using influence tactics described across social media posts leads to optimal sharing behavior, while moderate level of consistency or variation reduce sharing behavior. By so doing, we contribute to research showing that employing tactics with substantial level of consistency or variation tends to be more effective (e.g., Lai, 2017; Weiger et al., 2018).

Fourth, extending research on the synergistic effect of social media content and brand characteristics (Berger et al. 2020; Packard and Berger 2021), we determine that firms should frame their posts based on the femininity (vs. masculinity) of their brand name. Our results show that the femininity brand name enhance the effectiveness of ingratiation, while masculinity brand name enhance the effectiveness of compliance tactics. The findings further contribute to emerging research on the role of brand names in shaping consumers' perception and behaviors (Pogacar et al., 2021).

2. RESEARCH AND THEORETICAL BACKGROUND

2.1 Brand messages and sharing behavior

Conventional advertising approaches like print and broadcast media grapple with issues related to immediacy, accessibility, and cost efficiency (Kelleher & Sweetser, 2012), which often struggling to keep pace with the rapid flow of information in the modern age. Social media platforms are much less impeded by these challenges, leading to an increasing number of brands using social media to achieve their marketing goals (Marchand et al., 2021; Nian & Sundararajan, 2022). The swift expansion of social media platforms has led to a dramatic increase in the amount of online content to which a consumer is exposed (Han et al., 2020). Hence, the challenge for firms is to ensure their brand messages penetrate the vast sea of content and are effectively shared and disseminated.

Information sharing is a pivotal area within marketing research (Miranda & Saunders, 2003; Shi et al., 2014). The act of sharing not only supports the content but also increases its chances of becoming viral (Mallipeddi et al., 2021; Rishika & Ramaprasad, 2019; Weismueller et al., 2022). Researchers have long been interested in understanding the motivation and mechanisms behind sharing information with others (Bock et al., 2005; Heimbach & Hinz, 2018; Olivera et al., 2008; Rode, 2016; Wasko & Faraj, 2005). Most research utilizes social exchange theory to analyze sharing behaviors, asserting that individuals participate in sharing behavior with the expectation of getting something in return (Shi et al., 2014). In the absence of material or financial rewards, the underlying advantages of a social exchange can manifest as emotional comfort or social reward, including approval, status, and respect (Wasko & Faraj, 2005).

The decision of content sharing is typically driven by one of two types of motivations: recipient-related motives and sender-related motives (Shi et al., 2014). The first type can be reflected as altruism (Ho & Dempsey, 2010), a desire to assist others, leading to the sharing of content that is highly useful (Barasch & Berger, 2014a; Berger & Milkman, 2012a). Therefore, individuals driven by recipient-related motives frequently distribute informative content to

reinforce social ties or to build social capital (Choi et al., 2015; Zeng & Wei, 2013; Shi et al., 2014). Conversely, motives related to the sender are connected to self-representation, such as the desire to be perceived as knowledgeable and smart (Barasch & Berger, 2014a). Studies in social network analysis have also explored how a sender's social position and network structure impacts the information diffusion (Bampo et al., 2008; Dou et al., 2013; Hinz et al., 2011; Hinz & Spann, 2008). While motivations provide the initial impetus for sharing, the inherent characteristics of the content itself play a crucial role in determining whether the content will be shared.

Recent studies have identified several attributes of brand messages that affect consumer's sharing behavior, as summarized in Table 1. Research also has investigated whether vividness (Xu et al., 2023), certainty (Pezzuti et al., 2021), negations (Pezzuti & Leonhardt, 2023), discrepancies (Pezzuti, 2023), trademarking (Kumar et al., 2022), second person pronouns (Cruz et al., 2017) could effect on information sharing. Most of this research has built upon linguistic and emotion literature to explore various message attributes that could influence sharing behavior.

We posit that sales literature provides valuable insights into identifying communication tactics that can be applied within the branding context. Firstly, one of the primary objectives of buyer-seller interaction is to foster enduring relationships and elicit positive behavioral responses, mirroring the goals of brand communication (Carneval 2017). Secondly, both entail interactive exchanges between sellers and buyers, as well as between brands and consumers. Therefore, our research draws on selling literature, particularly the communication tactics employed by salespeople, to explore additional attributes of brand messaging that could enhance the virality of brand message via consumer sharing behavior.

2.2 Influence Tactics

Influence tactics is defined as the various communication strategies used by the people in their efforts to persuade (Frazier & Rody, 1991). It has long been studied in marketing that how

sellers can apply influence tactics to persuade consumers to take desired actions. Frazier and Summers (1984) initially introduced the concept of influence tactics to marketing, specifically focusing on their development for interorganizational contexts. The authors also delineated six tactics: including information exchange, recommendations, requests, promises, threats, and legalistic pleas, which can be used to exert influence on a target. Subsequent research has also introduced more new tactics such as ingratiation, inspirational appeal (McFarland et al., 2006), and assertiveness (Singh et al., 2020).

At a later stage, these tactics were also examined at the intraorganizational, person-to-person level in the organizational behavior and buying-center literature. Moving beyond the face-to-face communication in the previous study (McFarland et al., 2006; Venkatesh et al., 1995), literature has investigated influence tactics in the context of textual cues within email negotiations in the business-to-business setting (Singh et al., 2020).

Despite the application of influence tactics varies across different settings, they can be grouped into three main categories: internalization, compliance, and ingratiation (McFarland et al., 2006; Singh et al., 2020; Venkatesh et al., 1995). Internalization aims to change a buyer's perceptions about the inherent desirability of the proposed behavior (Frazier & Summers, 1984). In contrast, compliance attempts to alter the consumer's motivation to comply by leveraging consequences controlled by the source, whether they are positive or negative (Singh et al., 2020). Ingratiation aims to meet the psychological needs of the target by being appealing, sustaining an fulfilling relationship with the target, and inducing positive emotional reactions (McFarland et al., 2006).

Several components of influence tactics have been identified as relevant to the social media messages, including offering objective information (internalization), exerting demands (compliance), and conveying emotions (ingratiation) (Ordenes et al. 2017; 2019). Building on the concept of influence tactics from selling literature, our study aims to explore the impact of

applying these influence tactics in brand communication on social media on boosting the consumer's sharing behavior.

Table 1: Literature on message characteristics affecting brand message sharing

Authors	Year	Message Characteristics	Characteristics' literature	Platform	Context	Method	Findings
(Xu et al., 2023)	2023	Vividness	Linguist	WeChat	Brand Messages	Human Coding	Post vividness encourages more shares
(Kumar et al., 2022)	2022	Trademarking Hashtags	None	Twitter	Brand Messages	Simple Match	Trademarking hashtags plays a pivotal role in increasing information sharing
(Mallipeddi et al., 2021)	2021	Positive and negative Tone	Affect	Twitter	Human Brand (Indian Politician)	Naïve Bayes	Both positive-toned content and negative-toned content have a positive effect on information sharing
(Pezzuti & Leonhardt, 2023)	2023	Negations	Linguist	Facebook and Twitter	Brand Messages	LIWC	People more likely to share (like and reply) brand messages when their messages include negations
(Pezzuti, 2023)	2023	Discrepancies	Linguist	Facebook	Brand Messages	LIWC	Using the language that directs the attention of people to a discrepancy can increase the sharing (likes and comments) behavior

(Lee et al., 2018)	2018	Brand personality (Like humor and emotion)	Affect	Facebook	Brand Messages	Naïve Bayes and Rule-based	Widely used content related to brand personality—like humor and emotion—is associated with higher levels of shares (Likes and comments) with a message
(Pezzuti et al., 2021)	2021	Certainty	Linguist	Facebook and Twitter	Brand Messages	LIWC	Using words that express certainty resulted in more shares
(Cruz et al., 2017)	2017	Second Person Pronouns	Linguist	Facebook	Brand Messages	LIWC	Brand posts with a second person pronoun are more willing to be shared
(Villarroel Ordenes et al., 2019)	2019	Speech Acts(Assertive, expressive, directive, alliteration,	Linguist	Facebook and Twitter	Brand Messages	LIWC and Support Vector Machine	People share significantly more expressive and assertive messages than directive ones. The use of alliteration and repetitions enhance people message sharing

		repetitions)					
Our Study		Influence tactics (internalization, compliance, and ingratiation)	Selling Literature	Twitter	Brand Messages	BERT model and semi-supervised machine learning	All three types of influence tactics- internalization, compliance, and ingratiation- positively influence sharing behaviour

3. HYPOTHESES

3.1 Impact of influence tactics on sharing behavior

Internalization includes information sharing and recommendation (Venkatesh et al., 1995). Information sharing refers to communicating and exchanging information, whereas recommendation refers to explicitly suggesting a specific solution/service/product (Boyle et al., 1992; McFarland et al., 2006; Singh et al., 2020). Both of these tactics are attempts to change the consumer's preceptions about the intrinsic appeal of the intended behavior, functioned via the influence process of internalization (Frazier & Summers, 1984).

For the brand messages on social media, internalization means internal analysis by consumers, which involving assessing whether the posts are useful and align with their interests and benefits (McFarland et al., 2006). Information sharing encourages consumers to evaluate the substantive content of the brand messages and reflect on the messages's usefulness and alignment with their interests and benefits (McFarland et al., 2006; Singh et al., 2020). Regarding recommendation, offering a suggested action while leaving the decision-making to the consumers also encourages the consumers assess the message's usefulness and reliability (Singh et al., 2020). If the incoming information is deemed beneficial, it is likely to be internalized and lead to a more favorable attitude towards the subject of the information (Boyle et al., 1992). A primary motivation (recipient-related motives) for sharing information is to help others as mentioned before by providing useful information that could form their attitude and behaviors (Barasch & Berger, 2014b; Hennig-Thurau et al., 2004). More useful news articles are more prone to becoming viral (Berger & Milkman, 2012b), and marketing messages with more valuable information are more likely be shared (Chiu et al., 2012). Hence, internalization tactic could trigger social media consumers' internalization to assess the usefulness and benefits of the brand messages, thereby encouraging sharing behavior:

H1a: Internalization tactics positively influence sharing behavior.

Compliance is centered on influencing consumer motivation to comply (Frazier and Summers 1984; Keith, Jackson, and Crosby 1990; Venkatesh, Kohli, and Zaltman 1995). The primary distinction between internalization and compliance lies in the purpose of compliance: compliance does not seek to change individuals' perceptions of the inherent desirability of the intended behavioral response (Venkatesh et al., 1995). Compliance tactics includes promises, assertiveness, threats and legalistic pleas (3/28/24 6:42:00 PM. However, in a brand messages context, threats and legalistic pleas are relatively rare, as both strategies assume the existence of a pre-existing contract (Singh et al., 2020). Promises involves a commitment by the firms to offer a specific reward to the consumers, based on the condition that the consumer complies with the firm's request (Frazier and Summers 1984; Venkatesh et al., 1995), and assertiveness refer to initiating a call-to-action with consumer's stated desires (Singh et al., 2020). Both of them attempt to change people's motivation to accept the induced behavior with a compliance mechanism (McFarland et al., 2006; Singh et al., 2020).

In a brand messages context, firms' explicit promises of desired outcomes and reward in the post could enhance clarity and assist consumers in envisaging the anticipated benefits. People participate in content sharing behavior with the expectation of getting something in return (Shi et al., 2014) (De Bruyn & Lilien, 2008; Shi et al., 2014). In order to obtain the favorable return, people tend to accept the influence and comply the inducing behavior prompted by the influencer (McFarland et al., 2006). Regarding to assertiveness, firms use assertive tactics to show their confidence and knowledge. People commonly share things to present themselves (Berger, 2013), and social interactions can be regarded as a form of performance where individuals strive to create positive perceptions of themselves (Barasch & Berger, 2014b). Although no explicit material or financial gains are received, sharing the assertive content to present consumer's confidence and knowledge (sender-related motives) could yield social reward (Wasko & Faraj, 2005), such as reputation (e.g. knowledgeable and smart; Shi et al., 2014). Hence, compliance

tactics could activate the consumer's motivation to gain explicit and social reward for sharing the brand messages. Thus:

H1b: Compliance tactics positively influence sharing behavior.

Ingratiation refers to use behaviors that focus on improving one's interpersonal appeal and building a stronger connection with the target (Kumar & Beyerlein, 1991). It aims to fulfill a target's psychological needs by being appealing and eliciting positive emotional reactions (McFarland et al., 2006). Ingratiation emphasizes emotional utilities, rather than product features and benefits (Williams et al., 1990). In a brand message context, firms employ ingratiation tactics aimed at creating positive content that meets the psychological needs of consumers. At the same time, people inherently associate themselves more closely to positive traits than to negative ones (Paulhus & Levitt, 1987). People strategically shape the impressions others form of them by sharing content that aligns with their desired identity (Berger & Milkman, 2012). Hence, sharing positive content can lead to a more positive impressions of the consumer (sender-related motives). Oh et al. (2023) also empirically discovered that people are more willing to share news articles with positive content on Twitter. Thus:

H1c: Ingratiation positively influence sharing behavior.

3.2 Structure Influence Tactics Across Posts for Consumer Sharing

The effectiveness of messages is significantly influenced by how these messages are structured and interconnected (Batra & Keller, 2016b). On one end of the spectrum, firm might choose to consistently employ the same influence tactics to post the brand messages, relying on repetition for people learning (Kocielnik & Hsieh, 2017b). On the opposite end, companies might opt to vary their content by utilizing different tactics across their posts, which can enhance the effectiveness of the tactics (Batra & Keller, 2016b). Previous research presents inconsistent outcomes regarding the more effectiveness with influence tactics by either

consistency or variation. For instance, Lai (2017) suggests that messages maintaining consistency are more persuasive, while research by Weiger et al. (2018) point to the greater impact of variation messaging strategies. Hence, it is worth investigating whether firms should apply influence tactics consistently or vary influence tactics to enhance the effectiveness of persuasion.

Consumers may generally favor message with influence tactic that encourages conversation or prompt discussion. However, within a series of messages, it might be necessary to vary these tactics to alleviate monotony and stand out amidst competing content. On the one hand, consistently using the same influence tactics facilitates consumer learning. By reading the same content, consumer can learn through repetition, which promotes their positive attitudes (Schmidt & Eisend, 2015) and reduces uncertainty about the service/service (Kocielnik & Hsieh, 2017a; Ordenes et al., 2019). On the other hand, information that is incongruent with prior expectations can lead to more effortful or elaborative processing (Heckler & Childers, 1992). In this sense, varying information content across posts would increase consumer sharing behavior (Ordenes et al., 2019). However, moderate level of consistency or variation across posts may reduce the sharing behavior, as it neither sufficiently facilitate consumer's learning process nor provokes enough incongruity to stimulate information process. Overall, we anticipate an U-shaped relationship between the consistency of content presented across social media posts and consumer sharing behavior, suggesting an optimal, greater consistency or variation across posts.

Thus:

H2: The influence of variation of influence tactics presented on sharing behavior is nonlinear (U-shaped), such that a greater degree of consistency or variation increase sharing behavior the most.

3.3 The Moderating Effects of Brand Name

Brand name serves as the initial point of interaction for consumers (Aaker, 1997) and the presence of gender characteristics in a brand name could influence consumer's perception and behavior toward the brand (Pogacar et al. 2021). Individuals and groups are assessed along two key dimensions of social perception: warmth (affective aspect) and competence (cognitive aspect), which subsequently influence emotional and behavioral responses (Cuddy et al., 2011; Fiske et al., 2002; Glick et al., 2000). Research on Stereotype Content Model, finds that women are more associated with warmth (e.g., friendliness, kindness, trustworthiness, empathy), while men are highly related with competence (e.g., intelligence, power, efficacy, and skill) (Fiske, 2010; Cuddy et al., 2011). Kervyn et al. (2012) created a framework adapting the Stereotype Content Model for brands, showing that people evaluate brands based on perceived competence, which could influence the purchase intention and brand loyalty. Pogacar et al. (2021) empirically prove that brands with linguistically feminine names were more likely to be listed in performance-oriented Interbrand Global Top Brands list. Hence, It is worth of exploring whether the gender (femine vs. masculine) of brand name will influence the effectiveness of the influence tactics.

In our research, ingratiation tactic aims to evoke positive emotional reactions, while compliance and internalization seek to activate the people's cognitive process (McFarland et al., 2006; Singh et al., 2020). Internalization and compliance tactics primarily reflect firms' competence, indicating the extent to which firms can offer products/services that meet consumers' expectations. In contrast, identification tactics seem to demonstrate firms' desire to maintain a positive relationship with consumers (McFarland et al., 2006), thereby reflecting the firm's warmth.

Drawing on cognitive appraisal theory and the affect infusion model, Homburg et al. (2007) argue that approaches centered on emotions, like ingratiating, are more impactful in affective-intensive environments. Additionally, when communicating with warm objects/individuals, audiences expect to receive warmth-related rather than competence-related messages (Dubois et

al., 2016). Conversely, when communicating with competent objects/individuals, audiences expect to receive competence-related rather than warmth-related messages (Dubois et al., 2016)

Thus:

H3a: For brands with feminine (vs. masculine) brand names, using ingratiation tactics enhance sharing behavior

H3: For brands with masculine (vs. feminine) brand names, using (b) internalization and (c) compliance tactics enhances sharing behavior

4. DATA, VARIABLES, AND ESTIMATION METHODS

4.1 Data

To examine the hypothesis, we gathered data from the leading social media platform, Twitter (Now, X). As social media becomes increasingly prevalent, the majority of firms now own a Twitter account to do advertisement and interact with their consumers. Data obtained from Twitter has been widely employed to study the sharing behavior of brand messages on the social media platform (Cruz et al., 2017; Kumar et al., 2022; Pezzuti et al., 2021; Pezzuti & Leonhardt, 2023; Villarroel Ordenes et al., 2019; Xu et al., 2023). We collected the data through Twitter API, focusing on 122 publicly listed U.S. companies that own official Twitter accounts. This dataset included 893,222 brand-related tweets from 2007 to 2021.

4.2 Variables

Dependent Variable: Following previous research (Villarroel Ordenes et al., 2019), we operationalized the sharing behavior as the count of retweets per post.

Independent variable: Given the vast size of our dataset (893,222 brand messages), human coding is impractical for extracting influence tactics. Therefore, an automated classifier is required. We begin by establishing five indicators of influence tactics: recommendation, information exchange, promise, assertiveness, and ingratiation. Recommendation and

information exchange are elements of internalization, while promise and assertiveness are components of compliance. We utilized semi-supervised learning to develop a machine learning model capable of categorizing sentences into five different influence tactics. Semi-supervised learning serves as an intermediary machine learning strategy that combines both supervised and unsupervised learning, utilizing datasets that are only partially labeled (Chapelle et al., 2006). Our research involves 893,222 brand messages, where large-scale of data labelling is both expensive and time-consuming. However, relying on a limited subset for training might fail to capture the full spectrum of data variety, diminishing the model's ability to generalize. Therefore, we selected semi-supervised learning as the foundational approach for training our machine learning model. Specifically, we adopted the pre-trained BERT rather than employing a word dictionary, given that BERT is considered a leading-edge model in text classification (Hartmann et al., 2023). We trained and tested the machine learning model to classify influence tactics by following a four-step process, as detailed in Figure A1 in Appendix. In the first step, 5,000 brand messages from the total dataset are randomly selected. Then, the sampled 5,000 brand messages are manually annotated into five influence tactics by three independent coders as the initial labeled dataset (Krippendorff's $\alpha = 87\%$; disagreements resolved through discussion).

Second, we fine-tuned the first BERT model to collect trusted pseudo-labels using the PyTorch¹ framework and Python3 on Google Cloud with an NVIDIA A100 GPU. "Bert-base-uncased"² was employed as the pre-trained BERT model, which contain 12 layers, 768 hidden units, 12 attention heads, and around 110 million parameters. After 30 experiments, we identified the optimal combination of performance hyper-parameters and overall model settings, as detailed in Table A2 in Appendix. Initially, we fine-tuned the first BERT model on 5,000 human-labeled brand messages, then applied it to 150,000 randomly selected unlabeled brand messages to

¹ <https://pytorch.org/>

² <https://huggingface.co/bert-base-uncased>

generate pseudo-labels. Subsequently, we collected brand messages predicted by the model with high confidence (probability > 0.8), result in 98,021 trusted pseudo-labels.

For the third step, we fine-tuned a new BERT model based on the step 2 model's configuration using the 5,000 manually annotated labels and the 98,021 trusted pseudo-labels. The final fine-tuned BERT model demonstrated its effectiveness in identifying influence tactics, as evidenced by its average classification accuracy of 90.4 % and an average AUROC score of 0.894 (detail in appendix Table A3). These performance metrics highlight the model's strong capability. In the last step, we applied the new BERT model to predict the influence tactics for all the brand messages. Instead of transferring them into binary values (0 and 1), we kept the probability score, which varies between 0 and 1, as the measure of outcome for each influence tactic identified within a brand message.

Finally, we follow the Singh et al.(2020)'s framework, the *internalization* variables is constructed by summing recommendation and information exchange, while promise and assertiveness are combined to construct the *compliance* variable. The value assigned to the ingratiation indicator directly establishes the *ingratiation* variable.

Consistent with Ordenes et al. (2019), we defined message sequences as composition of at least three subsequent posts. We use Herfindahl-Hirschman (*HH*) index to measure the level of consistency (variation) of the three influence tactics in the brand messages, as follows:

$$Consistency_i = \left(\sum_{i=-2}^1 \frac{Internalization_i}{Influence\ tactics_i} \right)^2 + \left(\sum_{i=-2}^1 \frac{Compliance_i}{Influence\ tactics_i} \right)^2 + \left(\sum_{i=-2}^1 \frac{Ingratiation_i}{Influence\ tactics_i} \right)^2,$$

Where *Internalization_i*, *Compliance_i*, *Ingratiation_i* are the each influence tactics' score, and *Influence tactics_i* is the sum of the tactics score in each post. The measure of the consistency is range consistency from highly varied (0) to highly consistency (1). To form the quadratic term of consistency, we multiply consistency by itself.

Moderator In line with Pogacar et al. (2021)'s research, we operationalized the brand *name gender score* developed by Barry and Harper (1995), with further details available in Appendix 4. The name gender score measures the masculinity or femininity of a name through its length, sound, and stress, with scores varying from -2 to +2. This standardized scale is grounded in the analysis of male and female names in the United States and has been theoretically validated by later studies (Cassidy et al., 1999; Pogacar et al., 2021; Slepian & Galinsky, 2016). To classify a brand name's femininity, we further apply a baseline score of 0. To classify gender of the brand name, we further apply a baseline score of 0. Scores exceeding 0 indicate a feminine brand; scores below 0 suggest the brand name is masculinity.

Control Variables Given that longer posts can provide more information influencing decisions to share (Berger & Milkman, 2012b), we included the *word count* as a control variable, represented by the number of words in each tweet. The sharing behavior may also be affected by visual content (Villarroel Ordenes et al., 2019); therefore, we included the count of *photos*, *videos*, and *GIFs* in each tweet as control variables. *Links* and *question marks*, indicators of a post's interactivity that may affect consumer engagement on social media (De Vries et al., 2012), have also been included as control variables. Stieglitz & Dang-Xuan (2013) discovered that the quantity of hashtags can influence sharing behavior; hence, the number of hashtags is also included as a control variable. Incorporating negations into brand messaging could enhance the sharing behaviour, because it makes brands appear seem more powerful and consumers generally want to be linked with more powerful brands (Pezzuti & Leonhardt, 2023). Hence, in line with Pezzuti & Leonhardt (2023)'s research, we use the LIWC dictionary to measure *negation* as a control variable. The use of passive voice in brand messages is also considered a control variable due to its theoretical association with psychological distance (Burgoon, 2018; Chan & Maglio, 2020), which could influence the sharing behavior. Following Sepehir et al. (2023)'s research,

we measured the *passive* variable via python package ³ developed by them. Table 2 presents the correlation table for all variables.

[Table 2]

Brand fixed effects are included to account for the heterogeneity in the abilities and expertise of content managers in creating daily content (Kopalle et al., 2017; Villarroel Ordenes et al., 2019). Additionally, the effects of the year and month are controlled, ensuring that any temporal variations that could influence sharing behavior are accounted for, such as the brand messages posted in earlier years may receive less retweets as the platform are young and has less consumers. Moreover, the analysis utilized negative binomial regression to address the overdispersion in the count data (i.e. positive skew in the number of retweets for the brand messages (Pancer et al., 2019; Pezzuti & Leonhardt, 2023)). We proposed the following regression equation:

$$Retweets_{ij} = \beta_0 + \beta_1 Influence\ tactics_{ij} + Controls_{ij}\boldsymbol{\gamma} + Gaussian\ copula\ terms_{ij} + v_t + v_m + \mu_{ij}$$

in which i represents a tweet, j a brand, t a particular year, m a particular month, μ_{ij} is the error term.

To address the potential issue of endogeneity, we utilized the Gaussian copula approach, a likelihood method that could effectively deal with the challenges like reverse causality, errors in measurement, and the problem of omitted variables (Eckert & Hohberger, 2023). The assumption of the Gaussian copula method is that the variables within the model follow a specific likelihood function, and we can get the unbiased estimates for the parameters by optimizing this function. To achieve this, we added the three Gaussian copula terms, created by multiplying the inverse of the standard normal cumulative distribution function (CDF) for our three endogenous variables (internalization, compliance, and ingratiation) with their respective estimated CDFs, to the regression models. This method requires that the endogenous variables

³ <https://pypi.org/project/PassivePy/0.2.13/>

significantly follow a non-normally distribution (Eckert & Hohberger, 2023). To verify our variables met this criterion, we ran a Shapiro-Wilk test to check if the distribution of our three main variables was indeed non-normal. The test outcomes confirmed this, showing non-normal distribution for three variables (for internalization: $W= 0.78045$, $Z= 28.531$, $p < .001$; for compliance: $W= 0.59734$, $Z= 30.255$, $p < .001$; for integration: $W= 0.87447$, $Z= 26.943$, $p < .001$). These results validated our use of the Gaussian copula method.

5. EMPIRICAL RESULTS

5.1 Main Result

The regression result can be seen in the Table 3. The regression model of internalization, compliance, and ingratiation are reported in Columns 1, 2 and 3, respectively. Column 4 shows the lump-sum model, and column 5 demonstrate the effects of consistency tactics and its quadratic term. Column 6 presents the result of moderating effects of gender of brand name respectively.

[Table 3]

According to the columns 1-3, internalization, compliance, and ingratiation are not only positive but also statistically significant. When we include the three influence tactics variables in column 4, their respective coefficients continue to maintain their positive and statistically significant values ($\beta_{\text{internalization}}=0.239$, $p<0.01$, $\beta_{\text{compliance}}=0.225$, $p<0.01$, $\beta_{\text{ingratiation}}=0.323$, $p<0.01$), supporting H1a, 1b, and 1c. Then, A Chi-square test (Negative binomial regression) is executed to test the equivalence of the three coefficients. The result demonstrates that the effects of internalization tactic and compliance tactic are not significantly different ($\text{Chi}^2_{\text{Internalization=Compliance}}=0.38$, $p= 0.5359$), while the effects of ingratiation are significantly different from that of internalization and compliance ($\text{Chi}^2_{\text{Ingratiation = Internalization}}=4238.04$, $p<0.01$; $\text{Chi}^2_{\text{Ingratiation = Compliance}}= 427.99$, $p<0.01$). Therefore, we can conclude that

ingratiation tactic is more effective in enhancing the sharing brand messages than internalization tactic and compliance tactic.

The result in column 5 reveals that the coefficient for the consistency across post is negative and statistically significant ($\beta_{\text{consistency}} = -1.962, p < 0.01$), while the coefficient of square term of the consistency across posts are positive and statistically significant ($\beta_{\text{consistency} \times \text{consistency}} = -2.050, p < 0.01$). This suggests that consistency (variation) on sharing behavior is U shape, as illustrated by the predictive margin in the figure 1. This finding indicates the moderate degree of consistency (variation) (consistency = 0.48) enhance the sharing behavior worst, while stronger level of consistency or variation could boost the sharing behavior most. Hence, we accept the hypothesis H2.

[Figure 1]

The interaction effect of gender of the brand name is presented in column 5. The interaction coefficient between the ingratiation tactic and femininity of brand name is positive and statistically significant ($\beta_{\text{ingratiation} \times \text{femininity of brand name}} = 0.111, p < 0.01$). This result indicates that feminine brand name could enhance the effect of ingratiation tactic on sharing behavior, accepting H3a. The coefficient for the interaction between internalization tactic and the femininity of brand name is not statistically significant, rejecting H3b. Finally, the interaction coefficient between the compliance tactic and the femininity of the brand name is negative and statistically significant ($\beta_{\text{compliance} \times \text{femininity}} = -0.241, p < 0.01$). This suggests that the femininity of the brand name diminishes the impact of the compliance tactic on sharing behavior. In another word, the musicality of the brand name may enhance the effectiveness of the compliance tactic on sharing behavior. Therefore, we accept H3c.

5.2 Robustness Check

We use the number of replies as dependent variable to check the robustness of our result. Number of replies represents a weaker consumer engagement, and it is expected to get the

similar result of the sharing behaviours (Villarroel Ordenes et al., 2019). Hence, we run the model 1-5 with number of replies as dependent variable. To address issues such as omitted variables, measurement inaccuracies, and simultaneity bias, we add corresponding Gaussian copula terms into each regression analysis for each influence tactic. The findings, as presented in Appendix table A5, align with our main results and support our hypothesis.

6. DISCUSSION AND CONCLUSION

Although recent studies have identified several characters of messages based on linguist literature that affect consumer sharing behavior (e.g., Kumar et al., 2022; Oh et al., 2023; Pezzuti & Leonhardt, 2023; Xu et al., 2023), there is lack of the application insights from selling literature to enhance sharing behavior. Our research fills this gap by employing influence tactics, a strategy used to persuade others to take a desired action from selling literature to depend on our understanding of brand message sharing behavior. Our empirical results show that all three types of influence tactics-internalization, compliance, and ingratiation- positively influence sharing behaviour. Besides, the impact of consistency(variation) tactics on sharing behavior exhibits U-shape, indicating that a strong level of consistency or variation tactics across posts is most effective for the sharing of brand messages. Furthermore, utilizing ingratiation tactic and compliance tactic for the feminine brand name and the masculine brand name could enhance the effectiveness for brand message sharing respectively.

6.1 Theoretical contributions

Our research has three main theoretical contributions. First, we contribute the brand message sharing behavior literature by introducing the influence tactics from selling literature that could effectively enhance consumer sharing behavior. Previous research has applied the affect and linguist literature to study the attributes of the messages that influence consumer sharing behavior (e.g. Li & Xie, 2020; Luangrath et al., 2023; Pancer et al., 2019; Pezzuti & Leonhardt,

2023), which is lack of application insights from selling literature. Our research fills this gap by introducing influence tactics from selling literature that could effectively enhance the sharing behavior.

Second, this study advances the literature on influence tactics by extend extending its application to social media context. Frazier and Summers (1984) were the pioneers in introducing the concept of influence tactics to the field of marketing, particularly emphasizing their application in interorganizational, firm-to-firm settings. In the later stage, these tactics were explored at the intraorganizational and individual levels within the contexts of organizational behavior and buying-center studies (McFarland et al., 2006; Venkatesh et al., 1995). Recent studies have expanded the application of influence tactics to include textual cues in email negotiations in a business-to-business context, with the goal of securing sales contract awards (Singh et al., 2020). Different from existing research, focusing on one-to-one communication, we empirically explored and proved its effectiveness of these influence tactics on social media platform, which may lead to a more significant impact as it allows for persuading broader audiences to take desired actions (e.g., political selection).

Third, our research broadens the understanding of the effective level of consistency or variation in social media posts. While Lai (2017) suggests that maintaining consistency is more persuasive, research by Weiger et al. (2018) argue the benefits of employing variation tactics. Our study extends the existing research by empirically showing that the effect of consistency (variation) of influence tactics on sharing behavior is U-shape. This result suggests that strong level of consistency or variation across posts is most effective, while moderate consistency or variation tend to reduce their effectiveness.

Finally, we extend the synergistic effect of social media content and brand characteristics. Examining the femininity of the brand name provides guidance for companies on selecting suitable influence tactics aligned with their brand name to increase persuasiveness in social media sharing. While previous studies have focused on how human characteristics, such as trust

or suspicion (Hartmann et al., 2020; Oza et al., 2010), can affect the success of influence tactics, our research broadens this understanding. This study empirically demonstrates the impact of brand name femininity on the effectiveness of these tactics in promoting the sharing of brand messages on social media platforms.

6.2 Practical contributions

We have two main practical implications. First, our research provides the practical guides for content managers to compose the content. A major challenge for companies is to develop attractive brand messages with content that are less prone to being overlooked and more likely to be distributed (Villarroel Ordenes et al., 2019; Zadeh & Sharda, 2022). Our study shows that influence tactics can be utilized to develop content that is more likely to be shared. Besides, employing a high level of consistency or a high level of variation across the posts can boost sharing behavior. Moreover, brands with feminine names should employ ingratiation tactic to boost sharing behavior, whereas brands with masculine brand names ought to craft their content using compliance tactic to enhance consumer's sharing behavior.

Second, we propose a new machine learning framework for researchers and practitioners to extract more sophisticated constructs from large-scale data. As indicated in Table 1, previous studies primarily utilized conventional dictionary-based (e.g., LWIC) and statistical machine learning methods (e.g., SVM), which may not accurately extract constructs due to their inability to handle polysemy—words with multiple meanings—or because they treat words in isolation, neglecting the surrounding context (Hartmann et al., 2023). This study proposes a semi-supervised approach using an advanced, fine-tuned BERT model, enabling more accurate extraction of constructs and enhancing generalization across large datasets.

Reference

- Aaker, J. L. (1997). Dimensions of brand personality. *Journal of Marketing Research*, 34(3), 347–356. <https://doi.org/10.1177/002224379703400304>
- Bales, R. F. (1950). A set of categories for the analysis of small group interaction. *American Sociological Review*, 15(2), 257–263.
- Bampo, M., Ewing, M. T., Mather, D. R., Stewart, D., & Wallace, M. (2008). The effects of the social structure of digital networks on viral marketing performance. *Information Systems Research*, 19(3), 273–290. <https://doi.org/10.1287/isre.1070.0152>
- Barasch, A., & Berger, J. (2014a). Broadcasting and narrowcasting: How audience size affects what people share. *Journal of Marketing Research*, 51(3), 286–299. <https://doi.org/10.1509/jmr.13.0238>
- Barasch, A., & Berger, J. (2014b). Broadcasting and narrowcasting: How audience size affects what people share. *Journal of Marketing Research*, 51(3), 286–299. <https://doi.org/10.1509/jmr.13.0238>
- Barry, H., & Harper, A. S. (1995). Increased choice of female phonetic attributes in first names. *Sex Roles*, 32(11–12), 809–819. <https://doi.org/10.1007/BF01560190>
- Batra, R., & Keller, K. L. (2016a). Integrating marketing communications: New findings, new lessons, and new ideas. *Journal of Marketing*, 80(6), 122–145. <https://doi.org/10.1509/jm.15.0419>
- Batra, R., & Keller, K. L. (2016b). Integrating marketing communications: New findings, new lessons, and new ideas. *Journal of Marketing*, 80(6), 122–145. <https://doi.org/10.1509/jm.15.0419>
- Berger, J. (2013). *Contagious: Why things catch on*. Simon & Schuster.
- Berger, J., & Milkman, K. L. (2012a). What makes online content viral? *Journal of Marketing Research*, 49(2), 192–205. <https://doi.org/10.1509/jmr.10.0353>
- Berger, J., & Milkman, K. L. (2012b). What makes online content viral? *Journal of Marketing Research*, 49(2), 192–205. <https://doi.org/10.1509/jmr.10.0353>
- Bock, G.-W., Zmud, R., Kim, Y.-G., & Lee, J.-N. (2005). Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate. *MIS Quarterly*, 29, 87–111. <https://doi.org/10.2307/25148669>
- Boyle, B., Dwyer, F. R., Robicheaux, R. A., & Simpson, J. T. (1992). Influence strategies in marketing channels: Measures and use in different relationship structures. *Journal of Marketing Research*, 29(4), 462–473. <https://doi.org/10.1177/002224379202900407>
- Burgoon, J. K. (2018). Predicting veracity from linguistic indicators. *Journal of Language and Social Psychology*, 37(6), 603–631. <https://doi.org/10.1177/0261927X18784119>
- Carnevale, M., Luna, D., & Lerman, D. (2017). Brand linguistics: A theory-driven framework for the study of language in branding. *International Journal of Research in Marketing*, 34(2), 572–591. <https://doi.org/10.1016/j.ijresmar.2017.01.003>

- Cassidy, K. W., Kelly, M. H., & Sharoni, L. J. (1999). Inferring gender from name phonology. *Journal of Experimental Psychology: General*, 128(3), 362–381. <https://doi.org/10.1037/0096-3445.128.3.362>
- Chan, E. Y., & Maglio, S. J. (2020). The voice of cognition: Active and passive voice influence distance and construal. *Personality and Social Psychology Bulletin*, 46(4), 547–558. <https://doi.org/10.1177/0146167219867784>
- Chapelle, O., Chi, M., & Zien, A. (2006). A continuation method for semi-supervised SVMs. *Proceedings of the 23rd International Conference on Machine Learning - ICML '06*, 185–192. <https://doi.org/10.1145/1143844.1143868>
- Chiu, H.-C., Hsieh, Y.-C., & Kuo, Y.-C. (2012). How to align your brand stories with your products. *Journal of Retailing*, 88(2), 262–275. <https://doi.org/10.1016/j.jretai.2012.02.001>
- Choi, B. C. F., Jiang, Z. (Jack), Xiao, B., & Kim, S. S. (2015). Embarrassing exposures in online social networks: An integrated perspective of privacy invasion and relationship bonding. *Information Systems Research*, 26(4), 675–694. <https://doi.org/10.1287/isre.2015.0602>
- Cruz, R. E., Leonhardt, J. M., & Pezzuti, T. (2017). Second person pronouns enhance consumer involvement and brand attitude. *Journal of Interactive Marketing*, 39(1), 104–116. <https://doi.org/10.1016/j.intmar.2017.05.001>
- Cuddy, A. J. C., Glick, P., & Beninger, A. (2011). The dynamics of warmth and competence judgments, and their outcomes in organizations. *Research in Organizational Behavior*, 31, 73–98. <https://doi.org/10.1016/j.riob.2011.10.004>
- De Bruyn, A., & Lilien, G. L. (2008). A multi-stage model of word-of-mouth influence through viral marketing. *International Journal of Research in Marketing*, 25(3), 151–163. <https://doi.org/10.1016/j.ijresmar.2008.03.004>
- De Vries, L., Gensler, S., & Leeftang, P. S. H. (2012). Popularity of brand posts on brand fan pages: An investigation of the effects of social media marketing. *Journal of Interactive Marketing*, 26(2), 83–91. <https://doi.org/10.1016/j.intmar.2012.01.003>
- Dhaoui, C., & Webster, C. M. (2021). Brand and consumer engagement behaviors on facebook brand pages: Let's have a (positive) conversation. *International Journal of Research in Marketing*, 38(1), 155–175. <https://doi.org/10.1016/j.ijresmar.2020.06.005>
- Dou, Y., Niculescu, M. F., & Wu, D. J. (2013). Engineering optimal network effects via social media features and seeding in markets for digital goods and services. *Information Systems Research*, 24(1), 164–185. <https://doi.org/10.1287/isre.1120.0463>
- Eckert, C., & Hohberger, J. (2023). Addressing endogeneity without instrumental variables: An evaluation of the gaussian copula approach for management research. *Journal of Management*, 49(4), 1460–1495. <https://doi.org/10.1177/01492063221085913>
- Fei Ren, Yong Tan, & Fei Wan. (2023). Know your firm: Managing social media engagement to improve firm sales performance. *MIS Quarterly*, 47(1), 227–261. <https://doi.org/10.25300/MISQ/2022/16162>

- Fiske, S. T., Cuddy, A. J. C., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology*, 82(6), 878–902. <https://doi.org/10.1037/0022-3514.82.6.878>
- Fletcher-Brown, J., Turnbull, S., Viglia, G., Chen, T., & Pereira, V. (2021). Vulnerable consumer engagement: How corporate social media can facilitate the replenishment of depleted resources. *International Journal of Research in Marketing*, 38(2), 518–529. <https://doi.org/10.1016/j.ijresmar.2020.06.002>
- Frazier, G. L., & Rody, R. C. (1991). The use of influence strategies in interfirm relationships in industrial product channels. *Journal of Marketing*, 55(1), 52–69. <https://doi.org/10.1177/002224299105500105>
- Frazier, G. L., & Summers, J. O. (1984). Interfirm influence strategies and their application within distribution channels. *Journal of Marketing*, 48(3), 43–55. <https://doi.org/10.1177/002224298404800305>
- Glick, P., Fiske, S. T., Mladinic, A., Saiz, J. L., Abrams, D., Masser, B., Adetoun, B., Osagie, J. E., Akande, A., Alao, A., Brunner, A., Willemsen, T. M., Chipeta, K., Dardenne, B., Dijksterhuis, A., Wigboldus, D., Eckes, T., Six-Materna, I., Expósito, F., ... López López, W. (2000). Beyond prejudice as simple antipathy: Hostile and benevolent sexism across cultures. *Journal of Personality and Social Psychology*, 79(5), 763–775. <https://doi.org/10.1037//0022-3514.79.5.763>
- Han, Y., Lappas, T., & Sabnis, G. (2020). The importance of interactions between content characteristics and creator characteristics for studying virality in social media. *Information Systems Research*, 31(2), 576–588. <https://doi.org/10.1287/isre.2019.0903>
- Hartmann, J., Heitmann, M., Siebert, C., & Schamp, C. (2023). More than a feeling: Accuracy and application of sentiment analysis. *International Journal of Research in Marketing*, 40(1), 75–87. <https://doi.org/10.1016/j.ijresmar.2022.05.005>
- Hartmann, N. N., Wieland, H., Gustafson, B., & Habel, J. (2023). Research on sales and ethics: Mapping the past and charting the future. *Journal of the Academy of Marketing Science*. <https://doi.org/10.1007/s11747-023-00961-3>
- Heckler, S. E., & Childers, T. L. (1992). The Role of Expectancy and Relevancy in Memory for Verbal and Visual Information: What is Incongruity? *Journal of Consumer Research*, 18(4), 475. <https://doi.org/10.1086/209275>
- Heimbach, I., & Hinz, O. (2018). The impact of sharing mechanism design on content sharing in online social networks. *Information Systems Research*, 29(3), 592–611. <https://doi.org/10.1287/isre.2017.0738>
- Hennig-Thurau, T., Gwinner, K. P., Walsh, G., & Gremler, D. D. (2004). Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the internet? *Journal of Interactive Marketing*, 18(1), 38–52. <https://doi.org/10.1002/dir.10073>

- Hinz, O., Skiera, B., Barrot, C., & Becker, J. U. (2011). Seeding strategies for viral marketing: An empirical comparison. *Journal of Marketing*, 75(6), 55–71.
<https://doi.org/10.1509/jm.10.0088>
- Hinz, O., & Spann, M. (2008). The impact of information diffusion on bidding behavior in secret reserve price auctions. *Information Systems Research*, 19(3), 351–368.
<https://doi.org/10.1287/isre.1080.0190>
- Ho, J. Y. C., & Dempsey, M. (2010). Viral marketing: Motivations to forward online content. *Journal of Business Research*, 63(9), 1000–1006.
<https://doi.org/10.1016/j.jbusres.2008.08.010>
- Hollebeek, L., & Chen, T. (2014). Exploring positively- versus negatively-valenced brand engagement: A conceptual model. *Journal of Product & Brand Management*, 23(1), 62–74.
<https://doi.org/10.1108/JPBM-06-2013-0332>
- Horst, P., & Duboff, R. (2015, November 1). Don't let big data bury your brand. *Harvard Business Review*. <https://hbr.org/2015/11/dont-let-big-data-bury-your-brand>
- Hudson, S., Huang, L., Roth, M. S., & Madden, T. J. (2016). The influence of social media interactions on consumer–brand relationships: A three-country study of brand perceptions and marketing behaviors. *International Journal of Research in Marketing*, 33(1), 27–41.
<https://doi.org/10.1016/j.ijresmar.2015.06.004>
- Kelleher, T., & Sweetser, K. (2012). Social media adoption among university communicators. *Journal of Public Relations Research*, 24(2), 105–122.
<https://doi.org/10.1080/1062726X.2012.626130>
- Kervyn, N., Fiske, S. T., & Malone, C. (2012). Brands as intentional agents framework: How perceived intentions and ability can map brand perception. *Journal of Consumer Psychology*, 22(2), 166–176. <https://doi.org/10.1016/j.jcps.2011.09.006>
- Kocielnik, R., & Hsieh, G. (2017a). *Send Me a Different Message*. 2193–2207.
<https://doi.org/10.1145/2998181.2998324>
- Kocielnik, R., & Hsieh, G. (2017b). Send me a different message: Utilizing cognitive space to create engaging message triggers. *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*, 2193–2207.
<https://doi.org/10.1145/2998181.2998324>
- Kopalle, P. K., Fisher, R. J., Sud, B. L., & Antia, K. D. (2017). The effects of advertised quality emphasis and objective quality on sales. *Journal of Marketing*, 81(2), 114–126.
<https://doi.org/10.1509/jm.15.0353>
- Kumar, K., & Beyerlein, M. (1991). Construction and validation of an instrument for measuring ingratiation behaviors in organizational settings. *Journal of Applied Psychology*, 76(5), 619–627. <https://doi.org/10.1037/0021-9010.76.5.619>
- Kumar, N., Qiu, L., & Kumar, S. (2022). A hashtag is worth a thousand words: An empirical investigation of social media strategies in trademarking hashtags. *Information Systems Research*, 33(4), 1403–1427. <https://doi.org/10.1287/isre.2022.1107>

- Kumar, V., & Mirchandani, R. (2013). Increasing the ROI of social media marketing. *IEEE Engineering Management Review*, 41(3), 17–23. <https://doi.org/10.1109/EMR.2013.6596535>
- Lambrecht, A., Tucker, C., & Wiertz, C. (2018). Advertising to early trend propagators: Evidence from twitter. *Marketing Science*, 37(2), 177–199. <https://doi.org/10.1287/mksc.2017.1062>
- Lee, D., Hosanagar, K., & Nair, H. S. (2018). Advertising content and consumer engagement on social media: Evidence from facebook. *Management Science*, 64(11), 5105–5131. <https://doi.org/10.1287/mnsc.2017.2902>
- Lemon, K. N., & Verhoef, P. C. (2016). Understanding customer experience throughout the customer journey. *Journal of Marketing*, 80(6), 69–96. <https://doi.org/10.1509/jm.15.0420>
- Li, Y., & Xie, Y. (2020). Is a picture worth a thousand words? An empirical study of image content and social media engagement. *Journal of Marketing Research*, 57(1), 1–19. <https://doi.org/10.1177/0022243719881113>
- Luangrath, A. W., Xu, Y., & Wang, T. (2023). Paralanguage Classifier (PARA): An Algorithm for Automatic Coding of Paralinguistic Nonverbal Parts of Speech in Text. *Journal of Marketing Research*, 60(2), 388–408. <https://doi.org/10.1177/00222437221116058>
- Mallipeddi, R. R., Janakiraman, R., Kumar, S., & Gupta, S. (2021). The effects of social media content created by human brands on engagement: Evidence from Indian general election 2014. *Information Systems Research*, 32(1), 212–237. <https://doi.org/10.1287/isre.2020.0961>
- Marchand, A., Hennig-Thurau, T., & Flemming, J. (2021). Social media resources and capabilities as strategic determinants of social media performance. *International Journal of Research in Marketing*, 38(3), 549–571. <https://doi.org/10.1016/j.ijresmar.2020.09.011>
- McFarland, R. G., Challagalla, G. N., & Shervani, T. A. (2006). Influence tactics for effective adaptive selling. *Journal of Marketing*, 70(4), 103–117. <https://doi.org/10.1509/jmkg.70.4.103>
- Miranda, S. M., & Saunders, C. S. (2003). The social construction of meaning: An alternative perspective on information sharing. *Information Systems Research*, 14(1), 87–106. <https://doi.org/10.1287/isre.14.1.87.14765>
- Nian, T., & Sundararajan, A. (2022). Social media marketing, quality signaling, and the goldilocks principle. *Information Systems Research*, 33(2), 540–556. <https://doi.org/10.1287/isre.2021.1067>
- Oh, H., Goh, K.-Y., & Phan, T. Q. (2023). Are you what you tweet? The impact of sentiment on digital news consumption and social media sharing. *Information Systems Research*, 34(1), 111–136. <https://doi.org/10.1287/isre.2022.1112>
- Olivera, Goodman, & Tan. (2008). Contribution behaviors in distributed environments. *MIS Quarterly*, 32(1), 23. <https://doi.org/10.2307/25148827>
- Ordenes, F. V., Grewal, D., Ludwig, S., Ruyter, K. De, Mahr, D., & Wetzels, M. (2019). Cutting through Content Clutter: How speech and image acts drive consumer sharing of social media brand messages. *Journal of Consumer Research*, 45(5), 988–1012. <https://doi.org/10.1093/jcr/ucy032>

- Pancer, E., Chandler, V., Poole, M., & Noseworthy, T. J. (2019). How readability shapes social media engagement. *Journal of Consumer Psychology*, 29(2), 262–270.
<https://doi.org/10.1002/jcpy.1073>
- Paulhus, D. L., & Levitt, K. (1987). Desirable responding triggered by affect: Automatic egotism? *Journal of Personality and Social Psychology*, 52(2), 245–259.
<https://doi.org/10.1037/0022-3514.52.2.245>
- Pezzuti, T. (2023). Highlighting discrepancies in brand messaging increases social media engagement. *Journal of the Academy of Marketing Science*. <https://doi.org/10.1007/s11747-023-00983-x>
- Pezzuti, T., & Leonhardt, J. M. (2023). What’s not to like? Negations in brand messages increase consumer engagement. *Journal of the Academy of Marketing Science*, 51(3), 675–694.
<https://doi.org/10.1007/s11747-022-00894-3>
- Pezzuti, T., Leonhardt, J. M., & Warren, C. (2021). Certainty in language increases consumer engagement on social media. *Journal of Interactive Marketing*, 53(1), 32–46.
<https://doi.org/10.1016/j.intmar.2020.06.005>
- Pogacar, R., Angle, J., Lowrey, T. M., Shrum, L. J., & Kardes, F. R. (2021). Is nestlé a lady? The feminine brand name advantage. *Journal of Marketing*, 85(6), 101–117.
<https://doi.org/10.1177/0022242921993060>
- Rishika, R., & Ramaprasad, J. (2019). The effects of asymmetric social ties, structural embeddedness, and tie strength on online content contribution behavior. *Management Science*, 65(7), 3398–3422. <https://doi.org/10.1287/mnsc.2018.3087>
- Rode, H. (2016). To share or not to share: The effects of extrinsic and intrinsic motivations on knowledge-sharing in enterprise social media platforms. *Journal of Information Technology*, 31(2), 152–165. <https://doi.org/10.1057/jit.2016.8>
- Schmidt, S., & Eisend, M. (2015). Advertising repetition: A meta-analysis on effective frequency in advertising. *Journal of Advertising*, 44(4), 415–428.
<https://doi.org/10.1080/00913367.2015.1018460>
- Sepehri, A., Mirshafiee, M. S., & Markowitz, D. M. (2023). PassivePy: A tool to automatically identify passive voice in big text data. *Journal of Consumer Psychology*, 33(4), 714–727.
<https://doi.org/10.1002/jcpy.1377>
- Shi, Z., Rui, H., & Whinston, A. B. (2014). Content sharing in a social broadcasting environment: Evidence from twitter. *MIS Quarterly*, 38(1), 123–142.
- Singh, S. K., Marinova, D., & Singh, J. (2020). Business-to-business E-negotiations and influence tactics. *Journal of Marketing*, 84(2), 47–68.
<https://doi.org/10.1177/0022242919899381>
- Slepian, M. L., & Galinsky, A. D. (2016). The voiced pronunciation of initial phonemes predicts the gender of names. *Journal of Personality and Social Psychology*, 110(4), 509–527.
<https://doi.org/10.1037/pspa0000041>

- Statista. (2023). *Topic: Social media advertising and marketing worldwide*. Statista.
<https://www.statista.com/topics/1538/social-media-marketing/>
- Venkatesh, R., Kohli, A. K., & Zaltman, G. (1995). Influence strategies in buying centers. *Journal of Marketing*, 59(4), 71–82. <https://doi.org/10.1177/002224299505900406>
- Villarroel Ordenes, F., Grewal, D., Ludwig, S., Ruyter, K. D., Mahr, D., & Wetzels, M. (2019). Cutting through content clutter: How speech and image acts drive consumer sharing of social media brand messages. *Journal of Consumer Research*, 45(5), 988–1012.
<https://doi.org/10.1093/jcr/ucy032>
- Wasko & Faraj. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly*, 29(1), 35.
<https://doi.org/10.2307/25148667>
- Weiger, W. H., Hammerschmidt, M., & Wetzel, H. A. (2018). Don't you dare push me: How persuasive social media tactics shape customer engagement. *Journal of the Association for Consumer Research*, 3(3), 364–378. <https://doi.org/10.1086/698713>
- Weismueller, J., Harrigan, P., Coussement, K., & Tessitore, T. (2022). What makes people share political content on social media? The role of emotion, authority and ideology. *Computers in Human Behavior*, 129, 107150. <https://doi.org/10.1016/j.chb.2021.107150>
- Williams, K. C., Spiro, R. L., & Fine, L. M. (1990). The customer-salesperson dyad: An interaction/communication model and review. *Journal of Personal Selling & Sales Management*, 10(3), 29–43. <https://doi.org/10.1080/08853134.1990.10753832>
- Xu, Y., Chen, W., & Ow, T. T. (2023). The effects of social media posts' characteristics on customer engagement: Evidence from WeChat. *Information & Management*, 60(7), 103854.
<https://doi.org/10.1016/j.im.2023.103854>
- Zadeh, A., & Sharda, R. (2022). How can our tweets go viral? Point-process modelling of brand content. *Information & Management*, 59(2), 103594. <https://doi.org/10.1016/j.im.2022.103594>
- Zeng, X., & Wei, L. (2013). Social ties and user content generation: Evidence from flickr. *Information Systems Research*, 24(1), 71–87. <https://doi.org/10.1287/isre.1120.0464>
- Zhang, Y., Moe, W. W., & Schweidel, D. A. (2017). Modeling the role of message content and influencers in social media rebroadcasting. *International Journal of Research in Marketing*, 34(1), 100–119. <https://doi.org/10.1016/j.ijresmar.2016.07.003>

Figure A1: The Procedure for developing the classifier for influence tactics based on semi-supervised learning.

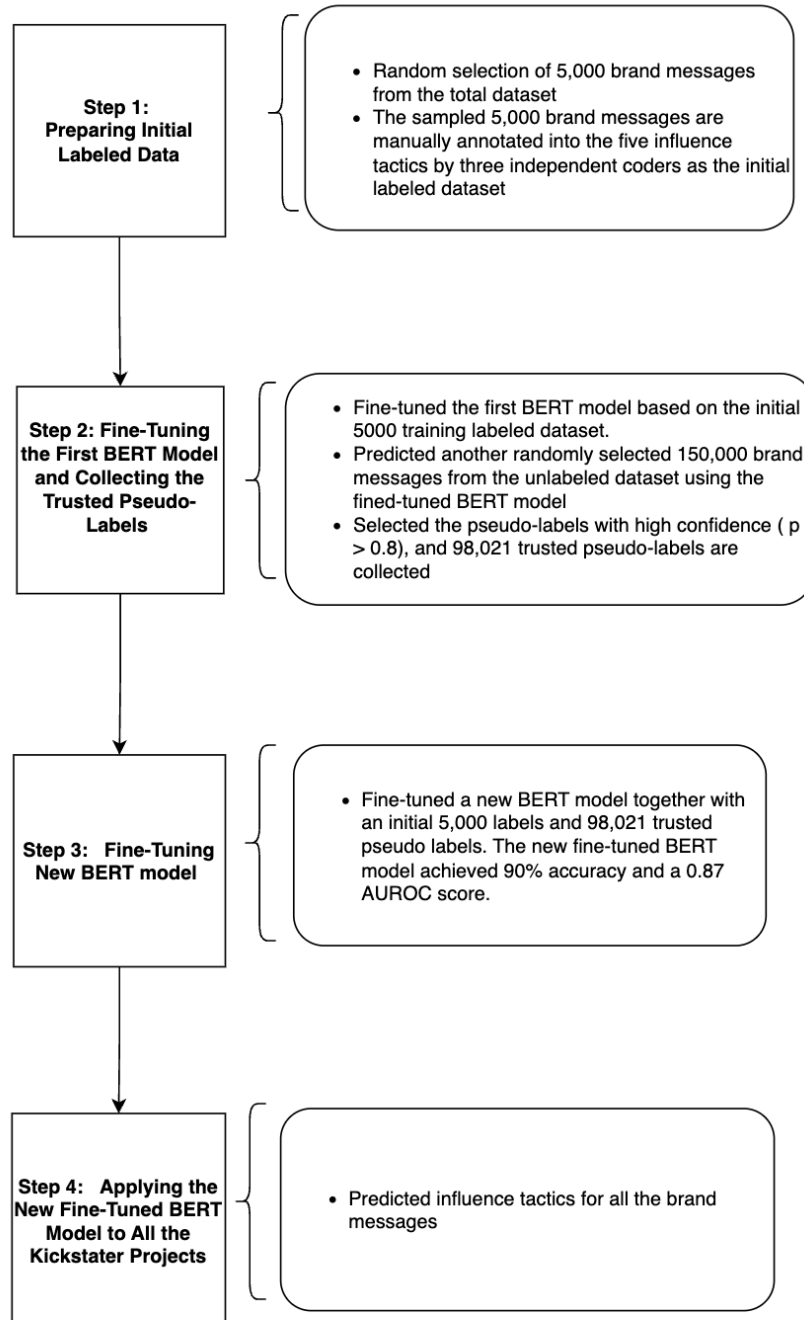


Table A2: Hyper-Parameters Setting for Fine-Tuning BERT Model

Hyperparameter	Value/Description
Pretrained-bert model	bert-base-uncase
Maximum Token Length	128
Training Epochs	6
Learning rate	warm-up
Training Batch size	8
Testing Batch size	8
Optimizer	Adam
Evaluation method	10-folder cross validation

Table A3 The Metrics of the Fine-Tuned BERT Model

Label	Accuracy	AUROC
Assertiveness	0.859	0.840
Information Sharing	0.835	0.863
Ingratiation	0.939	0.908
Promise	0.924	0.932
Recommendation	0.961	0.925
Average	0.904	0.894

Appendix 4:

Name Gender Scoring System (Based on Barry and Harper 1995)

Scale One

- +2: The accent is on the second or later syllable (e.g., Nicole, Sebastian).
- +1: The accent is on the first of three or more syllables (e.g., Brittany, Christopher).
- 0: The accent is on the first of two syllables and the name has fewer than six phonemes (Mary, Michael).
- 1: The name has one syllable (e.g., Jill, James)
- 2: The accent is on the first of two syllables and the name has six or more phonemes (e.g., Gertrude, Edward)

Scale Two

- +2: The last phoneme is a schwa (e.g., Donna, Joshua).
- +1: The last phoneme is any vowel except schwa (e.g., Ashley, Andrew).
- 0: The last phoneme is m, n, ng, r or l (e.g., Kathleen, Tyler).
- 1: The last phoneme is f, v, th, s, z, sh, ch, or j (e.g., Phyllis, George).
- 2: The last phoneme is p, b, t, d, k, or g (e.g., Deb, Jeb).

Name Gender Score = the average of scales 1 and 2.

Table 2: Correlation Coefficient

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Internalization	1.000														
(2) Compliance	-0.558	1.000													
(3) Ingratiation	0.609	-0.478	1.000												
(4) Consistency	0.323	-0.294	0.288	1.000											
(5) Weekend	-0.037	0.015	-0.050	-0.024	1.000										
(6) Gender	0.113	-0.049	0.046	0.054	0.002	1.000									
(7) Word Count	0.026	-0.011	-0.008	0.033	-0.024	0.066	1.000								
(8) Negate	0.001	0.021	-0.008	-0.022	0.005	-0.008	0.090	1.000							
(9) Passive	0.063	-0.025	0.042	0.026	-0.002	0.004	0.081	0.017	1.000						
(10) Photos	-0.017	-0.028	-0.078	-0.005	0.059	0.026	0.076	-0.010	-0.017	1.000					
(11) Videos	0.029	-0.023	0.004	0.012	0.024	0.050	0.116	0.021	0.004	-0.148	1.000				
(12) Gifs	-0.001	0.005	-0.004	-0.005	0.023	0.030	-0.044	0.006	-0.004	-0.089	-0.026	1.000			
(13) Links	0.091	-0.118	-0.129	0.061	0.038	0.098	0.089	-0.030	-0.026	0.559	0.069	0.026	1.000		
(14) Hashtags	0.011	0.005	-0.021	0.009	0.009	0.080	0.123	-0.005	-0.018	0.058	0.081	0.049	0.004	1.000	
(15) Question Marks	-0.074	0.107	-0.121	-0.070	0.005	-0.014	0.056	0.033	-0.026	-0.048	-0.011	-0.006	-0.097	-0.007	1.000

Figure 1: U-shape of Consistency (Variation) Influence Tactic Cross Posts:

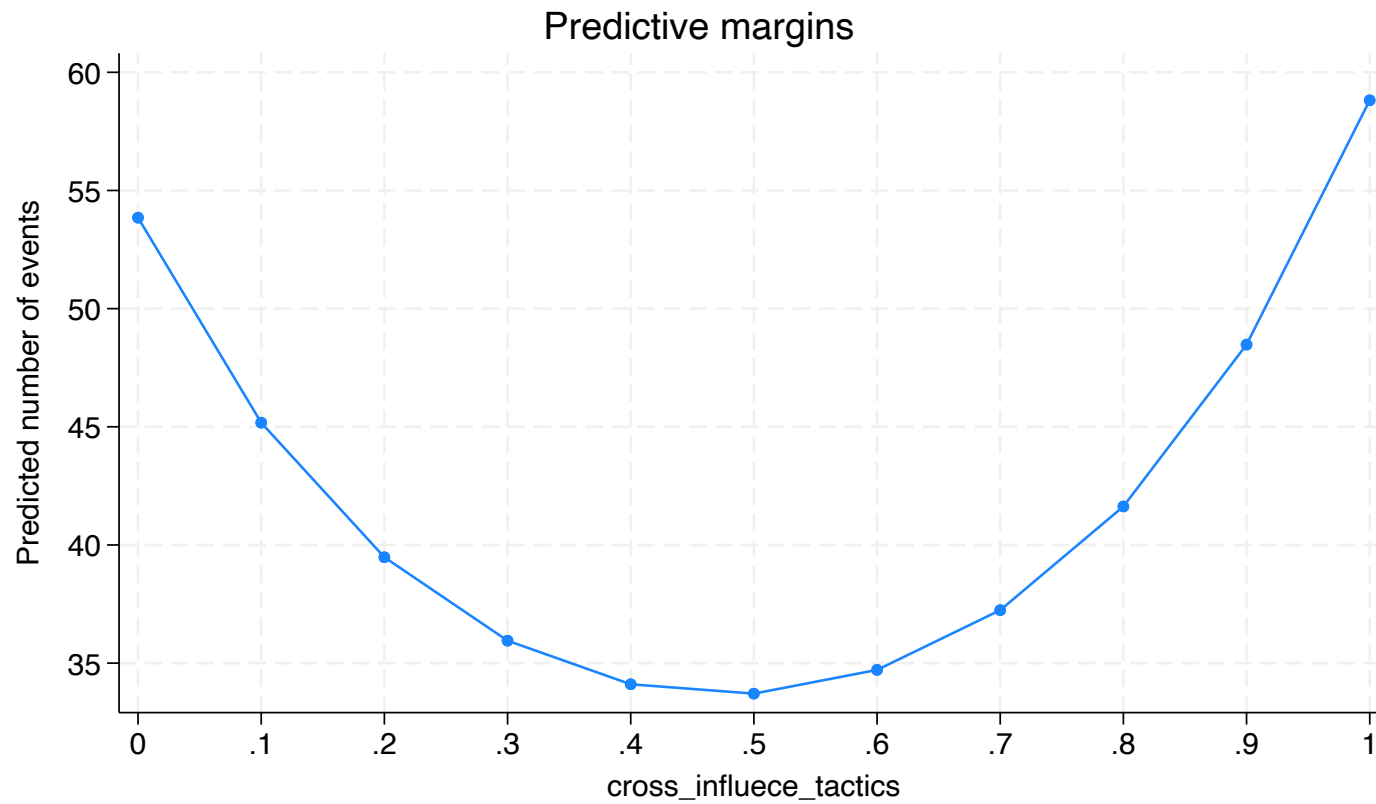


Table 3: Regression Result

	(1)	(2)	(3)	(4)	(5)	(6)
Internalization	0.239*** (0.00867)			0.163*** (0.0141)	0.164*** (0.0141)	0.160*** (0.0160)
Compliance		0.225*** (0.0106)		0.175*** (0.0109)	0.155*** (0.0112)	0.325*** (0.0153)
Ingratiation			0.323*** (0.0174)	0.760*** (0.0279)	0.767*** (0.0279)	0.699*** (0.0297)
Consistency					-1.962*** (0.262)	
Consistency * Consistency					2.050*** (0.285)	
Gender of brand name dummy						0.636*** (0.0258)
Internalization * Gender of brand name dummy						-0.0103 (0.0121)
Compliance * Gender of brand name dummy						-0.241*** (0.0171)
Ingratiation * Gender of brand name dummy						0.111***

						(0.0175)
Weekend	-0.0906*** (0.00427)	-0.0981*** (0.00428)	-0.0883*** (0.00428)	-0.0916*** (0.00427)	-0.0920*** (0.00427)	-0.0911*** (0.00427)
Word Count	0.00668*** (0.000247)	0.00652*** (0.000246)	0.00632*** (0.000247)	0.00682*** (0.000247)	0.00684*** (0.000247)	0.00689*** (0.000247)
Negation	0.134*** (0.00625)	0.118*** (0.00624)	0.118*** (0.00624)	0.122*** (0.00624)	0.121*** (0.00624)	0.122*** (0.00624)
Passive	0.411*** (0.0139)	0.385*** (0.0140)	0.380*** (0.0140)	0.406*** (0.0139)	0.406*** (0.0139)	0.408*** (0.0139)
Photos	0.299*** (0.00402)	0.304*** (0.00404)	0.321*** (0.00406)	0.307*** (0.00403)	0.307*** (0.00403)	0.309*** (0.00403)
Videos	0.489*** (0.00880)	0.495*** (0.00882)	0.503*** (0.00882)	0.501*** (0.00879)	0.501*** (0.00879)	0.504*** (0.00879)
GIFs	0.476*** (0.0130)	0.501*** (0.0130)	0.502*** (0.0130)	0.477*** (0.0129)	0.477*** (0.0129)	0.484*** (0.0129)
Links	-0.187*** (0.00336)	-0.153*** (0.00337)	-0.232*** (0.00340)	-0.192*** (0.00345)	-0.192*** (0.00345)	-0.192*** (0.00345)
Hashtags	-0.0194*** (0.00177)	-0.00540*** (0.00178)	-0.0144*** (0.00177)	-0.0183*** (0.00177)	-0.0184*** (0.00177)	-0.0184*** (0.00177)
Question Marks	-0.108*** (0.00160)	-0.105*** (0.00160)	-0.105*** (0.00152)	-0.111*** (0.00154)	-0.111*** (0.00154)	-0.111*** (0.00154)
Gaussian copula term for Internalization	-0.235*** (0.00337)			-0.124*** (0.00478)	-0.124*** (0.00479)	-0.123*** (0.00478)

Gaussian copula term for compliance		0.0677*** (0.00260)		0.0712*** (0.00325)	0.0713*** (0.00325)	0.0717*** (0.00324)
Gaussian copula term for ingratiation			-0.190*** (0.00385)	-0.210*** (0.00596)	-0.210*** (0.00596)	-0.211*** (0.00596)
Constant	0.00668*** (0.000247)	0.00652*** (0.000246)	0.00632*** (0.000247)	0.00682*** (0.000247)	0.00684*** (0.000247)	0.00689*** (0.000247)
Brand Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Month Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	893,222	893,222	893,222	893,222	893,222	893,222

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix table A5: Robustness Check

	(1)	(2)	(3)	(4)
Internalization	0.369*** (0.0120)			0.440*** (0.0195)
Compliance		0.336*** (0.0145)		0.234*** (0.0149)
Ingratiation			0.275*** (0.0239)	0.436*** (0.0383)
Weekend	-0.212*** (0.00588)	-0.214*** (0.00589)	-0.209*** (0.00588)	-0.212*** (0.00587)
Word Count	0.0180*** (0.000337)	0.0177*** (0.000337)	0.0179*** (0.000337)	0.0178*** (0.000337)
Negation	0.112*** (0.00853)	0.0938*** (0.00856)	0.0913*** (0.00854)	0.0918*** (0.00851)
Passive	0.527*** (0.0194)	0.488*** (0.0195)	0.472*** (0.0195)	0.526*** (0.0194)
Photos	0.329*** (0.00564)	0.341*** (0.00568)	0.350*** (0.00568)	0.338*** (0.00563)
Videos	0.269*** (0.0113)	0.278*** (0.0114)	0.289*** (0.0114)	0.284*** (0.0113)
GIFs	0.268***	0.304***	0.297***	0.269***

	(0.0166)	(0.0167)	(0.0166)	(0.0166)
Links	-0.563***	-0.513***	-0.620***	-0.573***
	(0.00451)	(0.00454)	(0.00457)	(0.00463)
Hashtags	-0.0687***	-0.0454***	-0.0624***	-0.0698***
	(0.00249)	(0.00249)	(0.00249)	(0.00249)
Question Marks	0.418***	0.426***	0.374***	0.390***
	(0.00539)	(0.00540)	(0.00542)	(0.00542)
Gaussian copula term for Internalization	-0.353***			-0.253***
	(0.00470)			(0.00670)
Gaussian copula term for compliance		0.0899***		0.0775***
		(0.00360)		(0.00452)
Gaussian copula term for ingratiation			-0.243***	-0.172***
			(0.00535)	(0.00826)
Constant	-3.641***	-3.412***	-3.274***	-3.797***
	(1.012)	(1.012)	(1.012)	(1.012)
Brand Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Month Dummies	Yes	Yes	Yes	Yes
Observations	893,222	893,222	893,222	893,222

Robust standard errors in
parentheses

*** $p < 0.01$, ** $p < 0.05$, *
 $p < 0.1$

The role of essential businesses in whole-of-society resilience to disruption

ABSTRACT

‘Whole-of-society resilience’ articulates a new multi-level policy ambition on resilience to disruption. The term is intuitive, appears incontestable, and places a new prominence on businesses by allocating them new obligations to enhance local resilience. However, a lack of conceptual clarity and a gap between policy expectations and business delivery problematizes operationalization of the term. This vagueness obscures how the policy is translated to assure business’s own continuity as well as the resilience of their external environment. These issues are particularly critical for businesses that deliver essential services to people who are disproportionately vulnerable to a disruption (e.g. people with chronic health issues). To explore the implications of this new expectation, we review scholarly and policy literature to identify the role of these ‘essential businesses’ in operationalizing whole-of-society resilience to disruption. We propose a definition for whole-of-society resilience to disruption and discuss how, and for whom, essential businesses can be involved in its operationalization. We present a framework to outline how essential businesses meet society’s essential needs by providing targeted support to help society adapt and advance in changing environments. We explain the implications for essential businesses, challenge the operational value of ‘whole-of’, and uncover implications for policy.

INTRODUCTION

Major disruptions from acute shocks like widescale power outage and chronic stresses like climate change (Cutter, 2018) undermine the continuity of businesses that are not resilient (McKnight and Linnenluecke, 2016). Such disruptions cause direct impacts on businesses like financial instability or indirect impacts through affected supply networks (Rose et al, 1997). This requires businesses to build their resilience to disruption by reinforcing the continuity of their key functions (Hillmann and Guenther, 2021), dynamically responding to lessen

disruptive impacts (Caiazza et al, 2021), and mobilizing capabilities to recover affected operations (Duchek, 2020). But, as actors in social systems, businesses both affect and are affected by wider social and natural systems (Folke and Berkes, 1998). In suggesting an interdependence between a business's resilience and the resilience of their business environment, the socio-ecological perspective (Berkes et al, 2003) renders insufficient a singular focus on the resilience of internal business operations (Williams et al, 2021). With this, Detoni et al (2021) identify the necessity of further research to examine how businesses influence and support the environment in which they are embedded. Our article contributes to this gap by exploring how businesses contribute to societal resilience.

Linnenluecke (2017: 25) discusses this interconnectedness and conceptualizes resilience in a “multi-level context” such as the recursive global, national, regional, local, and neighbourhood systems in which businesses are embedded (Pollock and Steen, 2021). Driving a new multi-level resilience perspective through “whole-of-society resilience” (WoSR), the UK Resilience Framework (HM Government, 2022) places a new prominence on the role of businesses as active agents in enhancing the resilience to disruption of society. However, gaps persist in understanding the roles and interactions of society's different levels in WoSR (Samaan et al, 2022), for example, how businesses can continue to supply the necessary services on which society depends when disruptions hit (Crane and Matten, 2021). Our article draws on Linnenluecke's (2017) concept of society as a multi-level system to focus on how businesses that provide essential services can become more resilient and contribute to the resilience of their environment.

National and international policy on WoSR asserts that networks, organizations (from private, public and nonprofit sectors), communities, and individuals should support themselves and each other during a disruption (e.g. European Parliament, 2021; HM Government, 2023c; North Atlantic Treaty Organization, 2023). The formal obligation for WoSR, for the World

Health Organization (2009), rests on government through their statutory duties to address societal needs in a disruption. However, a large and increasing number of businesses provide essential services and create such significant societal value, Wiśniewski et al (2023) describe, that interruptions to their continuity can profoundly impact society's capacity to respond to a disruption and recover from it. Recognizing their importance, the COVID-19 pandemic saw policy define such businesses as "essential" (Storr et al, 2021: 1230). Henceforth, we use the term 'essential businesses' to describe those businesses that are critical to society's functioning during disruption, and our article elucidates their role in WoSR.

Essential businesses, as described by Kouvali (2021), include healthcare, critical infrastructure like water and energy, food production and delivery, human services operations, communications, and financial services. Discontinuity in the provision of these essential services risks acute and disproportionate impacts for the most vulnerable people in society such as those with chronic health issues or without sufficient agency to self-determine their own resilience. For example, Dugan et al (2023) discuss how a major power outage can have ripple effects on water, communications, and health services which exacerbate risk to life for vulnerable people who will struggle to meet their basic essential needs. In recognizing their importance, WoSR policy generally "responsibilizes" (Pitidis et al, 2022: 699) essential businesses (European Parliament, 2021) and nudges them further toward being pseudo-governmental entities on which society's functioning relies (Scherer et al, 2014; Schrempf-Stirling, 2018). However, beyond providing a broad description of a new ambition for multi-level resilience and the importance of essential businesses in that, WoSR policy does not substantively inform how essential businesses should take this agenda forward.

Adoption of WoSR in policy has been so fast paced that management research has not yet caught up. As a policy rhetoric and philosophy, WoSR is intuitive so hard to argue against but, as a concept of operations, it lacks conceptual clarity and highlights a disconnect between

policy expectation and on-the-ground delivery. Our article identifies several tensions that problematize the operationalization of WoSR by essential businesses and we explain how these can be overcome. For example, the use of ‘whole-of’ suggests equal treatment of, and expectation on, everything and everyone in society which, counter-intuitively, fails to prioritize those most vulnerable to the impacts of disruption and the essential services they rely on. Research is urgently needed to identify the implications for essential businesses of this new policy and address the conceptual and implementation gaps it creates. To identify and begin to close these gaps we comprehensively review academic and policy literature guided by our central research question: How can WoSR be translated and operationalized by essential businesses?

Our literature review capitalizes on the explosive increase in policy and scholarly use of WoSR as governments and other bodies mobilize the approach (Commonwealth of Australia, 2011; Finland Ministry of Defence, 2017; United Nations, 2023). Our findings recalibrate the WoSR expectations on essential businesses and identify how WoSR can be translated from ambitious policy rhetoric to practical action. First, we detail our methodology before presenting our findings, culminating in a definition for essential businesses of WoSR to disruption. Our discussion presents a framework to operationalize WoSR and we explain essential businesses’ role in that. We explore the implications for essential businesses of their role in WoSR, question the value of operationalizing ‘whole-of’, and consider the implications for policy.

METHODOLOGY

Snyder (2019) established the semi-systematic literature review (S-SLR) method for business research to analyze broad research areas with varied conceptualizations. With over 8,000 citations on Google Scholar, S-SLR has rapidly gained approval as an approach to analyze academic literature and policy documents. By reviewing policy documents, we follow Aguinis, Jensen and Kraus (2022: 858) definition of ‘policy’ as “governance principles that

guide courses of action and behaviour” for businesses, government, and society. ‘Policy documents’ include publications from government and non-governmental institutions and organizations (Mahood, Eerd and Irvin, 2014). Our S-SLR follows four-stages: (1) *Design* - establish search strategy; (2) *Conduct* - identify relevant documents, screen, conduct full-text assessment; (3) *Analyze* - interrogate selected literature, synthesize findings; (4) *Report* - communicate findings. Below we detail our application of these stages.

Design

To guide our S-SLR, we defined the following research questions:

RQ1: What is the role of essential businesses in operationalizing whole-of-society resilience to disruption?

RQ2: What are the implications for essential businesses of their role in delivering whole-of-society resilience to disruption?

RQ3: What are the implications for policy of essential businesses’ role in whole-of-society resilience to disruption?

Snyder’s (2019) search strategy requires the design of search terms, database selection, and inclusion criteria. On WoSR, the terms ‘whole-of-society’ and ‘resilience’ were essential, and our pre-work discovered that WoSR was sometimes abbreviated to “whole society” and synonymous with “all of society”. We included hyphenated and non-hyphenated versions for surety. A wildcard (*) was used on ‘society’ (‘societ*’) and ‘resilience’ (‘resilien*’) to capture variations such as ‘societal’ and ‘resilient’. We searched a broad set of bibliometric databases for academic literature (Paul and Criado, 2020): Web of Science (ISI), Scopus, Wiley, and ABI Inform/ProQuest. All databases selected, except Wiley, accepted the wildcard.

Thus, we defined the following search strings: [“whole of societ*” OR “whole-of-societ*” AND “resilien*”]; [“whole societ*” OR “whole-societ*” AND “resilien*”]; [“all of societ*” OR “all-of-societ*” AND “resilien*”]. Hitherto, we use the term ‘whole-of-society resilience’

(WoSR), but this includes ‘all-of-society resilience’ and ‘whole-society resilience’ unless otherwise stated. We defined three inclusion criteria to select relevant publications (Snyder, 2019): (i) the article indicates a focus on WoSR and/or the role of essential businesses in resilience; and (ii) the article offers a substantial component on WoSR by using the terms from our search strings more than twice in-text (excluding bibliography); and (iii) the article discusses how WoSR can be operationalized by essential businesses and society.

The selection of policy documents followed a purposive sampling process where we searched Google and Google Scholar and chased policy documents cited in academic literature (Haddaway et al, 2015). We applied the same three criteria with an adjustment to criterion (i) which we call (i^b) for policy: document title contains the defined search terms, or the document source is a government or non-governmental organization working on resilience (for example North Atlantic Treaty Organization or United Nations).

Conduct

Focusing on quality, we sought academic journal articles that were peer reviewed (Xiao and Watson, 2019). The World Health Organization’s *Whole-of-society pandemic readiness* (2009) is frequently cited as a landmark publication on WoSR (Addy et al, 2014; Dubb, 2020; Fogg, 2021), so our search focused on articles published from January 2009 to June 2023 in English. Our academic literature search returned 2,808 articles which were organized into reference management software *EndNoteX9*. Following protocols outlined by Paul and Criado (2020), we removed duplicates and misclassified results that failed our criteria resulting in 2,509 articles. The policy search and purposive sampling identified 67 policy documents. These articles and documents were then screened.

For the academic articles, two researchers independently screened 2,509 results to identify those that satisfied criterion (i). The agreement between researchers was 97% and discussion reached full agreement. This agreed 519 articles of which Researcher 1 screened the number

of search term hits by applying criterion (ii), and abstracts by applying criterion (iii). Researcher 2 independently screened a 20% random sample (104 publications) with full agreement being attained. From this, 109 articles were selected for full-text assessment applying criterion (iii) which added two further articles (Addy et al, 2014; Dubb, 2020) cited in Hsieh et al (2021).

For the policy documents, Researchers 1 and 2 screened the 67 documents applying criteria (i^b) and (ii). This resulted in the selection of 58 documents for full-text assessment applying criterion (iii). Following Mahood et al (2014), Researchers 1 and 2 had ongoing discussions to broaden coverage of the policy documents. Regarding criterion (ii), articles/documents were excluded where the terms were used twice or more but were insubstantial, for example, used as a descriptor, adjective, or recommendation without detail. Full-text assessment resulted in a final selection of 62 academic articles and 52 policy documents to inform our literature review. Adapting Page et al (2021), Figure 1 presents a PRISMA diagram for stage ‘(2) Conduct’.

-----INSERT FIGURE 1 HERE-----

Analyze

Following Snyder (2019), descriptive data was recorded in evidence tables for our 62 academic articles and 52 policy documents (Supplementary data 1 and 2), including descriptions of WoSR (Appendix 1). This data was inductively coded as follows (Williams and Moser, 2019): *open coding* labelling data that answered the RQs (see examples in Table 1); *axial coding* compared open codes, identified relationships between them, and generated ‘thematic categories’; *selective coding* refined and integrated axial categories to generate ‘primary themes’ (see coding structure in Table 2). We analyzed the academic articles and policy documents separately to enable comparison in how WoSR is understood and operationalized – finding significant alignment in their characteristics of WoSR and the role of essential businesses. This lack of differentiation led us to combine our database and,

henceforth, describe them as ‘114 publications’. The following section addresses Stage (4) by reporting on the main findings of our S-SLR. We first provide an overview of the 114 publications before analyzing their content with specific reference to essential businesses.

-----INSERT TABLE 1 HERE-----

REPORTING OUR FINDINGS

Publications overview

The whole-of-society approach is described by the Organization for Security and Co-operation in Europe (2020) as originating in the field of public health and its specialized agencies like the World Health Organization (Samaan et al, 2022). The term has since been applied by the United Nations (2021) in disaster risk reduction/management, by governments in national security and resilience (HM Government, 2021) and sustainable development (Cázarez-Grageda, 2018). This is reflected in the high number of selected publications using the defined search terms in health-, disaster-, and sustainability-oriented journals. Figure 2 illustrates the term’s low use 2009-2012, steady increase 2013-2016, and significant annual growth from 2017 (accounting for 84% of selected publications). Methodological approaches favored in the articles were empirical (29), conceptual (21), analytical (12) (Supplementary data 1). Policy documents included government policies (12), guidance and technical documents from specialized agencies, non-governmental organizations (9), reports and publications from institutions, government networks (31) (Supplementary data 2).

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Of the 114 publications, 63 offered specific descriptions of the characteristics of WoSR to disruption (Appendix 1). Comparing the characteristics, we discovered similarities in the actors involved, the ambition, and features of WoSR such as the broad principles of inclusivity, collaboration, and shared responsibility. The descriptions failed to fully illuminate the role of essential businesses beyond “stakeholder” or provider of capacity (for example Appleby, 2020;

British Red Cross, 2022; European Parliament, 2021), and did not explain how WoSR is delivered by essential businesses.

Thematic analysis results

Thematic analysis of the 114 publications revealed 16 open codes that characterize WoSR and the role of essential businesses. Table 2 presents the primary themes as resulting from a coding structure of 3 selective codes (primary themes), constructed from 5 axial codes (thematic categories), formed from 16 open codes each of which frequently appears in the dataset. We first introduce the primary themes (identified with **bold underline headings**) that were selected to represent the thematic categories (***bold italic sub-headers***) which are described by the open codes (in-text *italics*). Figure 3 presents a framework resulting from our analysis and provides a blueprint of our core findings which we explain later with specific reference to essential businesses in the Discussion section.

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Primary theme 1: Align with local cross-sector partnerships

Our first of three primary themes describes how essential businesses can address WoSR by working through local cross-sector partnerships. These partnerships require a governance framework to design and implement WoSR. The selected publications provided evidence to describe this first primary theme through two thematic categories (Table 2): ‘work through cross-sector partnerships’ and ‘coordinate to manage delivery’ which are explained by nine interrelated open codes (3 and 6 open codes respectively), detailed below.

Thematic category 1: Work through cross-sector partnerships

WoSR requires essential businesses to *establish multi-actor/-sector collaboration* through cross-sector partnerships involving a range of societal actors (Papademetriou and Benton, 2016; Pan American Health Organization, 2015; World Health Organization, 2016). Essential businesses that provide services such as healthcare and utilities are, for the Association of

Southeast Asian Nations (2021) and Dubb (2020), crucial to these partnerships due to their value to society's resilience and the risks or cascading impacts that interruptions to their operations would create. Cross-sector partnerships operationalize WoSR at the local level, guided by national policy directives (Colgan et al, 2015; World Health Organization, 2009). Essential businesses as contributors should align to the collective ambition for WoSR of their partnerships. However, the characteristics of different essential businesses, such as firm size and resources (Kong and Sun, 2021), will influence their level and type of contribution requiring flexibility in a partnership's design of WoSR collaborations.

Multi-level participation from essential businesses and society in WoSR is advised by the International Committee of the Red Cross (2017), Samaan et al (2022) and the U.S. Government (2023). Essential businesses should *engage local actors*, which Matsuoka and Rocha (2021) specify to include local government, organizations (including non-profit), communities, and individuals. More broadly, WoSR is described by Gavari-Starkie et al (2021) as all-inclusive - it "leaves no one behind" (Lillywhite and Wolbring, 2022: 3) - which Simpson et al (2019: 6) similarly reference as involving "all people and institutions". Other scholars show that partnerships can be comprised of specific local actors with relevant knowledge to address focal areas like migration (Appleby, 2020) or extremism (Pierobon, 2021). Sector-specific partners during COVID-19 are illustrated by Dubb (2020), including examples of telecommunications companies providing logistical support to health services, and manufacturing companies surging their supply of clinical equipment.

Essential businesses are expected to *share responsibility* for the design and implementation of WoSR, for example, by taking responsibility for the continuity of the services they provide that society depends on (Commonwealth of Australia, 2011; International Institute for Sustainable Development, 2021; Uhnöo and Persson, 2021). Shared responsibility for WoSR is described by Bergstrom (2018: 31) as a shift in what has been traditionally government

responsibility for WoSR to “local and decentralized responsibility”. This responsibility, according to Shmueli, Ozawa and Kaufman (2021), is shared across local business-business networks and business-government/non-profit networks. The World Health Organization (2012) advocates that these networks should support firm competitiveness by WoSR enhancing the socio-economic environments in which they operate.

Thematic category 2: Coordinate to manage delivery

Essential businesses should *establish local governance* to support them in the coordination of WoSR activities. Two distinct frameworks for local governance appear in the literature. First, self-governance is described by Korosteleva (2018) and Bednarska-Olejniczak et al (2021) as involving essential businesses designing and managing their own WoSR activities. Second, polycentric governance is recommended by Addy et al (2014: 217) for multi-actor governing arrangements that involve business-business and business-government/-non-profit networks that facilitate “multiple centers of decision making”. Uhnöo and Persson (2021) discuss how essential businesses should adhere to established governance mechanisms, especially when partnering with official responder agencies.

To organize for WoSR, essential businesses and partners should *agree the partnership strategy* which enables them to collaboratively articulate the vision, define a collective ambition, establish strategic objectives, and identify delivery partners and activities (Addy et al, 2014; López-Gunn et al, 2021; Yong and Lemyre, 2019). To concentrate on local impacts, WoSR strategy should be aligned to a clear understanding of local knowledge and priorities (Kjellen et al, 2023; Yuan et al, 2021). This will, for Korosteleva (2018), help essential businesses and society to increase their agency to take responsibility for, and self-determine, their future resilience. The European Parliament (2021) exemplify Finland’s national WoSR policy which articulates that WoSR strategy should define the roles and responsibilities of each partner. National guidance and frameworks are emphasized by the World Health Organization

(2017b) to support essential businesses and partners to organize effectively for WoSR, individually and collaboratively. For example, HM Government (2022) highlights the importance of guidance on continuity planning, assurance frameworks, and risk standards.

Shmueli et al (2021) advocate that essential businesses should *facilitate co-production* so that they can engage the partners they require to collaborate on WoSR. Co-production is a process to transform shared ambition into collaborative action (O’Sullivan and Phillips, 2019), which Brunk (2016) found lays solid foundations for delivery. Several publications caution that effective co-production processes rely on inclusion, trust and meaningful engagement of essential businesses and societal partners in the implementation of WoSR (Bromley et al, 2017; Elavarasan et al, 2021; Friends of Europe, 2022). Here, co-producing WoSR goes beyond consultation and requires effort to build relationships and remove barriers and is delivered through equitable practices that heighten trust amongst partners (O’Sullivan et al, 2015).

Coordinating essential businesses to deliver WoSR activities is challenging because, as Månsson et al (2015) point out, partners view and plan for risks differently. Thus, WoSR requires essential businesses and partners to *coordinate by integrating systems*, for example, to manage risk and plan response. In many reviewed publications, this integration requires and enables a cooperative approach to governance based on common viewpoints and approaches (Bangladesh Government, 2020; Hsieh et al, 2021; Panneer et al, 2021). Integrated systems involve vertical coordination across scales (local-regional-national business/government) (North Atlantic Treaty Organization, 2021; Shmueli et al, 2021) and horizontal coordination across sectors (Kindornay and Kocaata, 2019; Weiland et al, 2020; World Bank, 2021). Coordination through integrated systems, as noted by Ongkowitzo and Doloi (2017), helps to moderate cascading impacts by systems working together to prevent and respond quicker to emerging cascades.

WoSR requires essential businesses to *provide strategic and tactical leadership* to maintain focus, manage resources, and ensure accountability (Brunk, 2016; Généreux et al, 2018; London Councils, 2023). The crucial leadership roles of essential businesses and government are emphasized by the World Health Organization (2017a) and World Bank (2013), including the roles of their networks such as supply chains.

Integrated systems require a comprehensive approach to communications so that they can *cooperate by sharing intelligence* on WoSR (HM Government, 2023a; Sundelius and Eldeblad, 2013). Sharing intelligence is found by Lin et al (2015) to help managers to communicate and make collaborative decisions about WoSR. Essential businesses are key sources of intelligence on services that society's function depends on. For example, Pöyhönen et al (2019) argue that they provide crucial intelligence on the risks and vulnerabilities in socio-technical systems (such a digital societal services) and are central actors in the preparation and management of technological incidents that undermine WoSR. Complementing intelligence from essential businesses, the United Nations (2021) highlights that non-profit organizations provide intelligence on vulnerable people's dependency on essential services, which helps to identify gaps in services resulting from disruption (Al-Mulki et al, 2022).

Primary theme 2: Support the provision of essential services

Our second primary theme describes how to focus the provision from essential businesses to enhance WoSR. Publications evidence the prioritization of people who are most in need from the impacts of a disruption, the essential services they depend on, and explain how working through cross-sector partnerships enables essential businesses to target those needs. This primary theme comprises two thematic categories (axial codes) (Table 2): 'deliver against needs' and 'mobilize targeted support' which are explained by five interrelated open codes (3 and 2 open codes respectively), detailed below.

Thematic category 3: Deliver against needs

To deliver value for networks, organizations, communities, and individuals WoSR should *pinpoint needs* (Domicelj and Gottardo, 2019; Federal Emergency Management Agency, 2011; Meszaros and Toca, 2020; Sagara et al, 2022). A “needs-based approach” is described by Pickering et al (2021b: 175) as focused on the demands for assistance arising from the impacts of a disruption, for example, healthcare, food, water, sanitation, and hygiene needs (United Nations, 2021). To deliver WoSR activities against needs, HM Government (2022) and the North Atlantic Treaty Organization (2021) highlight the importance of comprehensively understanding which parts of society have needs in a disruption, identifying what those needs are, and how they can be addressed by essential businesses and their partners.

To deepen understanding on needs, WoSR activities should *analyze how the context is changing* as societal needs are affected by dynamic socio-ecological environments (D’Andrea, Grifoni and Ferri, 2022; Moungar and Baldeh, 2020; United Nations, 2019; Yong and Lemyre, 2019). Contextual social factors such as marginalization, structural inequalities, and conflict (Haldane et al, 2021; Moya and Goenechea, 2022) exacerbate needs in a disruption and impede WoSR, requiring WoSR activities to establish a better understanding of the root causes of needs. Contextual ecological factors such as flood risk can be addressed through “nature-based solutions”, which is an approach advocated by the Council of Canadian Academies (2022: 44) for the responsible stewardship and protection of dynamic ecological contexts. In changing socio-ecological contexts, essential businesses and partners require systems that provide timely and accurate intelligence (Månsson et al, 2015) to monitor change (Bento and Couto, 2021) and inform dynamic decision making (Vieira et al, 2019). This, for Codreanu et al (2021), enables essential businesses to balance their objectives with changing contexts that bring new aspects to WoSR. For example, Genik and Godsoe (2015) discuss essential businesses monitoring the changes in socio-ecological risk that overlap with their operations.

Society relies on essential businesses to provide services that meet its needs and so WoSR activity should *ensure continuity of provision* of these essential services during disruption (International Displacement Monitoring Centre, 2018; Laitinen et al, 2022). Continuity is characterized by the European Parliament (2021) as the ability of essential businesses to assure internal operations and retain vital functions to provide services, scale up where demand has surged, and as Dubb (2020) adds, adapting operations to respond to changing needs. Many continuity challenges that essential businesses face also affect society (for example, national-local coordination and communication issues) which means that, for Tómasson (2022), business continuity contributes wider significance to managing WoSR to disruption. Continuity is the link between the resilience of essential businesses and wider society (World Health Organization, 2009). Here, essential businesses depend on the resilience of society (and vice versa), are impacted by external contingencies (for example, supply chains, stakeholder relationships) (Codreanu et al, 2021; Zackery et al, 2022), and have a responsibility to customers and employees (National Preparedness Commission, 2021). These factors, for Acciarini et al (2021), necessitate a departure from a reactionary response to disruption towards a more proactive approach to continuity by essential businesses. With this, continuity requires a deeper understanding of the most important societal needs and the corresponding responsibilities that essential businesses have for WoSR. For example, essential businesses can help identify customer needs in disruption and provide assistance to them (HM Government, 2022).

Thematic category 4: Mobilize targeted support

Support for WoSR is described by HM Government (2022) and Liang et al (2018) as the help that networks, organizations, communities and individuals require before, during, and after a disruption. This includes, for Acciarini et al (2021), essential businesses that will struggle to deliver services to those in need, described by McClelland et al (2022) as those that

lack the agency to help themselves and require targeted support. Resources to be mobilized that support needs and reduce demand on services requires WoSR activities to *develop local capacities and capabilities* (Council of the European Union, 2023; World Bank, 2023). WoSR capacity includes adaptive and transformative capacities within and across sectors (Yanakiev et al, 2018), to which the World Health Organization (2009) specifies the support from essential businesses to meet surging demand for services during disruption. The systems required to support WoSR capacity are described as capital, technology, knowledge and skills, equipment, infrastructure, planning, communications, and coordination (Kong and Sun, 2021; Pickering et al, 2021a; North Atlantic Treaty Organization, 2021).

WoSR capabilities reflect the efficient and effective mobilization of systems for WoSR and, for Williams et al (2018), includes essential businesses' self-sufficiency and integrated partnerships that establish collective resources and enable self-organization. Self-organization is described as employing local intelligence to align the provision of support with local needs, identifying gaps in provision (Pickering et al, 2021b; Simpson et al, 2019), self-helping for business continuity (Tómasson, 2022), and engaging business networks to help others and receive external help (World Health Organization, 2012).

To continually improve how the capacities and capabilities from essential businesses are mobilized for WoSR, Finland's Ministry of Defence (2017) advise that they regularly *test systems*. The National Preparedness Commission (2021) recommends that essential businesses exercise their systems with wider business networks, government, and non-profit organizations. For many, testing bolsters and integrates efforts of WoSR partners, enhances risk awareness, encourages proactive behaviors, and helps to share knowledge on best practice, capacities, capabilities and gaps in support (for example Cox et al, 2019; National Preparedness Commission, 2021; Oostlander, Bournival and O'Sullivan, 2020).

Primary theme 3: Manage in changing environments

Our third primary theme focuses on the purpose of WoSR capacities and capabilities that essential businesses and society develop for managing WoSR in changing environments. Evidence from publications describe this primary theme through one thematic category (axial code) (Table 2): ‘adapt and advance’, explained by two interrelated open codes detailed below.

Thematic category 5: Adapt and advance

To adapt, the systems that exist within essential businesses should be flexible to their changing business environment (Genik and Godsoe, 2015). Here, to adapt is for essential businesses to *prepare for, respond to, and recover from* disruption (Asia-Pacific Center for Security Studies, 2023; HM Government, 2021). Focusing on local recovery, McClelland et al (2022) illustrate that the COVID-19 environments which essential businesses operated in were continuously changing and creating cascading disruption. Many such disruptions are beyond the influence of essential businesses such as climate and ecological events (HM Government, 2023b), wide-scale health-related events such as pandemics (Wernli et al, 2021; Wang et al, 2022), or widespread technological hazards and major incidents like power outages and cyber incidents (Pöyhönen et al, 2019). Essential businesses manage WoSR in changing business environments and should focus on the impacts arising from many types of hazards rather than a single, specific, forecasted event.

To advance, WoSR activities should work to transform essential businesses’ approach to resilience so that they can *innovate through renewal* to strengthen their resilience to future disruption (United Nations, 2017; Vieira et al, 2019; Yanakiev et al, 2018). Innovation, for Acciarini et al (2021), involves strategic transformation such as the configuration of new business models and strategies for WoSR for which the broad-based knowledge of partnerships is crucial. McClelland et al’s (2022) framework advises that renewal through WoSR includes essential businesses delivering transactional (short-term) and transformational (long-term) activities across a range of disruptions and impacts. Through adapting and advancing, essential

businesses aim to deal with impacts no-matter what happens, where and when – meaning WoSR is a generic capability for all times and disruptions.

A framework representing the operationalization of WoSR in changing environments

To integrate these findings from our S-SLR, Figure 3 offers a framework to operationalize WoSR. Our findings illustrate that WoSR is a multi-level concept (Addy et al, 2014; Dubb, 2020; World Health Organization, 2009) so we present Figure 3 as a neutral framework that can be translated to all levels including networks, essential businesses, government, organizations, communities, individuals and their cross-cutting relationships at multiple scales (local, regional, national, global). Next, we discuss our framework’s application to essential businesses.

-----INSERT FIGURE 3 HERE-----

DISCUSSION

Ambitions for whole-of-society resilience articulate a new vision for multi-level system resilience in which there is a new prominence on the role of essential businesses. We first discuss our answer to RQ1 by explaining our framework (Figure 3), leading to a definition of whole-of-society resilience to disruption. Then we address RQ2 by discussing the implications for essential businesses and respond to RQ3 by considering the implications for policy.

Operationalizing WoSR

Our primary themes (below in-text in **bold**) and their sub-ordinate codes inform Figure 3 which presents our framework to operationalize WoSR answering RQ1 ‘*What is the role of essential businesses in operationalizing WoSR?*’. Although our framework is applicable to different levels of a multi-level society, we discuss our framework through the lens of essential businesses. Our framework begins in the center of Figure 3 by essential businesses contributing to a capability that strives to meet society’s essential needs in a disruption. These essential

needs may be new, or have heightened demand, as a result of the impacts of the disruption (World Bank, 2023).

Our framework is presented in quadrants and the following discussion enunciates our theory. We begin by discussing Quadrants 1 and 2 which sit under Primary Theme 1 that essential businesses should **align with local cross-sector partnerships** through which they can work collaboratively to design and implement WoSR (Kim et al, 2022; Uhnöo and Persson, 2021). In Quadrant 1, ‘work through cross-sector partnerships’ first requires essential businesses to understand their own priorities and the priorities of others to identify partners from diverse sectors with which they can align on a collective ambition for WoSR to establish their partnership. WoSR is operationalized by that partnership via its local actors which contribute their insight of the essential needs that may arise in their society from a disruption. That partnership should coordinate roles and objectives across multiple levels of society (Addy et al, 2014) including networks, essential businesses, government, organizations (including non-profit), communities and individuals (United Nations, 2019). Through partnerships, essential businesses share responsibility for WoSR, such as their responsibility for continuity, and should endeavor to balance their firm’s economic priorities with their social responsibilities (Zackery et al, 2022). In Quadrant 2, ‘coordinate to manage delivery’, cross-sector partnerships should establish local governance to support their effective collaborative working (Panneer et al, 2021). Governance should also seek to balance the impact of disruption on the internal operations of essential businesses to assure continuity (Tómasson, 2022). Partners should agree the partnership strategy and outline the expectations on essential businesses and partners to deliver WoSR (European Parliament, 2021). Partnerships should co-produce strategy and the corresponding coordination and management of WoSR activities (World Health Organization, 2017b). This coordination should work horizontally (across diverse partners) and vertically (across multiple societal levels) through systems that integrate

core delivery functions. WoSR strategy should include strategic and tactical leadership of management and communication systems for WoSR, and intelligence on risk and essential needs (Lin et al, 2015; Waldman, 2018; World Bank, 2021).

Quadrants 3 and 4 sit under Primary Theme 2 that essential businesses should **support the provision of essential services**. In Quadrant 3, ‘deliver against essential needs’, essential businesses should identify where they can effectively contribute to the essential needs that occur in all parts of society, including in their supply chain, customer base, and impacted employees (Codreanu et al, 2021). Delivery should understand and reduce risk (Genik and Godsoe, 2015), pinpoint essential needs and changes therein (Lillywhite and Wolbring, 2022), enhance preparedness for the next disruption (Eyerkauffer et al, 2016), and raise awareness of the need for continuing resilience (Kitagawa, 2019b). Our findings show that the intelligence-led partnerships that involve essential businesses should understand their changing socio-ecological (Folke, 2006), socio-economic (Council of Canadian Academies, 2022), and socio-technical (Pöyhönen et al, 2019) contexts. This will ensure that essential businesses are able to continually provide services to meet society’s changing essential needs in a disruption (European Parliament, 2021). In Quadrant 4, ‘mobilize targeted support’, essential businesses should develop capacity and capabilities to mobilize targeted support that assures continuity, addresses essential need, and reduces demand on services (World Bank, 2023). Publications discuss how specialized business capabilities can target specific business needs like infrastructure protection (Kitagawa, 2019a), while generic capabilities can provide all-hazards support like systems for providing business continuity advice, communicating warning and informing messages of impending incidents (Canadian Government, 2017; German Federal Government, 2016), and managing business volunteers (Waldman, 2018). WoSR capabilities mobilize systems to enhance the capacity of essential businesses to meet changing conditions during disruption, such as surging demand. Essential businesses should test these systems to

prepare, respond and recover from a disruption, including the management of business continuity and supporting the essential needs of vulnerable people (Finland Ministry of Defence, 2017).

In the outer circle of Figure 3 WoSR support is mobilized before, during, and after disruption to help society **adapt** and **advance** in **changing environments**. Practically, adaption includes delivering WoSR activities to enhance the preparedness, response, and recovery of internal and societal operations (D’Andrea et al, 2022; Eyerkauffer et al, 2016). Here, adaption is the capacity of essential businesses to prepare, respond and recover in a way that builds their capacity to deal with disruption. This aligns with Folke and Berkes’ (1998: 12) classical definition of socio-ecological resilience as these systems cope with disruption by “absorb[ing] perturbations ... and changing”. For WoSR this change aims to be a positive move towards society’s advancement following disruption. To advance, is for essential businesses to renew (McClelland et al, 2022) after a disruption to strengthen the resilience of internal operations, for example, innovating business models and strategies (Acciarini et al, 2021). Renewal also describes advancement as involving strategic action to transform how an essential business addresses issues in its environment that exacerbate risk and vulnerability. The changing business environments in which essential businesses manage WoSR are portrayed in our framework by the green arrows, representing the dynamic, processual nature of WoSR to disruption (Addy et al, 2014; Lee and Nakamura, 2021). Efforts to manage WoSR and organize capabilities to mobilize support for prioritized essential needs are not static and should be continuously reviewed against changing business environments. The capability of essential businesses to prepare for all-hazards signals their capacity to adapt and advance, thus we conceptualize WoSR as a generic capability to manage WoSR to disruption (Helfgott, 2018; Kikkert and Lackenbauer, 2021). Our framework provides conceptual clarity to define WoSR as:

capability that *targets support for essential needs* to help society *adapt* and *advance* in a *changing environment*

While this definition is relevant to essential businesses, it is not limited to that level as it is equally relevant to multiple levels of society including networks, public and voluntary sector organizations, communities, and individuals. But, following the focus of this article, next we explore the implications for essential businesses of their role in WoSR.

Implications for essential businesses in delivering whole-of-society resilience

To address RQ2 ‘*What are the implications for essential businesses of their role in delivering whole-of-society resilience to disruption?*’, Figure 3 shows how essential businesses are integral to the cross-sector partnerships and management processes required to operationalize WoSR. But, essential businesses are not just delivery partners – they will also benefit from the multi-level resilience system that WoSR strategy sets out to achieve (World Health Organization, 2009) including benefits to stabilize their business environment and support their employees, customers, and suppliers (National Preparedness Commission, 2021).

Our analysis identifies two primary implications for essential businesses of their role in WoSR. We frame these implications by integrating the internal and external organizational perspectives which are evident in each of Quadrants 1-4. WoSR should underpin a dual assurance that essential businesses are: (1) internally resilient - an internal assurance that maintains business continuity and delivery of essential services during a disruption (Tómasson, 2022); (2) strengthening external resilience - an external assurance where essential businesses contribute to, and benefit from, the resilience of the environment on which it depends for its own continuity (Folke, 2006). As examples of the latter, Rahman et al (2023) recommend flexible supply chains to meet demand surges and Williams et al (2021) discuss strategies to support the resilience of the ecosystems they depend on. We next explore these perspectives and discuss how essential businesses can fulfill their role in WoSR.

Essential businesses are lead actors in the network of WoSR support that society depends on to meet their essential needs in disruption and, thus, their internal assurance of their organizational resilience is paramount (North Atlantic Treaty Organization, 2020; World Bank, 2020). Organizational resilience is conceptualized by Hillmann and Guenther (2021) and Caiazza et al (2021) as the capacity of essential businesses to respond to disruption by mobilizing resources to maintain key business functions. Resources that essential businesses can develop that contribute to their internal continuity are found by Raetze et al (2021) and Williams et al (2017) to include: knowledge, skills, economic and structural resources, strategic practices, and innovative capacities. How organizations strategically mobilize resource to strengthen their resilience is conceptualized by business scholars through the capability perspective (Duchek, 2020; Haarhaus and Lienen, 2020) exemplified by Williams et al (2017) as self-organization and self-help capability. Extending the capability perspective, Duchek (2020: 216) frames the multiple capabilities that essential businesses require in relation to different phases of disruption and term this “meta-capability”. According to this perspective, to assure continuity and delivery of essential services for WoSR, essential businesses should: (1) anticipate by monitoring business environments to mitigate threats and inform continuity planning; (2) rapidly respond by activating plans and self-organize by coordinating through wider networks; and (3) utilize disruption to encourage change and improve adaptive capacity by implementing learning (Ibid). WoSR, according to Deloitte (2023), provides essential businesses with opportunities to interrogate their existing approach to organizational resilience and establish new strategic priorities and capabilities that align with their ambitions on WoSR. Exercising continuity plans should strengthen how essential businesses understand disruptive impacts, the efficacy of businesses to deal with those through business continuity (Ibid), and the implications of their service interruption or failure on the resilience of service users with essential needs (Wiśniewski et al, 2023).

Scholars, for example Williams et al (2021), highlight that research on organizational resilience has focused on organizational-level analysis. This primarily internal perspective is noted by Beninger and Francis (2022: 229) as contributing to a bounded framing (Hill, 2010) of essential businesses as “self-contained” economic actors (Porter and Kramer, 2011) separated from, as opposed to embedded in, wider socio-ecological contexts (Folke, 2006). Reflecting these observations, business scholars advocate for further research on the external contextual factors in business environments that interact with and impact on internal organizational resilience (Brueller et al, 2019; Linnenluecke, 2017). For example, illustrating the dependence of organizations on their socio-ecological environments, Williams et al (2021: 95) present “cross-scale systemic” perspective that essential businesses can adopt to inform strategies that strengthen their own continuity, enhance the resilience of their business environments, and contribute to WoSR. Our framework shows that by collaborating with whole-of-society, essential businesses can contribute capacity and capabilities to WoSR and benefit directly from the collective capacity and capabilities generated. This benefit, Hall and Lamont (2013) and Williams et al (2017) describe, creates a dynamic interaction that enables the whole system to mobilize collective adaptation. Beninger and Francis (2022) articulate this through a framework of integrated capitals, such as financial and human, that provide dual roles to support internal resilience and contribute externally to their wider business environments.

Our findings establish that essential businesses take responsibility for the continuity of their services on which WoSR depends. Scherer et al (2014) and Schrempf-Stirling (2018) argue that, as economic actors providing societal services, essential businesses are politicized by policies like WoSR which position them as pseudo-governmental entities with responsibility to deliver obligations that were traditionally government’s. WoSR expectations challenge essential businesses to reformulate strategies and practices to balance their profit-making objectives with their responsibility to contribute to the resilience of their business environment

for their own and society's benefit. A further tension that challenges essential businesses in their role in WoSR is that, for Crane and Matten (2021), essential businesses contribute to societal risk, yet WoSR identifies them as key contributors to the solutions required to overcome risk. This requires responsible practices from essential businesses which, Wiśniewski et al (2023) note, should minimize potential harm that their business operations might cause if they fail. Such practices, for Folke (2006) and the Council of Canadian Academies (2022), can prioritize the stewardship of natural resources on which essential businesses' provision of essential services rely.

Corporate social responsibility (CSR) has emerged as a popular mechanism through which many essential businesses create value for both the organization and their business environments (Zackery et al, 2022). CSR activities that contribute social value are described by Mahmud et al (2021) as corporate philanthropic and charitable initiatives such as spontaneous donations that support needs in a disruption. However, recent scholarly debate questions the predominance of CSR measurement through firm-level benefits and whether CSR actually delivers against its ambition of creating societal value and impact (Barnett, Henriques and Husted, 2020; Brammer, Branicki and Linnenluecke, 2020; Crane and Matten, 2021). The WoSR agenda challenges essential businesses to rethink CSR activities and adapt, in Wickert's (2021: 2) term, from "business-centric" to "society-centric" activities and our framework in Figure 3 outlines key aspects to accomplish such a movement. By working with cross-sector partnerships that have intelligence on society's essential needs (Dentoni et al, 2021), essential businesses can enhance their understanding of what public value WoSR requires them to contribute (Deloitte, 2023) and thereby design strategies and social responsibility practices on how to create that value through WoSR. Scholarship would benefit from empirical examination of the proactive contributions of essential businesses to WoSR

beyond CSR and entrepreneurial activities initiated for resilience rather than solely in response to a disruption.

Bringing together these strands, our article's second contribution focuses on four implications for WoSR of the role of essential businesses as: (1) critical in the network of support to address society's essential needs; (2) a core delivery partner providing capacity and capability; (3) a beneficiary of WoSR for their own continuity; (4) a contributor of risks that jeopardize society's smooth functioning. This implies that, to fulfil their role in delivering WoSR, essential businesses should:

*establish **capabilities** before, during, and after a disruption that support **business continuity** and the **external systems** on which they rely to **reduce risk** and **create value***

This translation of WoSR for essential businesses reflects the priorities of these businesses and positions essential businesses as a key contributor to societal risk and WoSR to disruption.

From policy rhetoric to practical action

We now focus on RQ3 '*What are the implications for policy of essential businesses' role in whole-of-society resilience to disruption?*'. Policy's use of 'whole-of' creates the rhetorical appeal of WoSR. The political necessity of 'whole-of' is understandable because government cannot leave parts of society behind (Lillywhite and Wolbring, 2022) and when framed as 'who should be involved', encourages a vague broadening of partners that includes "all sectors" (Liang et al, 2018: 4) and "everyone in society" (Oostlander et al, 2020: 4). However, this vagueness obscures its operationalization by failing to pinpoint a starting point which undermines the careful selection of cross-sector partnerships and corresponding targeting of essential needs. Most essential businesses have resilience and can activate this before, during and after a disruption to help themselves and support their supply chains, customers, and employees (Acciarini et al, 2021). Other essential businesses are less resilient and lack the capacity to reduce their own risk and vulnerability to the impacts of disruption (Rodrigues et al, 2021). For example, disruption can exacerbate continuity challenges to micro- and small-

medium enterprises including access to cash, human capital, and digital technologies (Ibid). These essential businesses are more vulnerable, have specific needs, and require targeted support to enhance their resilience.

From this perspective, the ‘whole-of’ aspect is problematic as the essential business sector and society are broad, heterogenous and formed of complex systems that differ in their advancement, pace, and resource (Kong and Sun, 2021; Wernli et al, 2021). But policy’s rhetorical use of ‘whole-of’-society resilience suggests homogeneity which sets a blanket and unrealistic ambition that could demoralize business leaders, especially where essential businesses think they are in the early stages of building resilience. Also, homogenization distracts from essential businesses that are providing essential services to meet essential needs, putting equal focus everywhere irrespective of risk, vulnerability, or essentiality. With this, literature defines a starting point for policy and practice as targeted action (McClelland et al, 2022) to identify who/where requires support, their essential needs, which actors can address those needs, and what capabilities are required. Framed as “for whom and by whom” provides essential businesses and society with the goal to operationalize WoSR as a capability (Helfgott, 2018: 854). Thus, we find that national WoSR policy should provide the strategic directive of targeted action through which essential businesses deploy resources to meet essential needs.

Cross-sector partnerships are key as essential businesses working alone cannot reach all of society’s essential needs so support from local partners is required to target action at local risks and essential needs. Strategic, cross-sector partnership working should include essential businesses providing knowledge and resource (Eyerkauf et al, 2016), and public/non-profit organizations providing insight to local essential needs (United Nations, 2023). However, cross-sector partnerships cannot assume responsibility for WoSR and deliver it in a top-down manner. Our findings uncover a tension of shared responsibility within the literature which can translate as shifting responsibility from government to networks, organizations, communities,

and individuals without all societal actors having adequate input and the capability to help themselves and others (Atkinson and Curnin, 2020). This devolution is observed as “responsibilization” by Pitidis, Coaffee and Bouikidis (2022: 699), which they argue reinforces existing governance arrangements and power relations that recycle structural inequalities and prevent society from self-determining resilience.

The Council of Canadian Academies (2022: xxi) argue that policy should provide a “clear delineation of responsibility among actors”. But responsibility should not be assigned to essential businesses without the corresponding cascade of support (North Atlantic Treaty Organization, 2021). While WoSR should not be a form of blanket responsibilization, it can mobilize renewed governance structures and relations by strategic cross-sector partnerships (World Health Organization, 2019). National policy implications include the direct involvement of essential businesses in the design and implementation of WoSR policies and governance systems to encourage ownership and the cascade of support, local knowledge, and capabilities to mobilize resources (Atkinson and Curnin, 2020). Guidance and flexible frameworks (Kong and Sun, 2021) should accompany this delineation of responsibility covering accountability, assurance, and risk standards (HM Government, 2022). For example, guidance on how to establish cross-sector partnerships, processes for joint-decision making, governance arrangements, management and communication systems, conflict resolution, and evaluation of partnership value (World Health Organization, 2012).

CONCLUSION

As whole-of-society resilience moves from policy rhetoric to practical delivery (HM Government, 2023c) and scholarly attention matures (Figure 2), early definition and conceptualization of the term for essential businesses and society is crucial to inform policy development on its operationalization.

Figure 3 provides a foundation for future research, beginning with empirical examination of the multi-level application of our framework to whole-of-society. Our findings provide

strong support for the application of our framework to multiple levels of society - including government, organizations, communities and individuals – and future empirical research to test this framework would strengthen this suggestion. Furthermore, although academic and policy literature provide broad geographical scope, this framework would benefit greatly from application in diverse societal contexts. Future research should explore the processes that successfully support cross-sector partnerships in their design, implementation, management, and evaluation of strategy for WoSR. This includes processes to identify strategic cross-sector partners which essential businesses require to collectively agree the vision, aims and objectives that will inform the strategy to operationalize WoSR to disruption as a capability. Research should also explore the nature of those partnerships to co-produce governance arrangements for implementation, the management of, and the process for evaluating WoSR.

Enacting WoSR will challenge which essential businesses, partners, and people in society are involved, their motivations, how power dynamics influence direction and outcomes, and how conflicting priorities are addressed (Brinkerhoff and Brinkerhoff, 2011). Thus, three further lines of inquiry emerge in this respect: the extent to which collaboration across essential businesses, government, organizations, communities and individuals is enabled; WoSR modes of collaborative governance; and how shared responsibility is distributed, managed, measured, and accounted for (Genik and Godsoe, 2015). Finally, future research should examine the processes that support essential needs in this endeavor by examining how local strategy translates into targeted activities. For example, questioning: By and for whom are WoSR practices initiated? Which businesses are deemed essential by society? How is the interdependence of essential businesses and society prioritized in WoSR? How are essential needs identified and what inequalities are evident in this respect? The way in which these questions translate through WoSR design and implementation will determine whether WoSR has a substantive impact on the resilience of essential businesses and society.

Bibliography A: S-SLR literature

This is the bibliography for the 114 publications selected for the S-SLR. The articles cited in this article that are not part of the 114 S-SLR publications can be found in Bibliography B: Supporting literature.

- Acciarini, C., Boccardelli, P. & Vitale, M. (2021). Resilient companies in the time of Covid-19 pandemic: a case study approach. *Journal of Entrepreneurship and Public Policy*, 10(3): 336-351.
- Addy, N. A., Poirier, A., Blouin, C., Drager, N., & Dubé, L. (2014). Whole-of-society approach for public health policymaking: a case study of polycentric governance from Quebec, Canada: Whole-of-society approach for public health policymaking. *Annals of the New York Academy of Sciences*, 1331(1): 216–229.
- Al-Mulki, J. M., Hassoun, M. H., & Adib, S. M. (2022). Epidemics and local governments in struggling nations: COVID-19 in Lebanon. *PloS One*, 17(1): e0262048.
- Appleby, J. K. (2020). Implementation of the Global Compact on Safe, Orderly, and Regular Migration: A Whole-of-Society Approach. *Journal on Migration and Human Security*, 8(2): 214–229.
- Association of Southeast Asian Nations (2021). *What it takes to build pandemic-proof and resilient cities*. Available at: <https://theaseanmagazine.asean.org/article/hugh-lim/> (Accessed 3 August 2023)
- Asia-Pacific Center for Security Studies (2023). *Experts from Europe and Indo-Pacific Collaborate to Strengthen Whole-of-Society Resilience*. Available at: <https://dkiapcss.edu/experts-from-europe-and-indo-pacific-collaborate-to-strengthen-whole-of-society-resilience/> (Accessed 3 August 2023)
- Bangladesh Government (2020). *National Plan for Disaster Management*. Government of the People's Republic of Bangladesh. Available at: https://modmr.portal.gov.bd/sites/default/files/files/modmr.portal.gov.bd/page/a7c2b9e1_6c9d_4ecf_bb53_ec74653e6d05/NPDM2021-25%20DraftVer5_23032020.pdf (Accessed 3 August 2023)
- Bednarska-Olejniczak, D., Olejniczak, J. & Klímová, V. (2021). Grants for Local Community Initiatives as a Way to Increase Public Participation of Inhabitants of Rural Areas. *Agriculture*, 11(11): 1060-.
- Bento, F. & Couto, K.C. (2021). A behavioral perspective on community resilience during the covid-19 pandemic: The case of paraisópolis in São Paulo, Brazil. *Sustainability (Basel, Switzerland)*, 13(3): 1447–.

- Bergstrom, J. (2018). An archaeology of societal resilience. *Safety Science*, 110, p 31–38.
- British Red Cross (2022). *Policy into practice: Implementing humanitarian priorities in the Global Compact for Safe, Orderly and Regular Migration*. Available at: <https://www.redcross.org.uk/-/media/documents/about-us/what-we-do/policy-into-practice-global-compact-migration.pdf> (Accessed 3 August 2023)
- Bromley, E., Eisenman, D. P., Magana, A., Williams, M., Kim, B., McCreary, M., Chandra, A., & Wells, K. B. (2017). How Do Communities Use a Participatory Public Health Approach to Build Resilience? The Los Angeles County Community Disaster Resilience Project. *International Journal of Environmental Research and Public Health*, 14(10): 1267–.
- Brunk, D. (2016). ‘Whole-of-society’ peacebuilding: A new approach for forgotten stakeholders. *International Journal (IJ): Canada’s Journal of Global Policy Analysis*, 71(1): 62–87.
- Canadian Government (2017). *An Emergency Management Framework for Canada*. Emergency Management Policy and Outreach Directorate. Available at: <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/2017-mrgnc-mngmnt-frmwrk/index-en.aspx> (Accessed 3 August 2023)
- Cázarez-Grageda, K. (2018). *The Whole of Society Approach: Levels of Engagement and Meaningful Participation of Different Stakeholders in the Review Process of the 2030 Agenda*. Partners for Review (P4R), Germany. Available at <https://sdghelpdesk.unescap.org/sites/default/files/2018-11/Whole-of-Society-P4R-Discussion-Paper-Oct.-2018-1.pdf> (Accessed 15 May 2023)
- Codreanu, A., Antonoaie, C., & Vasilescu, C. (2021). Resilience: a multi level approach and its relevance for the development of organization focused resilience frameworks. *Journal of Defense Resources Management*, 12(2): 7-24.
- Colgan, A., Kennedy, L., Doherty, N. (2015). *A primer on implementing whole of government approaches*. Dublin, Ireland: Centre for Effective Services. Available at <https://www.scie-socialcareonline.org.uk/a-primer-on-implementing-whole-of-government-approaches/r/a11G000000CTYotIAH> (Accessed 15 May 2023)
- Commonwealth of Australia (2011). ‘*National Strategy for Disaster Resilience: Building the Resilience of Our Nation to Disasters*’, Council of Australian Governments, Available at: <https://www.homeaffairs.gov.au/emergency/files/national-strategy-disaster-resilience.pdf> (Accessed 15 May 2023).

- Council of Canadian Academies (2022). *Building a Resilient Canada, Ottawa (ON)*. The Expert Panel on Disaster Resilience in a Changing Climate, Council of Canadian Academies. Available at: <https://www.cca-reports.ca/wp-content/uploads/2022/01/Building-a-Resilient-Canada-web-EN.pdf> (Accessed 3 August 2023)
- Council of the European Union (2023). *Council conclusions on strengthening whole-of-society resilience in the context of civil protection, including chemical, biological, radiological and nuclear (CBRN) preparedness*. Available at: <https://data.consilium.europa.eu/doc/document/ST-10048-2023-INIT/en/pdf> (Accessed 3 August 2023)
- Cox, R. S., Hill, T. T., Plush, T., Heykoop, C., & Tremblay, C. (2019). More than a checkbox: engaging youth in disaster risk reduction and resilience in Canada. *Natural Hazards (Dordrecht)*, 98(1): 213–227.
- D’Andrea, A., Grifoni, P., & Ferri, F. (2022). FADM: A feasible approach to disaster management. *Development Policy Review*, 1-22.
- Domicelj, T. & Gottardo, C. (2019). *Implementing the Global Compacts: the importance of a whole-of-society approach*. Forced Migration Review. Available at <https://www.fmreview.org/education-displacement/domicelj-gottardo> (Accessed 15 May 2023)
- Dubb, S.S. (2020). Coronavirus pandemic: applying a whole-of-society model for the whole-of-the world. *British Journal of Oral & Maxillofacial Surgery*, 58(7): 838–842.
- Elavarasan, R. M., Pugazhendhi, R., Shafiullah, G. M., Irfan, M., & Anvari-Moghaddam, A. (2021). A hover view over effectual approaches on pandemic management for sustainable cities – The endowment of prospective technologies with revitalization strategies. *Sustainable Cities and Society*, 68: 102789–.
- European Parliament (2021). *Best Practices in the whole-of-society approach in countering hybrid threats..* Available at [https://www.europarl.europa.eu/thinktank/en/document/EXPO_STU\(2021\)653632](https://www.europarl.europa.eu/thinktank/en/document/EXPO_STU(2021)653632) (Accessed 15 May 2023)
- Eyerkauffer, M.L., Lima, F.S. and Gonçalves, M.B. (2016). Public and private partnership in disaster risk management. *Jàmbá: Journal of Disaster Risk Studies*, 8(1), p 1-10.
- Federal Emergency Management Agency (2011). *A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action*. Available at

https://www.fema.gov/sites/default/files/2020-07/whole_community_dec2011_2.pdf

(Accessed 15 May 2023)

Finland Ministry of Defence (2017). *The Security Strategy for Society*. The Security Committee. Available at: https://turvallisuuskomitea.fi/wp-content/uploads/2018/04/YTS_2017_english.pdf (Accessed 3 August 2023)

Fogg, P. (2021). Learning lessons: school communities as points of connection in a “whole of society” pandemic response. *Pastoral Care in Education, ahead-of-print*(ahead-of-print), 1–26.

Friends of Europe (2022). *21st century warfare: a whole of society approach to resilience*. Available at: https://www.friendsofeurope.org/wp/wp-content/uploads/2022/04/06-01-PSD-Expert-briefing-Whole-of-society-resilience_event-report.pdf (Accessed 3 August 2023)

Gavari-Starkie, E., Casado-Claro, M.-F., & Navarro-González, I. (2021). The Japanese Educational System as an International Model for Urban Resilience. *International Journal of Environmental Research and Public Health*, 18(11): 5794–.

Généreux, M., Petit, G., Roy, M., Maltais, D., & O’Sullivan, T. (2018). The “Lac-Mégantic tragedy” seen through the lens of the EnRiCH Community Resilience Framework for High-Risk Populations. *Canadian Journal of Public Health*, 109(2): 261–267 .

Genik, L. & Godsoe, M. (2015). *Implementing Whole-of-Society Resilience: Observations from a Case Study in Pemberton Valley*. In *Strategies for Supporting Community Resilience: Multinational Experiences*, p.235-261. Defence Research and Development in Canada. Available at https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805839_A1b.pdf (Accessed 27 June 2023)

Haldane, V., Jung, A.-S., Neill, R., Singh, S., Wu, S., Jamieson, M., Verma, M., Tan, M., De Foo, C., Abdalla, S. M., Shrestha, P., Chua, A. Q., Nordström, A., & Legido-Quigley, H. (2021). From response to transformation: how countries can strengthen national pandemic preparedness and response systems. *BMJ (Online)*, 375: e067507–

HM Government (2021). *Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development and Foreign Policy*. Available at <https://www.gov.uk/government/publications/global-britain-in-a-competitive-age-the-integrated-review-of-security-defence-development-and-foreign-policy> (Accessed 12 December 2022)

HM Government (2022). *The UK Government Resilience Framework*. Cabinet Office. Available at: <https://www.gov.uk/government/publications/the-uk-government->

- [resilience-framework/the-uk-government-resilience-framework-html](#) (Accessed 19 December 2022)
- HM Government (2023a). *Crisis Communications: Operating Model*. Government Communication Service. Available at <https://gcs.civilservice.gov.uk/publications/crisis-communications-operating-model/> (Accessed 27 June 2023)
- HM Government (2023b). *National Risk Register*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1175834/2023_NATIONAL_RISK_REGISTER_NRR.pdf (Accessed 3 August 2023).
- Hsieh, C.-W., Wang, M., Wong, N. W., & Ho, L. K. (2021). A whole-of-nation approach to COVID-19: Taiwan's National Epidemic Prevention Team. *International Political Science Review*, 42(3): 300–315.
- International Committee of the Red Cross (ICRC) (2017). *The “Preventing and Countering Violent Extremism” approach: a Guidance Note for National Societies*. Available at: <https://www.icrc.org/en/document/guidance-note-national-societies-preventing-and-countering-violent-extremism-approach> (Accessed 3 August 2023)
- International Displacement Monitoring Centre (IDMC) (2018). *UnSettlement: Urban displacement in the 21st century – Towards local assessments of urban disaster displacement risk*. Norwegian Refugee Council. Available at: https://www.internal-displacement.org/sites/default/files/publications/documents/IDMC_AnalyticalFramework_final.pdf (Accessed 3 August 2023)
- International Institute for Sustainable Development (IISD) (2021). *Advancing the Climate Resilience of Canadian Infrastructure: A review of literature to inform the way forward*. Available at: <https://www.iisd.org/system/files/2021-07/climate-resilience-canadian-infrastructure-en.pdf> (Accessed 3 August 2023)
- Kikkert, P., & Lackenbauer, P. W. (2021). A Great Investment in Our Communities: Strengthening Nunavut's Whole-of-Society Search and Rescue Capabilities. *Arctic*, 74(3): 258–275.
- Kim, S., Goh, Y., & Kang, J. H. B. (2022). Moving toward a common goal via cross-sector collaboration: lessons learned from SARS to COVID-19 in Singapore. *Globalization and Health*, 18(1): 1-18.
- Kindornay, S. & Kocaata, Z. (2019). *A whole-of-society approach: Partnerships to realize the 2030 agenda*. Vancouver and Ottawa: British Columbia Council for International Cooperation and Canadian Council for International Co-operation. Available at:

<https://www.bccic.ca/wp-content/uploads/2019/06/International-Partnership.pdf>

(Accessed 15 May 2023)

- Kitagawa, K. (2019a). Co-constructing a narrative of ‘never give up’ in preparing for a mega-tsunami: An exemplar of ‘all-of-society engagement’? *Geosciences (Basel)*, 9(12): 486–
- Kitagawa, K. (2019b). Questioning ‘integrated’ disaster risk reduction and ‘all of society’ engagement: can ‘preparedness pedagogy’ help? *Compare*, 49(6): pp.851–867.
- Kjellen, M. et al (2023). *Governance: A ‘Whole-of-Society’ Approach*. UNESCO. Available at <https://cris.unu.edu/governance-%E2%80%98whole-society%E2%80%99-approach> (Accessed 15 May 2023)
- Kong, F. & Sun, S. (2021). Understanding the Government Responsibility and Role of Enterprises’ Participation in Disaster Management in China. *Sustainability*, 13(4): 1708–
- Korosteleva, E. A. (2020). Paradigmatic or critical? Resilience as a new turn in EU governance for the neighbourhood. *Journal of International Relations and Development*, 23(3): 682–700.
- Laitinen, J., Katko, T. S., Hukka, J. J., Juuti, P., & Juuti, R. (2022). Governance and Practices for Achieving Sustainable and Resilient Urban Water Services. *Water (Basel)*, 14(13):2009–.
- Lee, A., & Nakamura, K. (2021). Engaging Diverse Community Groups to Promote Population Health through Healthy City Approach: Analysis of Successful Cases in Western Pacific Region. *International Journal of Environmental Research and Public Health*, 18(12): 6617–
- Liang, F., Guan, P., Wu, W., Liu, J., Zhang, N., Zhou, B.-S., & Huang, D.-S. (2018). A review of documents prepared by international organizations about influenza pandemics, including the 2009 pandemic: a bibliometric analysis. *BMC Infectious Diseases*, 18(1): 383–.
- Lillywhite, B. & Wolbring, G. (2022). Emergency and Disaster Management, Preparedness, and Planning (EDMPP) and the ‘Social’: A Scoping Review. *Sustainability*, 14(20): 13519–.
- Lin, L., Nilsson, A., Sjölin, J., Abrahamsson, M., & Tehler, H. (2015). On the perceived usefulness of risk descriptions for decision-making in disaster risk management. *Reliability Engineering & System Safety*, 142: 48–55.
- London Councils (2023). *Member briefing: UK Resilience Framework*. Available at: <https://www.londoncouncils.gov.uk/our-key-themes/leadership-devolution-and-democracy/member-briefing-uk-resilience-framework> (Accessed 3 August 2023)

- López-Gunn, E., Swinkels, J. R. ., Anzaldúa, G., Bea, M., Colaço, M. C., Deksne, M., Lalaj, N., McDonald, H., & Rica, M. (2021). Communities of innovation for climate change adaptation and disaster risk reduction: Niche creation and anticipation. *Sustainability (Basel, Switzerland)*, 13(9): 5180–.
- Månsson, P., Abrahamsson, M., Hassel, H., & Tehler, H. (2015). On common terms with shared risks – Studying the communication of risk between local, regional and national authorities in Sweden. *International Journal of Disaster Risk Reduction*, 441–453.
- Matsuoka Y. & Rocha, E. G. (2021). The role of non-government stakeholders in implementing the Sendai Framework: A view from the voluntary commitments online platform. *Progress in Disaster Science*, 9: 100142–.
- McClelland, A. G., Jordan, R., Parzniewski, S., Shaw, D., O’Grady, N., & Powell, D. (2022). Post-COVID recovery and renewal through whole-of-society resilience in cities. *Journal of Safety Science and Resilience*, 3(3): 222–228.
- Meszaros E. L. & Toca C. V. (2020). The EU’s multifaceted approach to resilience building in the Eastern Neighbourhood. Security sector reform in Ukraine. *Eastern Journal of European Studies*, vol. 11, no. Special Issue, 2020: 120-.
- Moungar V, & Baldeh, Y. (2020). *A whole of society approach: Women are key to building resilient communities beyond COVID-19 – A joint Op-Ed*. World Development Bank Group. Available at: <https://www.afdb.org/en/news-and-events/whole-society-approach-women-are-key-building-resilient-communities-beyond-covid-19-joint-op-ed-vanessa-moungar-and-yero-baldeh-38961> (Accessed 3 August 2023)
- Moya, J., & Goenechea, M. (2022). An Approach to the Unified Conceptualization, Definition, and Characterization of Social Resilience. *International Journal of Environmental Research and Public Health*, 19(9), 5746–.
- National Preparedness Commission (2021). *Partnering with purpose*. Available at: https://www.marshmcLennan.com/content/dam/mmc-web/insights/publications/2021/november/Marsh_McLennan-National_Preparedness_Commission_Partnering-with-Purpose_vF.pdf (Accessed 3 August 2023)
- North Atlantic Treaty Organization (2020). *Building transatlantic resilience: Why critical infrastructure is a matter of national security*. Available at: https://www.nato.int/cps/en/natohq/opinions_180067.htm (Accessed 3 August 2023)
- North Atlantic Treaty Organization (2021). *Enhancing the resilience of allied societies through civil preparedness*. Available at: <https://www.nato-pa.int/download->

- [file?filename=/sites/default/files/2021-04/011%20CDS%2021%20E-%20RESILIENCE%20THROUGH%20CIVIL%20PREPAREDNESS_0.pdf](file?filename=/sites/default/files/2021-04/011%20CDS%2021%20E-%20RESILIENCE%20THROUGH%20CIVIL%20PREPAREDNESS_0.pdf) (Accessed 3 August 2023)
- O’Sullivan, T. L., Corneil, W., Kuziemy, C. E., & Toal-Sullivan, D. (2015). Use of the Structured Interview Matrix to Enhance Community Resilience Through Collaboration and Inclusive Engagement. *Systems Research and Behavioral Science*, 32(6): 616–628.
- O’Sullivan, T.L. & Phillips, K.P. (2019). From SARS to pandemic influenza: the framing of high-risk populations. *Natural Hazards (Dordrecht)*, 98(1): 103–117.
- Ongkowijoyo, C. & Doloi, H. (2017). Determining critical infrastructure risks using social network analysis. *International Journal of Disaster Resilience in the Built Environment*, 8(1): 5–26.
- Oostlander, S.A., Bournival, V. & O’Sullivan, T.L. (2020). The roles of emergency managers and emergency social services directors to support disaster risk reduction in Canada. *International Journal of Disaster Risk Reduction*, 51: 1-8.
- Organization for Security and Co-operation in Europe (2017). *Twenty-Fourth Meeting of the Ministerial Council*. Available at: <https://www.osce.org/files/f/documents/c/7/402209.pdf> (Accessed 3 August 2023)
- Organization for Security and Co-operation in Europe (2020) . *A Whole-of-Society Approach to Preventing and Countering Violent Extremism and Radicalization That Lead to Terrorism: A guidebook for Central Asia*. Organization for Security. Available at https://www.osce.org/files/f/documents/a/7/444340_0.pdf (Accessed 15 May 2023)
- Pan American Health Organization (2015). *Intersectional Action and Health Equity in Latin America: An Analytical Approach*. Available at <https://iris.paho.org/handle/10665.2/33873> (Accessed 15 May 2023)
- Panneer, S., Kantamaneni, K., Pushparaj, R. R. B., Shekhar, S., Bhat, L., & Rice, L. (2021). Multistakeholder participation in disaster management—the case of the covid-19 pandemic. *Healthcare (Basel)*, 9(2): 203–.
- Papademetriou, D. G. & Benton, M. (2016). *Towards a whole-of-society approach to receiving and settling newcomers in Europe*. Migration Policy Institute. Available at <https://www.migrationpolicy.org/research/towards-whole-society-approach-receiving-and-settling-newcomers-europe> (Accessed 15 May 2023)
- Pickering, C. J., Guy, E., Al-Baldawi, Z., McVean, L., Sargent, S., & O’Sullivan, T. (2021a). “I believe this team will change how society views youth in disasters”: the EnRiCH

- Youth Research Team: a youth-led community-based disaster risk reduction program in Ottawa, Canada. *Canadian Journal of Public Health*, 112(5): 957–964 .
- Pickering, C. J., Dancey, M., Paik, K., & O’Sullivan, T. (2021b). Informal Caregiving and Disaster Risk Reduction: A Scoping Review. *International Journal of Disaster Risk Science*, 12(2): 169–187.
- Pierobon, C. (2021). EU Efforts to Prevent Violent Extremism (PVE) by Engaging Civil Society in Kyrgyzstan. *Central Asian Affairs*, 8(2): 150–174.
- Pöyhönen, J. et al (2019). Cyber Situational Awareness and Information Sharing in Critical Infrastructure Organizations. *Information & Security*, 43(2), pp.236–256.
- Sagara, Y., Stables, T. & Baehr, L. (2022). *Building Resilience through a whole-of-society approach: COVID-19 pandemic response in East Asia*. Asia Pacific Initiative, The International House of Japan. Available at <https://apinitiative.org/en/east-asian-response-to-covid-19/> (Accessed 15 May 2023)
- Samaan, G., McPherson, M., Eidman, J., Obubah, O., Baptiste, J.-P., Kuppens, L., Von Harbou, K., Sembiring, M. F., Acharya, S., & Graaff, P. (2022). The World Health Organization’s Actions Within the United Nations System to Facilitate a Whole-of-Society Response to COVID-19 at Country Level. *Frontiers in Public Health*, 9: 1-7.
- Shmueli, D. F., Ozawa, C. P., & Kaufman, S. (2021). Collaborative planning principles for disaster preparedness. *International Journal of Disaster Risk Reduction*, 52: 1-8.
- Simpson, N.P., Shearing, C.D. & Dupont, B. (2019). Climate gating: A case study of emerging responses to Anthropocene Risks. *Climate Risk Management*, 26: 100196.
- South, J., Button, D., Quick, A., Bagnall, A.-M., Trigwell, J., Woodward, J., Coan, S., & Southby, K. (2019). Complexity and community context: Learning from the evaluation design of a national community empowerment programme. *International Journal of Environmental Research and Public Health*, 17(1): 91–.
- Sundelius, B. & Eldeblad, J. (2023). *Societal Security and Total Defense: The Swedish Way*. National Defense University Press. Available at <https://ndupress.ndu.edu/Media/News/News-Article-View/Article/3323928/societal-security-and-total-defense-the-swedish-way/> (Accessed 15 May 2023)
- German Federal Government (2016). *White Paper: On German security policy and the future of the Bundeswehr*. Available at: <https://ccdcoe.org/uploads/2018/10/2016-White-Paper-1.pdf> (Accessed 3 August 2023)
- Tómasson, B. (2023). Using business continuity methodology for improving national disaster risk management. *Journal of Contingencies and Crisis Management*, 31(1): 134–148.

- U.S. Government (2022). *Russia's invasion of Ukraine: Assessing the U.S. and International Response*. Committee on foreign relations, United States Senate. Available at: <https://www.congress.gov/117/chrg/CHRG-117shrg48350/CHRG-117shrg48350.pdf> (Accessed 3 August 2023)
- Uhnou, S., & Persson, S. (2022). The flip side of the coin: Perils of public–private disaster cooperation. *Journal of Contingencies and Crisis Management*, 30(4): 440-450.
- United Nations (2017). *Written contribution from Sweden: A whole of society response – a role for the private sector*. Sweden (Ministry of Foreign Affairs). Available at <https://www.unhcr.org/media/written-contribution-sweden-whole-society-response-role-private-sector> (Accessed 15 May 2023)
- United Nations (2019). *Resilience Dividend: Towards Sustainable and Inclusive Societies*. Available at: https://www.unisdr.org/files/66637_proceedingsen.pdf (Accessed 3 August 2023)
- United Nations (2021). *UN Common Guidance on Helping Build Resilient Societies*. Available at <https://unsdg.un.org/sites/default/files/2021-09/UN-Resilience-Guidance-Exec-Summ-Sept.pdf> (Accessed 15 May 2023)
- United Nations (2023). *Inclusive disaster risk reduction means resilience for everyone*. Available at <https://www.preventionweb.net/news/inclusive-disaster-risk-reduction-means-resilience-everyone> (Accessed 27 June 2023)
- Vieira, L. C., Serrao-Neumann, S., & Howes, M. (2019). Local action with a global vision: The transformative potential of food social enterprises in Australia. *Sustainability (Basel, Switzerland)*, 11(23): 6756–.
- Waldman, S., Yumagulova, L., Mackwani, Z., Benson, C., & Stone, J. T. (2018). Canadian citizens volunteering in disasters: From emergence to networked governance. *Journal of Contingencies and Crisis Management*, 26(3): 394–402.
- Wang, Y., Viseu Cardoso, R., & Forgaci, C. (2022). Urban Pandemic Vulnerability and COVID-19: A New Framework to Assess the Impacts of Global Pandemics in the Metropolitan Region of Amsterdam. *Sustainability (Basel, Switzerland)*, 14(7): 4284–.
- Weiland, L. V., Law, C., & Sunjka, B. P. (2020). Ensuring sustainable and resilient air traffic management systems for south Africa with complexity and whole-of-society theory approaches. *South African Journal of Industrial Engineering*, 31(3): 97–109.
- Wernli, D., Clausin, M., Antulov-Fantulin, N., Berezowski, J., Biller-Andorno, N., Blanchet, K., Böttcher, L., Burton-Jeangros, C., Escher, G., Flahault, A., Fukuda, K., Helbing, D., Jaffé, D., Sogaard Jørgensen, P., Kaspiarovich, Y., Krishnakumar, J., Lawrence, R. J.,

- Lee, K., Léger, A. & Young, O. (2021). Building a multisystemic understanding of societal resilience to the COVID-19 pandemic. *BMJ Global Health*, 6(7); 1-6.
- Williams, M. V., Chandra, A., Spears, A., Varda, D., Wells, K. B., Plough, A. L., & Eisenman, D. P. (2018). Evaluating community partnerships addressing community resilience in Los Angeles, California. *International Journal of Environmental Research and Public Health*, 15(4): 610-.
- World Bank (2013). *Pandemic risk*. Available at: https://www.worldbank.org/content/dam/Worldbank/document/HDN/Health/WDR14_bp_Pandemic_Risk_Jonas.pdf (Accessed 3 August 2023)
- World Bank (2020). *Protecting people and economies: Integrated policy responses to COVID-19*. Available at: <https://openknowledge.worldbank.org/server/api/core/bitstreams/09da6f84-4495-5ac2-840d-9f304e58e5f6/content> (Accessed 3 August 2023)
- World Bank (2021). *An EPIC Response*. World Bank. Available at: <https://openknowledge.worldbank.org/entities/publication/a98b2251-f185-55a0-8ebc-6a4cb78b43e9> (Accessed 3 August 2023)
- World Bank (2023). *5 ways the World Bank is leading by example on nature*. Available at: <https://blogs.worldbank.org/voices/5-ways-world-bank-leading-example-nature> (Accessed 3 August 2023)
- World Health Organization (2009). *Whole-of-society pandemic readiness – WHO guidelines for pandemic preparedness and response in the non-health sector*. Global Influenza Programme, Geneva, July. Available at <https://www.who.int/publications/i/item/whole-of-society-pandemic-readiness> (Accessed 15 May 2023)
- World Health Organization (2012). *Governance for Health in the 21st century*. Available at <https://apps.who.int/iris/handle/10665/326429> (Accessed 15 May 2023)
- World Health Organization (2016). *Glossary: Whole-of-government, whole-of-society, health in all policies, and multisectoral*. Available at: <https://www.who.int/global-coordination-mechanism/dialogues/glossary-whole-of-govt-multisectoral.pdf> (Accessed 15 May 2023)
- World Health Organization (2017a). *Pandemic Influenza Risk Management: A WHO guide to inform and harmonise national & international pandemic preparedness and response*. Global Influenza Programme. Available at <https://apps.who.int/iris/handle/10665/259893> (Accessed 15 May 2023)

- World Health Organization (2017b). *Progressing the Sustainable Development Goals through Health in All Policies: Case studies from around the world*. Available at <https://www.who.int/publications/m/item/progressing-the-sustainable-development-goals-through-health-in-all-policies> (Accessed 15 May 2023)
- World Health Organization (2019). *Governance snapshot: whole-of-society approach: the Coalition of Partners for Strengthening Public Health Services in the European Region*. Regional Office for Europe. Available at <https://apps.who.int/iris/handle/10665/346033> (Accessed 15 May 2023)
- Yanakiev, Y., Dimov, P., & Bachvarov, D. (2018). Conceptualizing the Role of Societal Resilience in Countering Hybrid Warfare. *Information & Security*, 39(1): 77–89.
- Yong, A. G., & Lemyre, L. (2019). Getting Canadians prepared for natural disasters: a multi-method analysis of risk perception, behaviors, and the social environment. *Natural Hazards (Dordrecht)*, 98(1): 319–341.
- Yuan, M., Lin, H., Wu, H., Yu, M., Tu, J., & Lü, Y. (2021). Community engagement in public health: a bibliometric mapping of global research. *Archives of Public Health = Archives Belges de Santé Publique*, 79(1): 1-17.
- Zackery, A., Amankwah-Amoah, J., Heidari Darani, Z., & Ghasemi, S. (2022). COVID-19 Research in Business and Management: A Review and Future Research Agenda. *Sustainability (Basel, Switzerland)*, 14(16): 9820–.

Bibliography B: Supporting literature

This is the bibliography for the articles cited in this paper that do not form part of the 114 publications selected for the S-SLR. The 114 S-SLR publications can be found in Bibliography A: S-SLR literature.

- Aguinis, H., Jensen, S.H. & Kraus, S. (2022). Policy implications of organizational behavior and human resource management research. *Academy of Management Perspectives*, 36(3), p 857-878.
- Atkinson, C., & Curnin, S. (2020). Sharing responsibility in disaster management policy. *Progress in Disaster Science*, 7: 100122.
- Barnett, M.L., Henriques, I. & Husted, B.W. (2020). Beyond Good Intentions: Designing CSR Initiatives for Greater Social Impact. *Journal of Management*, 46(6): 937–964.
- Beninger, S. & Francis, J. N. (2022). Resources for business resilience in a COVID-19 world: A community-centric approach. *Business Horizons*, 65(2): 227-238.
- Berkes, F., Colding, J., & Folke, C. (2003). *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press.

- Brammer, S., Branicki, L. & Linnenluecke, M.K. (2020). COVID-19, societalization, and the future of business in society. *Academy of Management Perspectives*, 34(4): 493-507.
- Brinkerhoff, D.W. & Brinkerhoff, J.M. (2011). Public–private partnerships: Perspectives on purposes, publicness, and good governance. *Public Administration and Development*, 31(1), pp.2-14.
- Brueller, D., Brueller, N. N., Brueller, R., & Carmeli, A. (2019). Interorganisational Relationships in Times of Decline: Implications for Organisational Resilience. *Applied Psychology*, 68(4), 719–758.
- Caiazza, R., Phan, P., Lehmann, E., & Etzkowitz, H. (2021). An absorptive capacity-based systems view of Covid-19 in the small business economy. *International Entrepreneurship and Management Journal*, 17(3): 1419–1439.
- Crane, A. & Matten, D. (2021). COVID-19 and the Future of CSR Research. *Journal of Management Studies*, 58(1): 278–282.
- Cutter, S.L. (2018). Compound, cascading, or complex disasters: what's in a name? *Environment: Science and Policy for Sustainable Development*, 60(6), pp.16-25.
- Deloitte (2023). *What does 'being resilient' really mean? Three steps for risk and resilience leaders to initiate right now*. December 2023. Available at: https://www2.deloitte.com/uk/en/pages/risk/articles/what-does-being-resilient-really-mean.html?nc=42&id=uk:2sm:3li:4dcom_share:5awa:6dcom:risk (Accessed 17 December 2023)
- Dentoni, D., Pinkse, J. & Lubberink, R. (2021). Linking Sustainable Business Models to Socio-Ecological Resilience Through Cross-Sector Partnerships: A Complex Adaptive Systems View. *Business & Society*, 60(5): 1216–1252.
- Duchek, S. (2020). Organizational resilience: a capability-based conceptualization. *Business Research (Göttingen)*, 13(1), p 215–246.
- Dugan, J., Byles, D., & Mohagheghi, S. (2023). Social vulnerability to long-duration power outages. *International Journal of Disaster Risk Reduction*, 85, 103501-.
- Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environmental Change*, 16(3), 253-267.
- Folke, C., & Berkes, F. (1998). *Linking social and ecological systems: management practices and social mechanisms for building resilience*. Cambridge University Press.
- Haarhaus, T. & Liening, A. (2020). Building dynamic capabilities to cope with environmental uncertainty: The role of strategic foresight. *Technological Forecasting & Social Change*, 155, 120033–.

- Haddaway, N. R., Collins, A. M., Coughlin, D., & Kirk, S. (2015). The role of google scholar in evidence reviews and its applicability to grey literature searching. *PloS One*, 10(9), e0138237–e0138237.
- Hall, P. A., & Lamont, M. (2013). *Social resilience in the neoliberal era*. New York, NY: Cambridge University Press.
- Helfgott, A. (2018). Operationalising systemic resilience. *European Journal of Operational Research*, 268(3): 852–864.
- Hill, R. P. (2010). A naturological approach to marketing exchanges: Implications for the bottom of the pyramid. *Journal of Business Research*, 63(6), 602–607.
- Hillmann, J. & Guenther, E. (2021). Organizational Resilience: A Valuable Construct for Management Research? *International Journal of Management Reviews : IJMR*, 23(1), p 7–44.
- HM Government (2023c). *The Resilience Framework: 2023 Implementation Update*. Cabinet Office. Available at: <https://www.gov.uk/government/publications/the-resilience-framework-2023-implementation-update> (Accessed 12 December 2023)
- Kouvali, A. (2021). *Essential Businesses and Shareholder Value*. The University of Chicago Legal Forum, 191–232. Available at: <https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1689&context=uclf> (Accessed 12 July 2023)
- Linnenluecke, M.K. (2017). Resilience in Business and Management Research: A Review of Influential Publications and a Research Agenda: Resilience in Business and Management Research. *International Journal of Management Reviews: IJMR*, 19(1), p 4–30.
- Mahmud, A., Ding, D. & Hasan, M.M. (2021). Corporate Social Responsibility: Business Responses to Coronavirus (COVID-19) Pandemic. *SAGE Open*, 11(1): 1-17.
- Mahood, Q., Eerd, D.V. & Irvin, E. (2014). Searching for grey literature for systematic reviews: challenges and benefits. *Research Synthesis Methods*, 5(3), p 221–234.
- McKnight, B., & Linnenluecke, M. K. (2016). How Firm Responses to Natural Disasters Strengthen Community Resilience: A Stakeholder-Based Perspective. *Organization & Environment*, 29(3), 290–307.
- Page, M. J., Moher, D., Bossuyt, M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McKenzie, J. E. (2021). PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ (Online)*, 372: 1-36.

- Paul, J., & Criado, A. R. (2020). The art of writing literature review: What do we know and what do we need to know? *International Business Review*, 29(4): 101717–.
- Pitidis, V., Coaffee, J. & Bouikidis, A. (2022). Creating ‘resilience imaginaries’ for city-regional planning. *Regional Studies*: 1-14.
- Pollock, K., & Steen, R. (2021). Total Defence Resilience: Viable or Not During COVID-19? A Comparative Study of Norway and the UK. *Risk, Hazards & Crisis in Public Policy*, 12(1), 73–109.
- Porter, M. E., & Kramer, M. R. (2011). Creating shared value. In *Harvard Business Review* (Vol. 89, Issues 1-2, pp. 62–77). Harvard Business School Publishing Corporation.
- Raetze, S., Duchek, S., Maynard, M. T., & Kirkman, B. L. (2021). Resilience in Organizations: An Integrative Multilevel Review and Editorial Introduction. *Group & Organization Management*, 46(4), 607–656.
- Rahman, T., Paul, S. K., Agarwal, R., Shukla, N., & Taghikhah, F. (2023). A viable supply chain model for managing panic-buying related challenges: lessons learned from the COVID-19 pandemic. *International Journal of Production Research*, 1–20.
- Rodrigues, M., Franco, M., Sousa, N., & Silva, R. (2021). COVID 19 and the business management crisis: An empirical study in SMEs. *Sustainability*, 13(11): 5912-.
- Rose, A., Benavides, J., Chang, S. E., Szczesniak, P., & Lim, D. (1997). The Regional Economic Impact of an Earthquake: Direct and Indirect Effects of Electricity Lifeline Disruptions. *Journal of Regional Science*, 37(3), 437–458.
- Scherer, A. G., Palazzo, G., & Matten, D. (2014). The Business Firm as a Political Actor: A New Theory of the Firm for a Globalized World. *Business & Society*, 53(2), 143–156.
- Schrempf-Stirling, J. (2018). State Power: Rethinking the Role of the State in Political Corporate Social Responsibility. *Journal of Business Ethics*, 150(1), 1–14.
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104: 333–339.
- Storr, V.H., Haeffele, S., Lofthouse, J.K. & Grube, L.E. (2021). Essential or not? Knowledge problems and COVID-19 stay-at-home orders. *Southern Economic Journal*, 87(4), p 1229-1249.
- Wickert, C. (2021). Corporate social responsibility research in the Journal of Management Studies: A shift from a business-centric to a society-centric focus. *Journal of Management Studies*, 58(8): 1-17.

- Williams, A., Whiteman, G. & Kennedy, S. (2021). Cross-Scale Systemic Resilience: Implications for Organization Studies. *Business & Society*, 60(1), p 95–124.
- Williams, M. & Moser, T. (2019). The art of coding and thematic exploration in qualitative research. *International Management Review*, 15(1): 45-55.
- Williams, T.A., Gruber, D.A., Sutcliffe, K.M., Shepherd, D.A. & Zhao, E.Y. (2017). Organizational response to adversity: Fusing crisis management and resilience research streams. *Academy of Management Annals*, 11(2), p 733-769.
- Wiśniewski, M., Szwarc, K., & Skomra, W. (2023). Continuity of Essential Services as an Emerging Challenge for Societal Resilience. *IEEE Access*, 11, 44614–44635.
- Xiao, Y. & Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, 39(1): 93–112.

TABLE 1 Open Coding examples

Citation	Quote	Open code(s)
European Parliament (2021: 21)	“strategic planning process”	▪ <i>Strategy</i>
Uhnöo & Persson (2021: 441)	“a shared responsibility”	▪ <i>Shared responsibility</i>

TABLE 2 Coding structure

Selective codes	Axial codes	Open codes	Frequency (N=)
Align with local cross-sector partnerships	Work through cross-sector partnerships	<i>Establish multi-actor/-sector collaboration</i>	81
		<i>Engage local actors</i>	46
		<i>Share responsibility</i>	27
	Coordinate to manage delivery	<i>Establish local governance</i>	24
		<i>Agree the partnership strategy</i>	42
		<i>Facilitate co-production</i>	30
		<i>Coordinate by integrating systems</i>	40
		<i>Provide strategic & tactical leadership</i>	28
		<i>Cooperate by sharing intelligence</i>	30
Support the provision of essential services	Deliver against needs	<i>Pinpoint needs</i>	80
		<i>Analyze how the context is changing</i>	33
		<i>Ensure continuity of provision</i>	42
	Mobilize targeted support	<i>Develop local capacities & capabilities</i>	50
		<i>Test systems</i>	20
Manage in changing environments	Adapt & advance	<i>Prepare for, respond to, recover from</i>	70
		<i>Innovate through renewal</i>	19

FIGURE 1 PRISMA for S-SLR Stage 2 *Conduct*

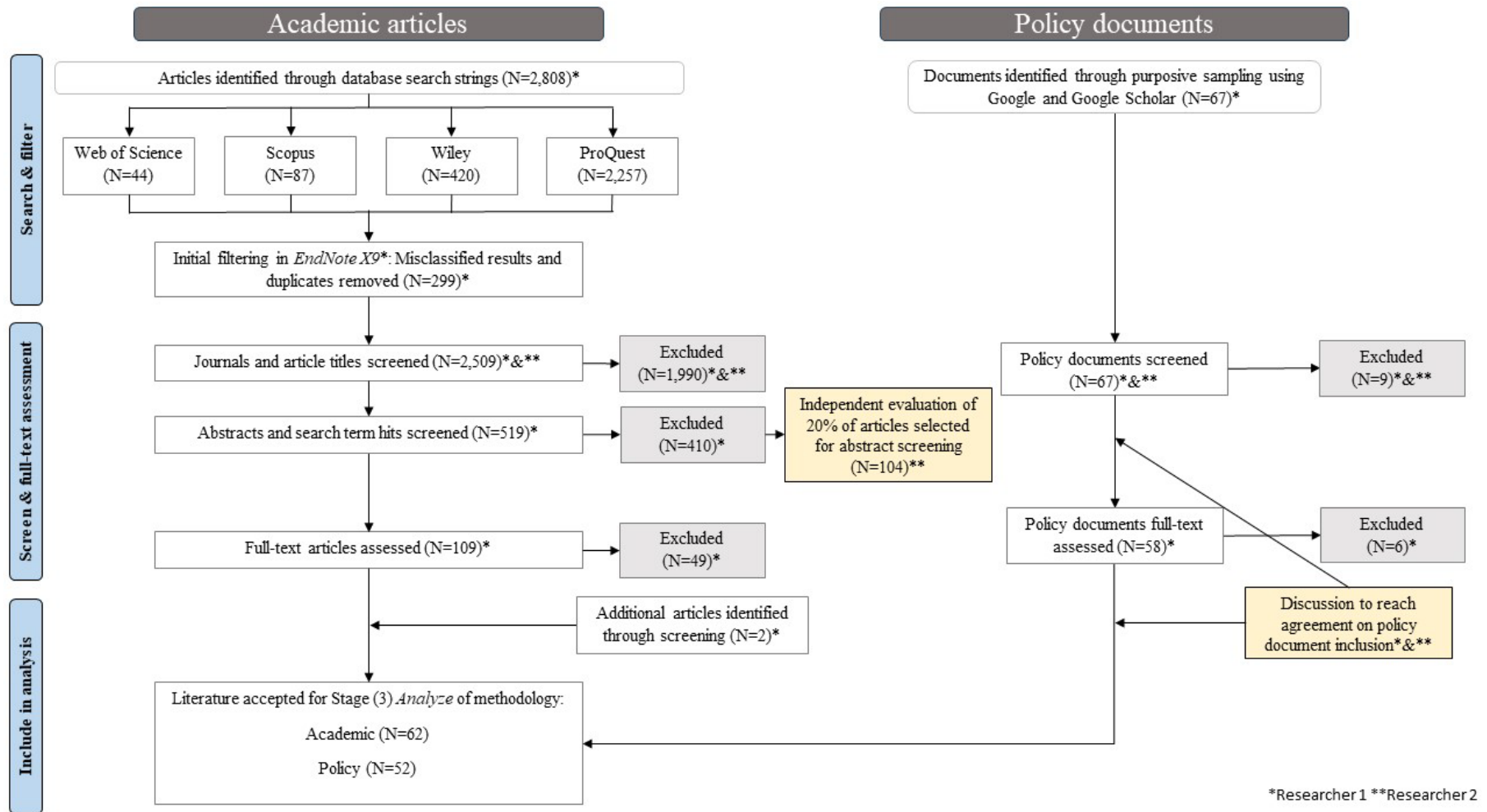


FIGURE 2 Distribution of publications January 2009 – December 2022 (N=2,201)

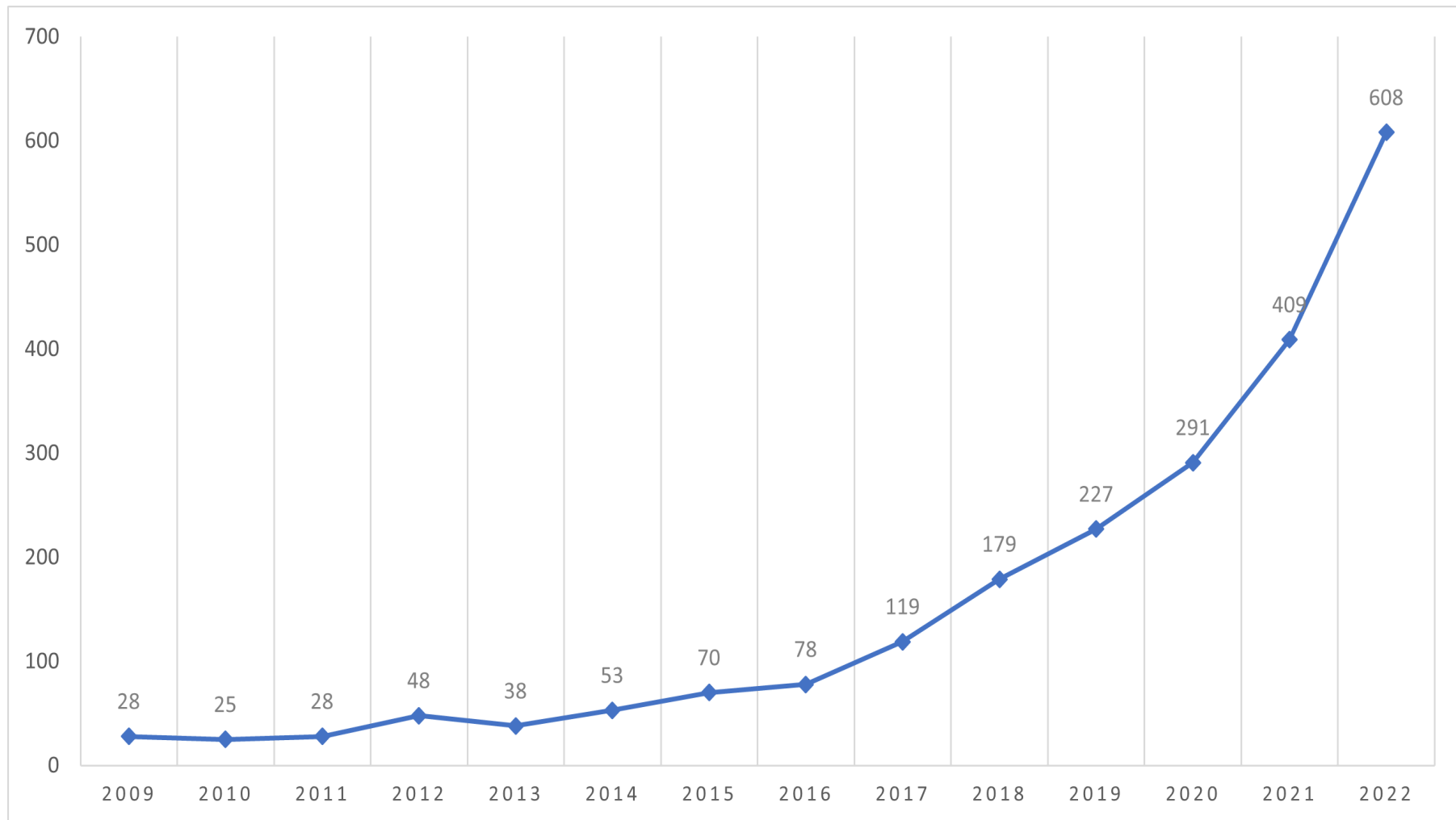
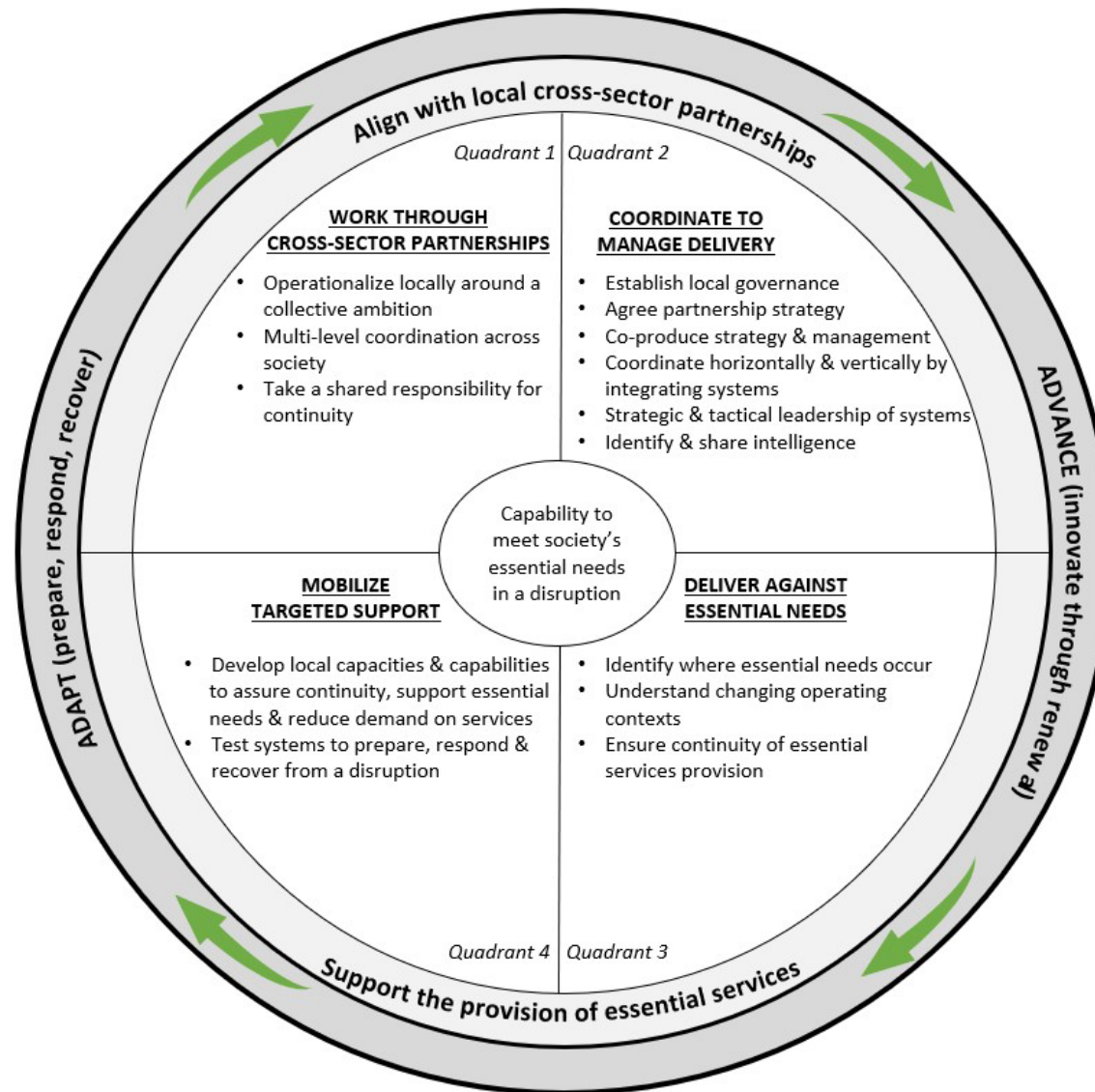


FIGURE 3 Operationalizing whole-of-society resilience to disruption in changing environments



APPENDIX 1 How 63 publications describe WoSR

Citation	Description
World Health Organization (2009: 7)	“involves all sectors and requires a concerted and collaborative effort by various government ministries, business and civil society to sustain essential infrastructure and mitigate impacts on the economy and functioning of society”
Commonwealth of Australia (2011: v)	"collective responsibility of all sectors of society, including all levels of government, business, the non-government sector and individuals" key to which is a "shared sense of responsibility"
World Health Organization (2012: 33)	“form of collaborative governance that emphasizes coordination through normative values and building trust among various actors in society”
Sundelius & Eldeblad (2013: 95)	“indicates a more inclusive approach than the more generally advocated whole-of-government approach, which is considered too narrow in scope. The effort toward enhancing societal security can be effective only to the extent that partners or stakeholders outside the sphere of national government become engaged and contribute”
World Bank (2013: 15)	“People-centered, where governments open up the process and remove boundaries, where people participate to identify and satisfy their needs and where people are well informed and motivated to proactively reduce risks to their lives and livelihoods”
Addy et al (2014: 216)	“engages multiple stakeholders in public health policies across contexts” and involves “stakeholders from international agencies, states, for-profits, and community organizations”
Genik & Godsoe (2015: 245)	“requires a means of developing shared responsibility for risk and collaborative actions to address local problems. This requires working across sectors with different groups facing competing priorities”
Månsson et al (2015: 441)	“systems intended to provide protection for people, property and the environment must be able to cater for all types of disruptions, integrate the functional areas of DRR [disaster risk reduction], while including a vast number of stakeholders”
Brunk (2016: 73)	“distinct from existing whole-of-government models in terms of the degree to which non-state actors are explicitly accounted for within government strategies and institutional mechanisms”
Papademetriou & Benton (2016: 26)	“engages people outside of government, and more importantly, outside of insular policy communities and the political establishments”
German Federal Government (2016: 59)	“A common understanding of potential risks is the basis on which to build whole-of-society resilience”
World Health Organization (2016: 2)	"Acknowledge the contribution of and important role played by all relevant stakeholders, including individuals, families and communities, intergovernmental organizations and religious institutions, civil society, academia, the

	media, voluntary associations and, where and as appropriate, the private sector and industry, in support of national efforts for noncommunicable disease prevention and control, and recognize the need to further support the strengthening of coordination among these stakeholders in order to improve the effectiveness of these efforts”
Bromley et al (2017: 2)	“inclusive, accessible, and non-discriminatory participation”
Canadian Government (2017: 11)	“partnerships based on effective collaboration, coordination and communication”
International Committee of the Red Cross (2017: 5)	“requires the involvement of all sectors and actors - civil society organizations, the private sector, UN agencies, peacekeeping operations, development NGOs and humanitarian actors, depending on the environment and the activity”
World Health Organization (2017a: 55)	“encompasses three major groups in society – governments, business and civil society – at the global, national, subnational, local and community levels. The nine circles around the disaster management continuum of mitigation, prevention, preparedness, response, and recovery represent nine key essential areas: health, defence, law and order, finance, transport, telecommunications, energy, food and water”
Waldman (2018: 394)	“seek to incorporate bottom-up, community-based volunteer activity”
Liang et al (2018: 4)	“all sectors play a significant role”
Williams et al (2018: 2)	“improvement of organized voluntary work of citizens”
Cox et al (2019: 223)	“requires bridging DRR [disaster risk reduction] and resilience to other complex issues of concern to youth and others (for example, climate change) and supporting the identification and application of youth’s existing and potential competencies as change makers”
Domicelj & Gottardo (2019: 82)	"inherently fully inclusive"
Kindornay & Kocaata (2019: 2)	"an enabling environment that promotes partnership and contributions by a wide range of stakeholders to collective impact ... demands collaboration and cooperation across sectors and in partnership with local communities"
United Nations (2019: 35)	“Increased effort - by governments and non-State actors - to understand the social, ecological, political, and economic dimensions of exposure and vulnerability, and develop transdisciplinary systems-based approaches to risk management”
World Health Organization (2019: 1)	“ensures institutional coordination and coherence with partners from across society, a crucial aspect of effectively implementing multi- and intersectoral action...requires systematic multi- and intersectoral governance structures and processes that can facilitate and support action”

Yong & Lemyre (2019: 320 & 337)	“acknowledges that all stakeholders within a society have important contributions and responsibilities in disaster risk reduction” and “fosters collaboration between regulators and communities to define risks, needs, concerns, expectations, and context”
Simpson et al (2019: 6)	“will depend on the actions of all people and institutions living in the city”
Kitagawa (2019b: 853)	“the amalgamated effort of public investments, individual self-help and community-based actions”
Appleby (2020: 214)	“state collaboration with societal actors, such as civil society organizations, faith-based organizations, the private sector, migrant and diaspora groups, trade unions, and other relevant stakeholder”
Bangladesh Government (2020: 7)	“seeks to promote mainstreaming of climate change adaptation and mitigation to reduce existing and future risks”
Dubb (2020: 840)	"three central entities: governments, civil society and business with nine surrounding essential services such as Health, Defense, and Food ... all managed by a continuum of readiness, response, and recovery”
North Atlantic Treaty Organization (2020)	“Engaging the triple helix of government, the private sector and civil societies”
Oostlander, Bournival & O’Sullivan (2020: 4)	“everyone in society is responsible and has a role to play in all phases of disaster management”
Organization for Security and Co-operation in Europe (2020: 24)	“a cooperative and coordinated effort involving relevant government agencies and non-governmental actors, including those actors and sectors - such as the business sector - usually excluded from definitions of civil society”
Weiland et al (2020: 103)	“builds on interventions through a shared understanding of the conditions, so a shared method is used to find the solution” and includes “government departments, NGOs, business, the public, and communities”
World Bank (2020: 20)	“involving various ministries, the private sector, civil society organizations, communities and the collaboration of individuals”
Elavarasan et al (2021: 3)	“demands trust development among every individual, distribution of resources, enhanced cooperation and consensus-orientated decision making among various level of governments, business units and public members”
European Parliament (2021: 21)	“cooperative framework that integrates the capacities and capital possessed by various private and civil society sector actors into one unified strategic planning process”
Fogg (2021: 2)	“the importance of community organizations, including schools, in pandemic preparedness and response”
Gavari-Starkie et al (2021: 3 & 16)	“broad and inclusive...an [educational] approach reaching out to communities beyond school and promoting active participation of various stakeholders...involve everyone because disaster risk reduction is something that concerns everyone”

Haldane et al (2021: 5)	“targeted and long term social protection of vulnerable populations...an equitable approach that engages civil society, business, and government at all levels, in acknowledgment of the intersectional nature of health and wellbeing, while also dismantling inherent structural marginalization and inequalities”
HM Government (2021: 88)	“an integrated approach, bringing together all levels of government, Critical National Infrastructure operators, the wider private sector, civil society and the public”
Hsieh et al (2021: 303)	“government agencies engaging all relevant stakeholders including, but not limited to, intergovernmental organizations, the private sector, civil society, communities, families and individuals in support of joint efforts for epidemic prevention and control”
International Institute for Sustainable Development (2021: 9)	“integrated approach...recognizes that the resilience of public infrastructure, both built and natural, can improve resilience in other sectors as well, such as public health”
Kikkert & Lackenbauer (2021: 266)	“initiatives [that] embrace holistic approaches that focus on community strengths, and have broader societal impacts than more resource-intensive options involving pre-positioning federal [search and rescue] assets”
Matsuoka & Rocha (2021: 1)	“governments have the primary responsibility to prevent and reduce risk [but] all stakeholders such as the private sector, non-government organizations, academia, civil society, etc. share this responsibility”
North Atlantic Treaty Organization (2021: 12)	“all civilian and military actors work in synergy and can respond effectively to crises of every nature”
Pickering et al (2021a: 958)	“populations at heightened risk involved in the design and implementation of policies and plans to reduce disaster risk... supports communities to engage in DRR [disaster risk reduction] activities such as DRR education, disaster planning, and preparedness to strengthen community resilience”
Shmueli, Ozawa & Kaufman (2021: 2)	“drawing the community, including citizens and private and non-profit organizations into government decision making, and encouraging regulatory agencies to operate in networks both horizontally across specialties and vertically across scales”
Uhnöo & Persson (2021: 441)	“a more inclusive approach, a ‘shared responsibility’, as well as collaboration between public and private sectors”
United Nations (2021: 38)	“Resilience-building will need to start from a broad and contextualized analysis of whole-of-society capacities, vulnerabilities and risks to anticipate how a system will respond when it comes under pressure”
World Bank (2021: iii)	“inclusive and representative of the needs of all of society”
Al-Mulki, Hassoun & Adib (2022: 11)	“approach which calls for resource sharing, trust building, and engaging the community in decision making”

British Red Cross (2022: 13)	“advocates addressing migration in all its dimensions by forming partnerships that include migrants, diasporas, local communities, civil society, academia, the private sector, parliamentarians, trade unions, national human rights institutions, the media and other relevant stakeholders”
Council of Canadian Academies (2022: 103)	“collaborative and participatory style of governance [which] facilitates the integration of adaptation and DRR [disaster risk reduction] to enhance disaster resilience for all”
HM Government (2022: 5)	“organizing society in a coherent, resilience-focused way, but also taking a much broader focus on resilience”
Kim, Goh & Kang (2022: 12)	“harnessing private sector capacity”
Lillywhite & Wolbring (2022: 3)	“leaves no one behind”
McClelland et al (2022: 224)	“mobilized to understand the diverse needs of groups/stakeholders, improve abilities to identify and reduce risks, adapt to shifting landscapes of vulnerability, and enhance local preparedness and response as crises transition through various stages”
Samaan et al (2022: 2)	“a governing arrangement where public agencies directly engage non-state stakeholders in a collective decision-making process that is consensus-orientated, deliberative, and aims to make or implement public policy or manage public programs or assets”
Tómasson (2022: 7)	“approach to resilience, linking businesses, community organizations and the public”
Asia-Pacific Centre for Security Studies (2023)	"incorporates the government sector and all members of society" in enhancing "capacity, at the national and collective level, to prepare for, resist, respond to, and quickly recover from strategic shocks and disruptions, across the full spectrum of threats"
HM Government (2023b: 24)	“For communities, a ‘whole-of-society’ approach to resilience means that where possible, communities recognize their role in, take responsibility and contribute to the UK’s resilience”
Kjellen et al (2023: 713)	“the joint pursuit of common solutions to complex problems ...embraces both formal and informal institutions in seeking a generalized agreement across society about policy goals and the means to achieve them”

SUPPLEMENTARY DATA

SUPPLEMENTARY DATA 1: Evidence table for 62 academic articles selected

Author(s)	Article type	Method	Subject area	Academic article data
Addy et al (2014)	Analytical	Secondary	Health (general)	▪ Polycentric governance; networked relationships; resource; trust; multi-actor; context; strategy; private sector, government, civil society; vulnerable people; adaptation, prevention, response; public-private partnerships; essential services
Lin et al (2015)	Empirical	Primary	Disaster Risk Reduction	▪ Multi-actor; integration (national, regional, local); intelligence sharing; risk and vulnerability; collective management of risk; mobilization of resource; targeting of vulnerability and risk; preparedness, response, and recovery
Månsson et al (2015)	Empirical	Primary	Disaster Risk Reduction	▪ Multi-actor; integrated management; accurate risk and vulnerability intelligence; sharing of intelligence; systems; capability; risk and vulnerability; identify, understand (including changes), and reduce risk and vulnerability; protect people and built and natural environments; preparedness and response
O'Sullivan et al (2015)	Empirical	Primary	Disaster Risk Reduction	▪ Vulnerability; needs; prepare, respond, recover; adapt and change
Brunk (2016)	Conceptual	Secondary	Peacebuilding	▪ Co-production; strategy; accountability; non-state actors – political, citizens, business, faith sector, civil society; multi-actor; needs and priorities; trust; local context; capabilities; leadership; local; collaborative planning, and coordination; create social impact
Eyerkauffer et al (2016)	Empirical	Primary	Disaster Risk Management	▪ Shared responsibility; multi-actor/sector; local actors; partnerships; public-private; training; collaboration; coordination and cooperation; capabilities and systems; enhance awareness, preparedness, response, and recovery; build capacity

				Internal organizational resilience; ensure continuity; contribute knowledge and value to wider societal efforts; share knowledge and expertise
Bromley et al (2017)	Empirical	Primary	Disaster Risk Reduction; Health (general)	Whole-community; multi-sector partnerships; share knowledge; vulnerable people; trust and inclusivity; advance
Ongkowijoyo & Doloi (2017)	Analytical	N/A	Disaster Risk Reduction; Critical Infrastructure & Essential Services	Identify risk; governance; decision-making; sharing intelligence across systems; continuity; essential services; root causes of diverse impacts of disruptions; manage and maintain functioning of essential services; prevent cascading impact
Bergstrom (2018)	Conceptual	N/A	National Security & Resilience	Local; partnerships; decentralized; shared responsibility; preparedness, response, resilience
Généreux et al (2018)	Analytical	Secondary	Disaster Risk Reduction; Health (general)	Leadership (political); self-determination; local needs and priorities; capacity; needs
Korosteleva (2018)	Conceptual	N/A	Disaster Risk Reduction; National Security & Resilience; Governance	Self-governance; local actors – civil society, business, share knowledge, local/regional authorities, national government; inclusive; collective coordination; self-determination; self-organize; local context; local needs and priorities
Liang et al (2018)	Analytical	N/A	Health (pandemics)	Multi-actor – government, private sector, community organizations, individuals; all sectors; self-help; local; continuity; shared responsibility; vulnerable people; testing systems; leadership; intelligence; frameworks and guidance; targeted support; businesses responsible for continuity of essential services, their employees and customers

Waldman (2018)	Empirical and conceptual	Primary	Disaster Risk Reduction	Partnerships; shared responsibility; shared resources; local actors - individuals, communities, private and public sectors, non-governmental organizations; strategy; volunteers; training; networked governance; systems; bottom-up; preparedness, response, recovery
Williams et al (2018)	Empirical	Primary	Disaster Risk Reduction; Health (general)	Capabilities; engagement; partnerships; volunteers; vulnerable people; at-risk businesses; self-organize; preparedness, response, recovery
Yanakiev et al (2018)	Analytical	Secondary	Disaster Risk Reduction; National Security & Resilience	Risk; adaptive and transformative capacities; advance following disruption
Cox et al (2019)	Conceptual	N/A	Disaster Risk Reduction	Local actors; change; multi-actor partnerships; co-production; roles and responsibilities; self-organize; training; vulnerable people; preparedness, response, recovery; climate change
Kitagawa (2019a)	Empirical	Primary	Disaster Risk Reduction	Public-private partnerships; capabilities; local context; risk and vulnerability; share knowledge; co-production; local actors; self-help; preparedness, response, recovery
Kitagawa (2019b)	Empirical and conceptual	Primary	Disaster Risk Reduction	Self-help; co-production; strategy; share knowledge; build awareness; adapt
O'Sullivan & Phillips (2019)	Conceptual	Secondary	Disaster Risk Reduction; Health (pandemics)	Leadership; local context; vulnerability; strategy; self-help; collaborative governance; trust; co-production; inclusive
Pöyhönen et al (2019)	Empirical	Primary	National Security & Resilience; Critical Infrastructure	Cyber security; capabilities; intelligence sharing; continuity; cooperation; essential services – energy, transport, health, financing, and digital services; situational awareness

			& Essential Services	
Simpson et al (2019)	Empirical	Secondary	Sustainable Development; Critical Infrastructure & Essential Services; Governance	Local; multi-actor/sector; continuity; essential services; at-risk and vulnerable people; needs; self-organize; preparedness, response, recovery; transformation
South et al (2019)	Empirical and conceptual	Primary	Health (general)	Local context; local actors; systems; partnerships; strategy; self-help; needs; reduce risk and vulnerability; local capabilities; self-help; local knowledge and priorities
Vieira et al (2019)	Empirical and conceptual	Primary	Sustainable Development; Critical Infrastructure & Essential Services	Capacity; capabilities; horizontal integration for decision-making; trust; local; multi-actor; collaborative governance; self-organization; transformation; coordination; essential services; recover; businesses are a source of social and environmental risk
Yong & Lemyre (2019)	Empirical	Primary	Disaster Risk Reduction	Local actors; responsibility; collaboration; needs; share knowledge; local context; strategy; risk communications; preparedness
Appleby (2020)	Conceptual	Secondary	Migration	Local; context; partnerships; resource; vulnerable people; gaps in service delivery; coordination
Dubb (2020)	Conceptual	Secondary	Health (pandemics)	Integrated systems; strategy; governments, civil society, business; intelligence; essential services; continuity; vulnerable people; partnerships; local context; adapt; collective response; target resource; integrated systems; preparedness, response, recovery
Meszaros & Toca (2020)	Empirical	Secondary	National Security & Resilience	Needs - risk and vulnerability; trust

Oostlander et al (2020)	Empirical	Primary	Disaster Risk Reduction	Multi-actor; shared responsibility; share knowledge; co-production; risk and vulnerability; knowledge and skills; response and recovery
Weiland et al (2020)	Conceptual	N/A	Critical Infrastructure & Essential Services	Integration of multiple systems; vertical and horizontal; strategy; capabilities; multi-actor/sector; shared responsibility; co-production; involves government, NGOs, business, civil society, communities
Acciarini et al (2021)	Empirical	Primary	Business & Management	Strategy; organizational resilience; partnerships; continuity; capacities; innovation; proactive and integrated response and recovery
Bednarska-Olejniczak et al (2021)	Analytical	Secondary	Sustainable Development	Self-governance; needs; local actors; self-determination; co-production; trust; inclusive; integration; strategy; shared responsibility; continuity; context
Bento & Couto (2021)	Empirical	Primary	Disaster Risk Reduction; Health (pandemics)	Local; systems; non-state actors; risk and vulnerability; context; needs; adapt; collaborative action
Codreanu et al (2021)	Conceptual	N/A	Business & Management	Strategy; continuity; guidance and frameworks; adapt - prepare, respond, recover; transformation; business continuity; monitor context; systems
Elavarasan et al (2021)	Analytical	Multi-criteria Decision Analysis	Sustainable Development; Health (pandemics)	Collaborative decision-making; government, private sector, public sector, civil society, communities; trust; resource; local actors; shared responsibility; strategy; vulnerable people
Fogg (2021)	Empirical	Primary	Disaster Risk Reduction; Health (pandemics)	Local; vulnerable groups; continuity of essential services; strategy; integration; adapt - preparedness, response, and recovery;
Gavari-Starkie et al (2021)	Conceptual	N/A	Disaster Risk Reduction	Governance; integrated systems (national, regional, local); inclusive; local context; shared responsibility; multi-actor partnerships; local actors; risk and vulnerability; preparedness, response, recovery; transformative capacity;

Haldane et al (2021)	Empirical	Primary	Crisis Management; Health (pandemics)	Needs of vulnerable people; engagement – civil society, business, government; partnerships; preparedness, response, recovery; a move from response-orientated action to transformational change; targeted support; reduce inequality
Hsieh et al (2021)	Empirical	Secondary	Disaster Risk Reduction; Health (pandemics)	‘Whole-of-nation’; multi-actor/sector; national-local integration; partnerships; vulnerability; co-production; engage local actors - intergovernmental organizations, the private sector, civil society, communities and individuals; collaborative governance; context; prevent and prepare
Kikkert & Lackenbauer (2021)	Empirical	Primary	Crisis Management	Specialized response capabilities; skills, resource, capabilities; local needs and context; communication and coordination systems; risk and vulnerability; societal impact; planning and preparedness
Kong & Sun (2021)	Conceptual	N/A	Crisis Management	Partnerships; multi-actor coordination; risk; capacities; capabilities; strategy; continuity; guidance and frameworks; businesses as a source of resource (capital, technology, equipment) and risk; essential services; resilient systems; prepare, respond, recover
Lee & Nakamura (2021)	Empirical	Secondary	Health (general)	Local strategy; partnerships; continuity; collaborative governance; vulnerability; leadership; integration; co-production; share knowledge; context
López-Gunn et al (2021)	Empirical	Primary	Disaster Risk Reduction; Sustainable Development	Strategy; partnerships; intelligence sharing; collective ambition; multi-actor; innovation; integration; local context; leadership; trust; social impact
Matsuoka & Rocha (2021)	Conceptual	Secondary sentiment analysis	Disaster Risk Reduction	Collaborative action - private sector, non-government organizations, civil society; shared responsibility; vulnerable people; local; preparedness, response, recovery
Panneer et al (2021)	Conceptual	N/A	Disaster Risk Reduction; Health (pandemics)	Collaborative governance; vertical and horizontal integration; reduce risk; mitigate negative economic and societal impacts; essential services

Pickering et al (2021a)	Conceptual	Descriptive case study analysis	Disaster Risk Reduction	Local; strategy; targeted support; co-production; resources; partnerships; coordination; inclusive; most in need; prevention and preparedness; co-production; build awareness
Pickering et al (2021b)	Analytical	Scoping review	Disaster Risk Reduction; Health (general)	Resources; partnerships; needs - risk and vulnerability; local context; mobilize systems and capabilities; planning, preparedness, and resilience
Pierobon (2021)	Conceptual	N/A	Extremism	Trusted sources of intelligence; communications; needs – risk and vulnerability; context; local actors; leadership; strategy; governance; resource; partnerships; coordination
Shmueli, Ozawa & Kaufman (2021)	Conceptual	N/A	Disaster Risk Reduction	Whole-community; engage local actors; shared responsibility; preparedness, response, recovery; horizontal and vertical integration
Uhnöo & Persson (2021)	Empirical	Primary	Disaster Risk Reduction	Public-private partnerships; strategy; management and delivery systems; continuity; shared responsibility; cross-sector collaboration; inclusive; capacities; capabilities; frameworks and guidance; preparedness, response, recovery; businesses as source of risk; essential services
Yuan et al (2021)	Analytical	N/A	Health (general)	Strategy; leadership; local actors; multi-actor; partnerships; local; co-production; needs – risk, vulnerability; local knowledge and priorities; collaborative management and delivery; integration; share knowledge; local context; trust; inclusive; targeted support; essential services
Wernli et al (2021)	Conceptual	N/A	Health (pandemics); Crisis Management	Integrated systems; essential businesses; vulnerable people; surging demand; continuity; strategy; accountability; participation; communications; capacities; sustain core functions in society; adapt; transform; changing environments; prepare, respond, recover; reduce vulnerabilities
Al-Mulki, Hassoun & Adib (2022)	Empirical	Primary	Crisis Management; Health	Integrated systems; shared resources; engage local actors; collaborative management; multi-actor cooperation; address gaps in services and support; preparedness and response

			(pandemics); DRR	
D’Andrea, Grifoni & Ferri (2022)	Conceptual	N/A	Disaster Risk Reduction	Strategy; integrated systems (national, regional, local); societal, economic, and environmental context; multi-actor coordination and collaboration; private sector; needs; self-help; preparedness and response; continuity
Moya & Goenechea (2022)	Analytical	Literature review	Disaster Risk Reduction	Collaboration; strategy; vulnerable people; capacities and capabilities; adapt- preparedness, response, recovery; transform
Kim, Goh & Kang (2022)	Empirical	Secondary	Health (pandemics); Crisis Management	Public-private partnerships; strategy; resource; capacity; collaboration; governance; needs of essential business and vulnerable people; continuity; response and recovery
Laitinen et al (2022)	Analytical	N/A	Sustainability	Public-private partnerships; integrated systems; shared responsibility; continuity of essential services; businesses as a source of resource and support; shared responsibility
Lillywhite & Wolbring (2022)	Conceptual	N/A	Crisis Management; Disaster Risk Reduction	Context; needs and changes therein; vulnerability; strategy; targeted support; transform
McClelland et al (2022)	Conceptual	Secondary	Crisis Management; Disaster Risk Reduction	Collaborative governance; needs - risk and vulnerability; local actors; partnerships; strategy; co-production; leadership; integrated systems; capacities and capabilities; targeted support; adapt- preparedness, response, recovery; transformative capacity; agency
Samaan et al (2022)	Empirical	Primary	Health (pandemics)	Local; multi-actor partnerships; cross-sector collaboration; collective decision-making; resource; local actors; context; risk and vulnerability; share knowledge; integrated systems; strategy; governance
Tómasson (2022)	Analytical	Secondary	Crisis Management	Continuity of essential services; cross-sector collaboration; local actors; multi-actor; shared responsibility; response and

				recovery; essential businesses are reliant on resilience of society and are a contributor to resilience
Wang, Cardoso & Forgaci (2022)	Conceptual	Secondary	Sustainable Development; Health (pandemics)	▪ Societal needs - changing risks and vulnerabilities; context; preparedness, response, recovery
Zackery et al (2022)	Empirical	Systematic literature review	Business & Management	▪ Strategy; continuity; essential services; supply chains; adapt; innovate; transform; create social impact through business strategies, go beyond CSR; businesses are reliant on societal resilience and are a contributor to societal resilience

SUPPLEMENTARY DATA 2: Evidence table for 52 policy documents selected

Author(s) and year	Country; Organization	Document type	Subject area	Policy document data
World Health Organization (2009)	International; World Health Organization	Non-governmental agency guidance	Health (pandemics)	Local strategy aligned with national directive; multi-sector collaboration; shared responsibility; continuity of essential services; integrated systems (national, regional, local); leadership; frameworks and legislation; addresses needs of vulnerable people and organizations; local capacity and capability; response and recovery
Commonwealth of Australia (2011)	Australia; Council of Australian Governments	Government policy	Disaster Risk Management	Local context (social, built, economic and natural environments); continuity; shared responsibility; partnerships; integration for coordination; self-help; local needs - vulnerabilities; collaborative governance; capacity and capability; adapt; businesses as provider of resource, skill, expertise, essential services
Federal Emergency Management Agency (2011)	USE; Federal Emergency Management Agency	Non-governmental agency publication	Crisis Management	A 'whole-community approach' - collaboration and collective action; identify and address needs; self-organize; capacities
World Health Organization (2012)	Switzerland; World Health Organization	Non-governmental agency publication	Health (general)	Cross-sector collaboration; leadership; coproduction; decentralized decision-making; vulnerable people; self-organization; integration; learning; multi-actor; sharing intelligence for coordination; strategy; resource; collaborative governance; shared responsibility; continuity; adaptive capacity; mobilize capability; businesses should create "shared value", contributing both to business growth and enhancing socio-economic environments

Sundelius & Eldeblad (2013)	Sweden; National Defense University Press	Non-governmental institution briefing	National Security & Resilience	Multi-actor coordinated action; intelligence sharing; inclusive; preparedness, response, and recovery
World Bank (2013)	International; World Health Organization	Non-governmental agency guidance	Disaster Risk Management	Multi-sector coordination; continuity of essential services; integrated systems (local, regional, national); leadership and accountability (government and essential businesses); test systems; participation; capacity; identify and reduce risk; preparedness, response, recovery
Colgan et al (2015)	Ireland; The Centre for Effective Services	Non-governmental institution publication	Health (general)	Integrated systems; align national policy-local delivery
Genik & Godsoe (2015)	Canada; Defence Research and Development	Non-governmental institution publication	National Security & Resilience	Cross-sector coordination; strategy; shared responsibility; partnerships; strategy; collective ambition; integrated systems; leadership; test systems; essential services; public-private cooperation; inclusive; capabilities; shared decision-making; local needs and priorities; local context; resources; continuity; trust; self-help; co-production; preparedness, response, recovery; identify and reduce risk and vulnerability; capabilities; realignment of responsibilities; businesses as a source of risk; shared responsibility
Pan American Health Organisation (2015)	Latin America; Pan American Health Organization	Non-governmental agency publication	Health (general)	Multi-sector; horizontal and vertical coordination of integrated systems

Papademetriou & Benton (2016)	Europe; Migration Government policy Institute; European Commission	Non-governmental organization report	Migration	Multi-sector; public-private-nonprofit; create social impact; adapt business models; goes beyond traditional CSR approaches
German Federal Government (2016)	Germany	Government policy	National Security & Resilience	Warning and informing; government, essential businesses, and society; partnerships; collective ambition; cooperation; capacities; capabilities; adaptation
World Health Organization (2016)	International; World Health Organization	Non-governmental agency guidance	Health (general)	Multi-actor coordination; leadership; integration; local actors; prevention and preparedness
Canadian Government (2017)	Canada; Emergency Management Government policy and Outreach Directorate	Government policy	Crisis Management	Multi-actor collaboration; partnerships; coordination; define roles, responsibilities, and expectations; shared responsibility; continuity of essentials services; vulnerable people; leadership; integration; warning and informing; preparedness, response, recovery; reduce risk; capacity to adapt
Finland Ministry of Defence (2017)	Finland	Government policy	National Security & Resilience	Strategy; multi-actor/-sector cooperation and coordination; integrated systems (local, regional, national); intelligence sharing; test systems; continuity; capacities and capabilities; maintain vital societal functions; preparedness, response, recovery

International Committee of the Red Cross (2017)	International; International Committee of the Red Cross	Non-governmental organization publication	Extremism	Multi-actor/sector/; alignment across partners; collective ambition; share knowledge; targeted activities
Organization for Security & Co-operation in Europe (2017)	Europe;	Non-governmental organization publication	National Security & Resilience	Public-private partnerships; civil society; identify and reduce risk
United Nations (Refugee Agency) (2017)	Sweden; Ministry of Foreign Affairs, Sweden	Non-governmental agency publication	Migration	Self-help; multi-sector; vulnerable people; innovation for economic and social impact
World Health Organization (2017a)	International; World Health Organization	Non-governmental agency guidance	Crisis Management; Health (pandemics)	Multi-sector collaboration and coordination; government, business, and civil society; integration; continuity of essential services;; guidance and frameworks; shared responsibility; local context; capacities; leadership; adapt - preparedness, response, and recovery; needs - vulnerable people; adapt services to meet demand; business responsibilities to customers and employees
World Health Organization (2017b)	Australia; World Health Organization	Non-governmental agency publication	Sustainable Development	Multi-actor; integrated systems; partnerships, self-determination; leaves no-one behind; collaborative governance; co-production; local; self-help
Cázarez-Grageda (2018)	Germany; Partners for Review	Government network publication	Sustainable Development	Multi-actor; co-production

International displacement monitoring centre (2018)	Non-governmental agency report; Norwegian Refugee Council	Non-governmental agency report	Disaster Risk Reduction	Local; needs - vulnerable people; intelligence sharing; partnerships; targeted support
Domicelj & Gottardo (2019)	UK; Forced Migration Review	Non-governmental institution publication	Migration	Multi-sector coordination; collaborative governance; societal needs; local context; inclusive
Kindornay & Kocaata (2019)	Canada; British Columbia Council for International Cooperation	Government policy	Sustainable Development	Leaves no-one behind; multi-actor/sector collaboration and coordination - government, the private sector, civil society organizations, and citizens; frameworks and guidance; intelligence sharing; integration; trust; inclusive; shared responsibility; collaborative governance; local needs; leadership; local capacities; collective impact; sustainable business models;
United Nations (DRR) (2019)	International; United Nations	Non-governmental agency publication	Sustainability	Communication systems; partnerships; engage local actors; strategy; capacity; vulnerable people; integration; preparedness, response, recovery
World Health Organization (2019)	International; World Health Organization	Non-governmental agency technical document	Health (general)	Multi-sector; governance; new roles and responsibilities
Bangladesh Government (2020)	Bangladesh; Government of the People's	Government policy	National Security & Resilience	Strategy; governance; business continuity; accountability; multi-actor/-sector coordination and cooperation; collective resource; integrated systems (local, regional, national); capacity; response

	Republic of Bangladesh			and recovery; comprehensive understanding of risk and vulnerability
Moungar & Baldeh (2020)	Africa; African Development Bank Group	Non-governmental agency briefing	National Security & Resilience	Multi-sector; changing context - social, economic, political, and environmental; vulnerable people; partnerships; integration; warning systems; preparedness, response and recovery
North Atlantic Treaty Organization (2020)	International; North Atlantic Treaty Organization	Non-governmental organization report	National Security & Resilience; Critical Infrastructure & Essential Services	Continuity of essential businesses - transport, energy, food and water; collective ambition; cooperation; strategy; preparedness, response, recovery; changing needs
Organization for Security & Co-operation in Europe (2020)	Central Asia; Europe; Organization for Security & Co-operation in Europe	Non-governmental organization guidance	National Security & Resilience	Cross-sector partnerships; collaboration and cooperation; shared responsibility; collective ambition; capacity; strategy; needs – vulnerable people; integration; co-production; collaborative governance
World Bank (2020)	International	Non-governmental agency guidance	Crisis Management	Coordination; integration; partnerships; leadership; intelligence sharing; engagement; preparedness, response, recovery; targeted support; prioritization of needs; capacity and capability; businesses are responsible for the management of continuity of essential services
Association of Southeast Asian Nations (2021)	South East Asia; Association of Southeast Asian Nations	Non-governmental association briefing	Crisis Management	Local context; continuity of essential services and supply chains; capacity; inclusive; targeted support to most vulnerable and at-risk; share resources
World Bank (2021)	International; World Bank	Non-governmental agency guidance	Disaster Risk Management	Shared responsibility; horizontal and vertical integration; multi-actor/-sector; leadership; strategy; intelligence sharing; capacity; needs of vulnerable people

HM Government (2021)	UK	Government policy	National Security & Resilience	Targeted support; vulnerable people; essential business; strategy; whole system; integration; partnerships; guidance and frameworks; increased responsibilities of sectors; preparedness, response, recovery; businesses as source of risk
International Institute for Sustainable Development (2021)	Canada; International Institute for Sustainable Development	Non-governmental organization publication	Sustainability	Integrated systems; essential services; shared responsibility; multi-sector; partnerships; cooperation; changing context
National Preparedness Commission (2021)	UK	Non-governmental organization report	Crisis Management	Public-private partnerships; integrated systems; strategy; cross-sector; capabilities; test systems; reduce risk; continuity of essential services; preparedness, response, recovery; changing environments; businesses' responsibilities for employees and customers
North Atlantic Treaty Organization (2021)	International; North Atlantic Treaty Organization	Non-governmental organization report	National Security & Resilience	Legislative and institutional frameworks; warning and informing; resource; continuity; communication systems; intelligence sharing; test systems; capacities and capabilities; vertical and horizontal integration; partnerships; strategy; cross-sector; capacities and capabilities; adapt – preparedness, response, recovery; continuity of essential businesses
United Nations (2021)	International; United Nations	Non-governmental agency guidance	Disaster Risk Reduction	Integrated systems; multi-actor; collaboration; capacities and capabilities; governance; socio-ecological context; local actors; strategy; leadership; reduce risk and vulnerability; capacity to adapt; delivery framework; preparedness, response, recovery, continuity of essential services
European Parliament (2021)	Europe; European Parliament	Government policy	National Security & Resilience	Public-private cooperation; intelligence sharing; continuity management; test systems; strategy; collective ambition; capacities; inclusive; preparedness, response, and recovery; guidance

British Red Cross (2022)	International	Non-governmental organization report	Migration	Partnerships; governance; trust; collaboration; accountability; enhance awareness
Council of Canadian Academies (2022)	Canada	Non-governmental organization publication	Disaster Risk Management; Sustainability	Strategy; intelligence sharing; local needs and priorities; leadership; guidance and standards; coordination; collaboration; governance; accountability; resource; capacities and capabilities; vulnerable people; partnerships; integrated systems (local, regional, national); adaptive capacity; continuity of essential services; preparedness, response, recovery; enhance awareness
Friends of Europe (2022)	Europe	Non-governmental organization report	National Security & Resilience	Shared capabilities; collaboration
HM Government (2022)	UK	Government policy	National Security & Resilience	Multi-actor collaboration; strategy; local context; vulnerable people; continuity of essential services, guidance and frameworks; integrated systems (local, regional, national); capacity; whole system; partnerships; preparedness, response, recovery; targeted support; intelligence sharing on risk and vulnerability; businesses as source of risk
Sagara et al (2022)	East Asia; The International House of Japan	Non-governmental organization publication	Crisis Management; Health (pandemics)	Local needs; intelligence sharing; guidance and frameworks; targeted support for the most vulnerable
U.S. Government (2022)	U.S.	Government policy	National Security & Resilience	Collaboration; partnerships; communications systems; intelligence sharing
Asia-Pacific Center for Security Studies (2023)	Indo-Pacific	Non-governmental institutional briefing	National Security & Resilience	Collaboration; essential services; preparedness, response, recovery

Council of the European Union (2023)	Europe	Governing body publication	National Security & Resilience	▪ Societal need; public-private cooperation; capacities and capabilities; intelligence sharing; coordinate collective action; preparedness and response
HM Government (2023a)	UK; UK Government	Government policy	Crisis Management	▪ Whole system action - local organizations, business, voluntary sectors, communities; intelligence; communications systems; integration; preparedness, response, recovery
HM Government (2023b)	UK	Government policy	National Security & Resilience	▪ Collaboration; engagement of communities and the voluntary sector; partnerships; coordination and integration; capacities and collective capabilities; changing context - health, social, financial, and environmental; better understanding of needs; preparedness, response, recovery
Kjellen et al (2023)	International; United Nations	Non-governmental agency publication	Sustainable Development	▪ Strategy; integration; local actors; needs; collaborative governance; collective ambition; partnerships; local knowledge and priorities; cooperation; capacities and capabilities
London Councils (2023)	UK	Non-governmental organization publication	National Security & Resilience	▪ Strategy; communications systems; vulnerable people; capability; roles, responsibilities, and accountability; continuity of essential services; test systems; intelligence sharing
United Nations (2023)	International; United Nations	Non-governmental agency briefing	Disaster Risk Reduction	▪ Multi-actor; local actors; shared responsibility; leadership; trust; inclusivity; local needs – risk and vulnerability; marginalized groups; essential businesses; capacities and capabilities; leadership; preparedness, response, recovery
World Bank (2023)	International	Non-governmental agency briefing	Sustainability	▪ Partnerships; capacities and capabilities; local needs, knowledge and priorities; self-determination

The Effects of U.S. Open Banking Adoption*

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Abstract

The drive for open data in the financial services sector is reflected in various open banking initiatives that allow bank customers to gain greater access to their banking and transaction data and enable them to share their data with other financial institutions and FinTechs. Open banking adoption usually involves the adoption of external application programming interfaces (APIs) that allow banks to exchange data with other third-party financial institutions safely and securely. As open banking adoption of U.S. banks has previously been led by voluntary market-based initiatives, we analyze determinants of open API adoption by U.S. banks and subsequent changes in bank performance using a panel database of 713 U.S. banks. We show that 3% of U.S. banks in our sample have adopted APIs and that banks experience measurable improvements in Return on Assets (*ROA*) and modest increases in *Tobin's Q* after adoption. We also highlight heterogeneous effects after API adoption, as performance increases are greater for banks with lower levels of credit risk, lower levels of competition, and smaller sizes. Our results are consistent with previous theoretical findings that open banking might give FinTechs competitive advantages and that increased competition might disrupt the information spillover within traditional banks.

JEL classifications: G21; G28; O32; O33

Keywords: API adoption; open banking; data portability; FinTech; bank performance

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1. Introduction

The financial services sector has experienced a drive for open data in recent years, reflected in the variety of open banking initiatives in different countries and jurisdictions. Open banking describes the process whereby bank customers gain greater access to their account data (such as their transaction and credit history) and more control to share such data with other third-party providers and financial institutions outside of the individual banks with which they are customers. European Union countries and the United Kingdom in particular have taken further steps toward an open financial framework with the implementation of the EU Payment Services Directive 2 (PSD2) and the open banking initiative as the basis for open banking. In contrast, the discussions surrounding open banking in countries like the U.S. are focused on voluntary market-based initiatives.¹ From the banks' perspective, the adoption of an open banking strategy usually involves adopting external application programming interfaces (APIs) that facilitate the link and interaction with FinTechs, payment providers, and other third-party financial institutions.

The opening up of customer data can pose a significant threat to the information monopoly of banks over their customers' data under the traditional bank model due to the resulting competition from other banks and FinTech startups (Marquez, 2002; Zachariadis & Ozcan, 2016). Furthermore, the adoption can come with considerable investment costs (due to its impact on the entire banking architecture (Dinçkol et al., 2023)) as well as cybersecurity risks and data privacy challenges (Benzell et al., 2023). However, proponents of open banking argue that the increase of available data and data sharing required by the adoption of an open banking strategy may expand the markets for both lending and payment services. Furthermore, the introduction of APIs by banks can increase their productivity through more efficient data sharing internally and with third parties, facilitate the automation of lending processes, and lead to more accurate risk assessments through access to more data (Babina et al., 2022).

In this paper, we analyze the determinants of API adoption by U.S. banks and the effects of open API adoption on bank performance. Based on the theory of the impact of IT innovation on firm performance (such as Brynjolfsson, 1993; Clemons, 1986) and IT adoption in banking (Hauswald &

¹ See Babina et al. (2022) for an overview of open banking regulation in different countries.

Marquez, 2003), we explore the determinants of API adoption and changes in performance after adoption. To analyze changes in performance after API adoption, we construct a unique panel dataset covering the API profiles of 713 U.S.-listed banks from 2007-2022. We find that 22 banks adopted external APIs from 2007 to 2022, representing 3% of our overall sample of banks, with a wide range regarding the bank size and characteristics. We further find support for improved performance after adopting the first API. In particular, we observe an increase in Return on Assets (*ROA*) and some modest enhancements and improvements in the bank's Tobin's *Q*, as well as a significant decrease in loan loss provision (*LLP*). Our results are robust to various robustness tests, such as when correcting for self-selection as proposed by Heckman (1976) and testing for differences between adopting and non-adopting banks, using propensity score matching to identify the control sample. In addition, we also find heterogeneous changes in bank performance after API adoption, as banks with lower levels of credit risk (measured by non-performing loans and loan loss provision), lower levels of competition (measured by product similarity and fluidity), and total assets and deposits experience greater increases in performance after API adoption.

Our results are consistent with existing studies on FinTech competition and open banking that show that the increasing availability of bank customer data can lead to a reduction of credit risk and default (Berg et al., 2020). However, open banking and bank data portability might result in some unintended consequences for bank and FinTech competition and borrower welfare, as shown in the complementary theoretical frameworks of He et al. (2023) and Parlour et al. (2022). In particular, Parlour et al. (2022) find that allowing voluntary data porting by consumers might lead to possible unraveling and negative data externality for consumers who do not share their data. While FinTechs can benefit from additional access to customers, resulting competition can thus disrupt information spillover within traditional banks, leading to higher prices of banks' payment services. Consistent with their results, we observe that banks with low product similarity and fluidity² experience stronger increases in Tobin's *Q*.

² Hoberg & Phillips (2016) and Hoberg et al., (2014) proposed measures of product similarity and fluidity that related to the intensity of direct competitors and potential competitors within an industry group based on the similarity of 10-K filings.

Our paper contributes to the literature in three ways. First, we contribute to an emerging body of research on open banking and data portability. Our study is closely related to Benzell et al. (2023), who study how API adoption can create value through an “inverted” firm strategy³, and Babina et al. (2022), who analyze the effects of open banking regulation on venture capital investment in FinTech firms in an international study. Our study differs from Benzell et al. (2023) as we focus on banks only whose API adoption does not necessarily adhere to an inverted firm strategy. In contrast, bank APIs can enable easier and safer sharing of bank customer data. We further argue that there is limited potential for banks to fully transform into a platform company that generates most of its value externally, making the effects of API adoption by banks inherently different than for companies from other industries. In contrast to Babina et al. (2022), we focus on voluntary adoption in the U.S. rather than open banking regulation in different countries and their effects on venture capital in the financial services sector.

The adoption of open banking can have further important implications for bank customers’ and borrowers’ welfare and financial inclusion, as banks might focus on attracting only a specific group of customers at the disadvantage or exclusion of other groups of customers. In this context, Goldstein et al. (2022) compare resource allocation efficiency and borrower welfare in open and closed banking scenarios, raising concerns that open banking might increase inefficiencies in resource allocation and complementing previous studies by Parlour et al. (2022) and He et al. (2023).

Second, our study relates more widely to the impact of technological innovations on the banking sector. Existing studies have examined the effect of technology on bank performance using measures such as the adoption of ATMs, internet and online banking, payment technology, and robo-advice (such as Beccalli, 2007; Berger, 2003; Hernández-Murillo et al., 2010; D’Andrea & Limodio, 2023; D’Acunto et al. 2019), or overall bank IT expenditure and number of personal computers (Pierri & Timmer, 2022). In our paper, we use external API adoption (based on the first adopted API) as an indicator of an open banking strategy and individual banks’ intention of widening data access and control for their customers. While API adoption can be considered a form of digital investment, it differs from traditional bank digitalization efforts in several ways. Previous technological bank innovation often involved automating

³ The inverted firm strategy refers to the notion that firms can create value externally by opening up their data and services to third parties and becoming platforms, thereby creating an ecosystem of interactions (Benzell et al., 2023).

and digitizing internal processes within the bank to improve internal efficiency and reduce costs. In contrast, APIs enable banks to access data through external third-party applications and services, allowing them to share data and functionality. Therefore, APIs can help facilitate banks' collaboration with third-party providers to offer a broader range of (mostly digital) services and products without needing to develop these services internally, but rather relying on the expertise and reach of their third-party collaborators. Therefore, APIs can help banks remain competitive, by broadening their reach and expanding their customer base while enhancing the experience of existing customers.

Third, our paper is further related to the general body of FinTech research and its impact on the lending industry. Berg et al. (2022) and Vives (2019) provide an overview of the digital disruption for the banking sector and lending industry, respectively. Several papers further focus on the impact of FinTech lending on traditional bank lending (see for example, Buchak et al. (2018); Fuster et al. (2019); Gopal & Schnabl (2022), and Tang (2019)). In this context, we analyze the role of competitive pressures on the decision to adopt an open banking strategy but also discuss the implications of competitive pressures which might disrupt information spillovers from payment to lending operations within commercial banks, as suggested by Parlour et al. (2022).

Our study has significant practical and policy implications. Adopting an open banking strategy implies a fundamental transformation of the bank's internal processes as well as engagement with the overall external innovation ecosystem of third parties. We consider API adoption as a possible means for digitally engaged banks to widen their service offering to their customers, increase their customer base, and decrease their credit risk, thereby improving their performance. Furthermore, our empirical study is an essential complement to existing studies on open banking and bank digitalization strategies that have provided qualitative and theoretical evidence regarding the potential impact of open banking and data portability on bank competition and performance, and wider effects on financial inclusion and borrower welfare. API and open banking adoption can help banks enhance performance, by improving profitability through widening the customer network and expanding bank service offerings. To the best of our knowledge, we are the first quantitative paper to use voluntary API adoption as a measure for open banking and evaluate its relationship with bank performance, leveraging existing work to theorize

and suggest hypotheses on the potential effects of open banking strategies and data portability regulation.

Additionally, we analyze the effects of voluntary open banking adoption in a less stringent regulatory environment compared to the explicit open banking mandates in Europe and the United Kingdom⁴. In the United States, rather than focusing on the technical details of open banking adoption, banks adopt APIs in a voluntary manner. However, we argue that recent banking regulations and data portability announcements that focus on protecting consumer privacy and data have led to an increasing rate of API adoption.⁵ The results of our cross-sectional analysis reveal that effects after API adoption are heterogeneous and may depend on the level of credit risk, size, and market competition. We thus confirm existing theoretical studies on open banking and data portability by He et al. (2023) and Parlour et al. (2022) that show that stringent open banking regulations could have adverse effects on some banks and the banking landscape.

The remainder of our paper is structured as follows: In section 2, we discuss the related literature to our study as the basis for our hypothesis development. We provide details of our sample selection and descriptive statistics in section 3 and present our results in section 4. Section 5 finally concludes.

2. Related Literature and Hypothesis Development

2.1 API and Bank Performance

Information Technology (IT) has changed the way the financial industry and banks use information and data, affecting bank performance and lending decisions as well as the competitive landscape in the payment and lending industry. Previous evidence has demonstrated that bank digitalization strategies

⁴ In European, there are list of mandatory regulations for banks to adopt open banking strategy, such as PSD2 and General Data Protection Regulation (GDPR) which is a regulation on information privacy in the European Union (EU) and the European Economic Area (EEA). It enhances individuals' control and rights over their personal information and simplifies regulations for international business. The GDPR became effective on 25 May 2018 and supersedes the Data Protection Directive 95/46/EC. It is directly applicable with force of law on its own without the need of transposition as an EU regulation instead of a directive. However, there is an on-going debate whether existing open banking regulations in the UK and the EU have led to measurable performance gains for financial institutions which have adopted APIs.

⁵ See discussions on bank data porting and ownership by Parlour et al. (2022) and the July 2018 executive order on data portability by the Biden administration: <https://www.whitehouse.gov/briefing-room/statements-releases/2021/07/09/fact-sheet-executive-order-on-promoting-competition-in-the-american-economy/>.

and IT investments can have a positive effect on bank output and performance. Martín-Oliver & Salas-Fumás (2008) show that IT investments of 72 Spanish commercial banks contribute significantly to bank profitability while using internet distribution channels (for funds transfers, brokerage, and securities trading transactions and deposits) leads to improvements in the bank's ROA and Return on Equity (ROE). In addition, Scott et al. (2017) measure the impact of payment technology adoption on bank performance using a sample of more than 6,000 banks over 40 years. Their findings also report a positive aggregate result over 10 years following the technology investment and innovation adoption, however, this varies over time with accumulated losses over the first 2-3 years before benefits are realized.

On the other hand, there is conflicting evidence in the literature on the impact of IT investments and adoption on bank performance. According to the theory of the productivity paradox, IT adoption does not necessarily increase profitability (Brynjolfsson, 1993), as digital innovators can only benefit from their innovations if they are able to establish a significant market share before second-tier competitors act (Clemons, 1986). Empirical studies have found inconclusive beneficial effects of the digitalization of banks on performance, for example when analyzing the adoption of online banking (Sathye, 2005) or mobile payments (Staykova & Damsgaard, 2015). Therefore, it remains an open question whether adopting an open banking strategy will help improve bank performance, possibly through improving risk management and competitiveness with other competitors.

While API adoption can be considered a form of digital innovation and investment, it also differs from traditional bank digitalization efforts (such as online or mobile banking) in several ways. Previous innovation effects focused on positive effects on internal efficiency and attractiveness to the banks' existing customer base. IT innovations can significantly reduce the cost of bank customers searching for and switching banks by allowing banks to screen and monitor new customers more effectively (Hauswald & Marquez, 2003), thereby avoiding the problem of information asymmetry associated with the high cost of screening and monitoring (Agarwal & Hauswald, 2010; Degryse & Ongena, 2005). Thus, banks can gain a competitive advantage through IT adoption, as it might help understand customers' needs better, thereby increasing customer satisfaction and customer retention (Mithas et al., 2012; Dadoukis et al., 2021).

In addition to improving the experience of existing customers, external APIs can generate further value outside the firm via third parties as part of an “inverted” firm strategy (Benzell et al., 2023), which generates value externally.⁶ Though banks can further create internal value by leveraging APIs internally to improve existing processes, the value created by third parties might expand the boundaries of banks’ service offerings and clientele. Thereby, banks with APIs can create a wider range of products and services and a banking ecosystem in which third parties help banks broaden their core business and maximize the use of resources.⁷

However, Benzell et al. (2023) note that API adoption can have limited effects on market value, as external third parties might not necessarily engage with the APIs, and IT investments might fail to produce value without complementary investment (Brynjolfsson et al., 2021). Furthermore, building a platform incurs procurement costs, and the initial investment costs of API adoption might be considerable, reducing the positive effects of API adoption at least in the initial years after adoption. Due to the tension of the possible effects of API adoption on bank performance, we propose the following hypothesis:

H1: Banks’ API adoption has a significant relationship with bank performance.

2.2 API and Credit Risk

As one of the key functions of banks is to screen and monitor borrowers, IT-intensive banks can have a relative advantage when it comes to accessing and processing information to aid processes such as collateral screening, default risk assessment, and loan processing. In particular, bank IT adoption may reduce banks’ credit risk through greater client information acquisition and transparency (Hauswald & Marquez, 2003) and lead to softer lending competition (Hauswald & Marquez, 2006). Branzoli et al. (2024) show banks with higher IT expenditure and usage experience higher credit growth during the Covid period, while Oikonomou et al. (2023) show that high IT adoption by banks is related to lower increases in non-performing loans (NPL) during the financial crisis, a measure of bank distress and

⁶ This contrasts with the traditional “pipeline” strategy where the firm generates value mainly internally by designing, producing, and selling products on its own (Alstynne et al., 2016).

⁷ Lindman et al. (2015) uses different business models to illustrate how businesses can create value by enriching open data.

credit risk. Furthermore, credit providers' lending capacity is inherently determined by their screening abilities, with FinTechs having a technological advantage due to their more advanced data analysis algorithms (He et al., 2022).

We highlight the reduction of credit risk through greater data sharing and transparency of bank customers as API adoption allows to obtain more enriched customer data, consistent with the information generation hypothesis (Koetter & Noth, 2013). In this context, API adoption can further facilitate banks' information acquisition through more efficient data sharing with third-party providers and improve the management of credit risk through the availability of more historical transaction data, leading to more accurate assessments of credit risk scores.

However, beneficial effects might depend on the screening capabilities and credit management of adopting banks. In particular, Parlour et al. (2022) study competition between FinTech payment providers and a monopolistic bank, illustrating how FinTech competition in payment services might disrupt the information spillover of payment data used to assess consumers' credit quality within the traditional bank model. They find that allowing voluntary data porting by consumers might lead to a possible negative data externality for consumers who do not share their data and disrupt information spillover within banks. Thus, we conjecture that banks with lower credit risk will be affected less by the disruption of information spillover, allowing them to harness the potential provided through the increase in customer data through API adoption. As API adoption can have varying effects on bank performance for banks with different levels of credit risk management and screening abilities, we put forward the second hypothesis:

H2: The relationship between API adoption and bank performance depends on the banks' individual level of credit risk.

2.3 API and Banking Competition

IT adoption can further help banks gain competitive advantages against their competitors, by increasing efficiencies in data sharing and loan processing, expanding their service offering, and widening their pool of customers.

Koetter & Noth (2013) show that the use of IT, proxied by IT expenditures, use of information technology (IT) contributes to bank output. Hauswald & Marquez (2003) conclude that investments in bank IT can influence the strength of bank competition by affecting information processing power.

In contrast to other IT innovations, however, banks adopt APIs to increase collaboration with third parties and possibly competitors, thereby also facilitating overview and insight into third-party providers and possible competitors. By understanding third-party systems, banks can gain insight into their business strategies and digital offerings, thereby reducing their own transaction costs and expanding their customer base, similar to interactions of Amazon with third-party providers (Zhu & Liu, 2018). Furthermore, APIs can improve the efficiency of collaboration between banks and third parties as APIs allow for direct data exchange between different divisions, similar to the spillover effects postulated by Parlour et al. (2022). This type of data sharing is more conducive to collaboration and access to information and can thus help to interconnect business and service processes between organizations, thereby increasing the banks' productivity and market power (or monopoly as suggested by Parlour et al. (2022).

Existing open banking research has extensively researched the impact of the growth of FinTechs on competition in the banking sector and the competitive relationship between traditional banks and FinTech lenders (Berg et al., 2022; Fuster et al., 2019; Vives, 2019; Vives & Ye, 2023). However, the role of competition in the decision to adopt an open banking strategy is not well understood. He et al. (2023) study the effects of open banking based on their theoretical model of credit market competition, highlighting negative concerns about open banking as it might widen the screening ability gap and over-empower FinTechs compared to banks, leaving borrowers worse off. In equilibrium, they find that lenders with stronger screening capabilities face a less severe winner's curse and earn positive profits, whilst lenders with weaker screening abilities might widen their lending offers but also suffer from a more severe winner's curse, resulting in zero average profit in equilibrium.

To analyze how competition and product differentiation influence the effects of API adopting banks, we utilize product similarity and product fluidity measures proposed by Hoberg & Phillips (2016) and Hoberg et al. (2014) to measure the competitive pressures faced by banks with regard to competitive threats of existing competing banks and potential new entrants. While both measures are based on

textual analysis of 10-K filings, product similarity measures the availability of alternatives to a company's products and services on the market, while product fluidity measures the frequency of new products and services appearing on the market. Based on the above discussion, we propose a third hypothesis:

H3: The relationship between API adoption and bank performance depends on the levels of competitive threats (by existing and potential competitors) faced by banks.

3. Data and Sample Selection

We manually collect evidence of banks' external API adoption and analyze their effects on bank performance. Our sample consists of all publicly listed bank firms (i.e., firms with SIC (Standard Industrial Classification) codes between 6020 and 6999) level information from the Compustat and CRSP database for the years covered by our sample period (2007-2022), including banks' financial information. We exclude firm-year observations with missing values for the key variables. Our final data sample consists of 713 banks and 5,692 firm-year observations. API data are manually collected from the bank's official developer websites as well as from a few APIs and open-banking integration platforms, such as Programmable Web, APIdashboard, Openbanking tracker, Platformable, and APItracker. Our key financial data stem from Compustat, CRSP, and BankFocus.

3.1 Sample Selection

We extract financial data for U.S.-listed banks from Compustat annual filings and BankFocus. We exclude companies with year-end share prices below \$1, companies with total assets and book-to-equity annual observations of firms with negative values, and firms with insufficient financial data to calculate the variables of interest in our analysis. After applying these selection criteria, our final sample consists of 5,692 firm-year observations (713 unique banks). To eliminate the potential effect of outliers, we winsorize all continuous variables at the 1% and 99% percentiles to alleviate the potential impact of outliers.

Measures of banks' API implementation

API implementation is measured by a dummy variable $API\_Adopt_{i,t}$ that takes the value 1 if bank i has

adopted public APIs in or before year t , and 0 otherwise, during the sample period from 2007-2022. We also incorporate a dummy variable for API_bank , where bank i is classified as an API_bank if it has adopted at least one API during the sample period, and otherwise not. We manually collect the API information (such as API name, categories, description, adoption date, etc.) from the bank's official developer websites as well as from API and open-banking integration platforms, such as Programmable Web, APIdashboard, Openbanking tracker, Platformable and APItracker.⁸

Measures of bank performance

We use *Tobin's Q* and *ROA* to measure bank performance and further analyze changes in banks' market value (*MRKTV*) (similar to Benzell et al. (2023)). Following Hirtle et al. (2020), we analyze different components of bank earnings, in particular net interest margin (*NIM*), the ratio of other noninterest expenses to total assets (*NIE*), the ratio of noninterest income to total assets (*NII*) and the ratio of loan loss provisions to total asset (*LLP*). We further control for several bank-level characteristics as is common in the literature, such as *Bank Size*, *Firm Age*, *Capital Intensity*, *Leverage*, *Tangibility*, *Cash Holding*, *Cost of Capital*, *Deposit Ratio*, *Loan Ratio*, and the number of employees (*Employee*). The specific variable names, definitions, and sources are provided in Table 1.

Measures of Competition and Competitive Threats

To analyze the influence of competitive factors in the banking industry, we use the product similarity and product fluidity measures for individual banks, from the Hoberg-Phillips Data Library⁹. Product similarity measures the availability of alternatives to a company's products and services, while product fluidity measures the frequency of new products and services appearing on the market. Hoberg & Phillips (2016) use textual analysis of product descriptions in companies' 10-K files to identify competitors for each company. They find that firms with higher *product similarity* scores are more likely to mention competitive pressure posed by rivals. In contrast, *product fluidity* measures the ex-ante competitive threats faced by a firm in its product market that captures changes in rival firms' products relative to the firm (Hoberg et al. (2014)). Using both measures, we can capture both competitive pressures by existing and potential rivals based on product descriptions in the 10-K filings.

⁸ We assign the year of the API adoption based on internet archives.

⁹ Hoberg and Phillips Data Library can be found here: <https://hobergphillips.tuck.dartmouth.edu>.

API classification

Our API adoption dataset contains public APIs that financial institutions use to communicate data and information externally (with third-party providers and partners). To classify APIs, we use a broader approach based on the information they process: we cluster APIs by HTTP method¹⁰ combination (Craig et al., 2016; Serbout et al., 2022) and draw inspiration from the Financial Conduct Authority's (FCA)¹¹ definition of two types of third-party providers: read-only related Account Information Service Providers (AISP) and read-and-write related Payment Initiation Service Providers (PISP). We determine whether an API can only request data from a specified resource (*Read-only*) or also send data to a server to create/update a resource (*Read-Write*)¹². First, *Read-only* APIs provide data access to third-party providers who can only see and ‘consume’ data without making any amendments to the original database or initiating any actions such as account creation or issuing of contracts or services. These are relevant when access to data is needed, such as bank account, transactional and balance information. On the other hand, *Read-Write* APIs enable a stronger connection and deeper integration between parties, allowing different systems to communicate data and initiate transactions on their behalf following explicit customer consent. The payment initiation process is a typical example where read-write APIs are applied. In our data, 51.13% of APIs of U.S. public banks are *Read-only* APIs whereas 48.87% of APIs are *Read-Write* APIs, allowing us to separately analyze the influence of the two API types.

3.2 Descriptive Statistics

We present the summary statistics of the overall sample (Full Sample) and the subsamples of banks

¹⁰ The Hypertext Transfer Protocol (HTTP) is designed to enable communications between clients and servers. HTTP works as a request-response protocol between a client and server. The two most common HTTP methods are: GET and POST. GET is used to request data from a specified resource, while POST is used to send data to a server to create/update a resource.

¹¹ Financial Conduct Authority (2017) provide the definition of Account information and payment initiation services. An authorised AISP can using bank API access a user’s bank account data via their financial institution, but this only happens when the user provides explicit consent. This access is, defined as “read-only”, which means that they can only see the information but cannot access the account; While an authorised PISP can not only view consumer-permission financial data on a bank account through bank API, but they’re also authorised to make payments on behalf of the customer. This has led some industry commentators to refer to PISPs as having “read-write” access: <https://www.fca.org.uk/consumers/account-information-payment-initiation-services>.

¹² Read and write APIs information can see from the official website of the UK Open Banking Implementation Entity (OBIE): <https://www.openbanking.org.uk/glossary/read-write-api/#:~:text=Read%2FWrite%20APIs%20enable%20third,initiate%20payments%20from%20those%20accounts>.

with and without APIs in Table 2. The table reports selected mean and standard deviations (SD) for relevant variables of our analyses for the full sample and two subsamples. The statistics are from 2007 to 2022, covering the major period of growing API adoption.

[Insert Table 2 about here]

The summary statistics in Table 2 give insight into the characteristics of banks with and without APIs. We find that only around 3% of the U.S.-listed banks in our sample have adopted APIs (22 out of 713 banks). Banks that have adopted public APIs tend to have larger average total assets (*Bank Size*), have higher levels of *ROA* and non-interest income (*NII*) as well as market value (*MRKTV*) and *Tobin's Q*, compared to banks that have not adopted public APIs. Furthermore, banks with APIs have larger loans and more employees, higher leverage and cash holdings, lower cost of capital, generally lower credit risk (as determined by non-performing loans (*NPL*)), higher operational efficiency (*Efficiency*), relatively lower product similarity (*Similarity*) and product fluidity (*Fluidity*). We formally test the determinants of API adoption using a logistic regression in Section 4.1.

Table A1 in Appendix A further shows the overall correlation between the main independent and dependent variables and bank characteristics. The correlation coefficients show positive correlations of API adoption and API intensity with *Tobin's Q*, market value, and *ROA*, and negative correlations with credit risk (*NPL*, *LLP*, and *Z-Score*) and competition metrics (*Similarity* and *Fluidity*).

3.3 API Adoption by Banks

We analyze the API adoption of banks over time and present our results in Figure 1 and Figure 2.

[Insert Figure 1 and Figure 2 about here]

Figure 1 shows the growth and cumulative APIs and API-banks for the sample period of 2007 to 2022. The bar chart illustrates the cumulative number of API-banks and banking APIs, while the line chart illustrates the number of API-banks and APIs added each year. There is a sizeable increase in API adoption in 2020 and 2021, pointing towards an increasing trend of adopting APIs in the banking industry. Figure 2 displays the distribution of banks that adopted APIs (API banks) by each U.S. state in the sample period.

4. Empirical Results

4.1 Determinants of API Adoption

Studies have shown that bank characteristics such as profitability, bank size, presence in urban markets, membership in bank holding companies, branching intensity, capital-to-asset ratio, non-performing loan ratio, etc., play an essential role in adopting bank websites and online banking services (Furst et al., 2002; DeYoung et al., 2007; Hernandez-Murillo et al. 2010). To analyze the factors that determine API adoption based on bank-specific characteristics, we apply the following logistic regression:

$$API_{bank_i} = \alpha_{it} + \beta Bank\ Characteristics_{i,t} + \omega_t + \epsilon_{i,t} \quad (1)$$

where API_{bank_i} is a dummy variable that equals one if bank i has adopted APIs during the sample period and 0 otherwise. We include the following measures for bank characteristics prior to API adoption: the age of the bank in years (*Firm Age*), the size of the bank (*Bank Size*) measured as the log of bank i 's total assets, the percentage of non-performing loans (*NPL*) and loan loss provision (*LLP*), and the degree of financial leverage (*Leverage*), calculated as the ratio between selected financial assets of the banking sector and its total equity, and measures of liquidity such as cash holdings (*Cash Holding*). We further include measures of operational efficiency (*Efficiency*), *Capital Intensity*, cybersecurity risk exposure (*Cybersecurity*), Tier 1 capital ratio (*Tier 1*), and risk-weighted assets (*RWA*) as well as the competition metrics (*Similarity* and *Fluidity*) (see Table 1 for variable definitions). To examine the factors influencing API adoption, we include bank characteristics based on observations in the years before the API was adopted. For API banks, only the observations prior to API adoption were retained, whereas for non-API banks, the observations before 2017 were included. We further control for year-fixed effects ω_t . Table 3 presents the results of the logistic regression in Equation (1) based on a sample of 3,911 firm-year observations.

[Insert Table 3 about here]

We find that bank size (*Bank Size*) and operating efficiency (*Efficiency*) are positive determinants of API adoption, as banks with more resources and funds are more likely to cover the considerable investment costs of adopting APIs. In addition, we observe that younger banks (*Firm Age*) with lower *Capital Intensity* are more likely to adopt API technologies. On the credit side, banks with better credit

risk management (as measured by non-performing loan ratio (*NPL*), loan loss provision (*LLP*), and risk-weighted assets (*RWA*)) are more likely to adopt APIs. *Tier 1 capital* has also been found to correlate with increased API adoption. Finally, banks with lower levels of product similarity (*Similarity*) within the banking industry are more likely to adopt and implement APIs.

4.2 API Adoption and Bank Performance

4.2.1 Baseline Results

We examine the changes in bank performance after API adoption using a two-step regression approach by Heckman (1976) to correct for self-selection. In the first stage regression, we use a Probit model to estimate the selection equation and generate the inverse mills ratio (*IMR*) to account for self-selection which is included in the second stage regression. The Probit model includes control variables and broadband access within the state that the bank is headquartered in (*Broadband*), provided by the Internet Access for High-Speed Services data on broadband adoption¹³, as an exogenous variable. As the adoption of APIs is implemented at the bank's headquarters, broadband penetration can have a positive effect on the decision to adopt and develop APIs, with minor consequences to banks' overall performance. In the second stage of regression, shown in equation (3), we include *IMR* to account for self-selection bias. *Controls_{i,t}* are a set of time-varying firm control variables, respectively; and $\epsilon_{i,t}$ is the error term. Specifically, we estimate the following model:

$$Pr(API\_Adopt_{i,t}) = \alpha_{i,t} + \beta Broadband_{i,t} + \gamma Controls_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (2)$$

$$Perf_{i,t} = \alpha_{i,t} + \beta API\_Adopt_{i,t} + \gamma Controls_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (3)$$

where i and t denote bank and year, respectively. The main variable of interest in the baseline model is *API_Adopt_{i,t}*, which is an indicator set to one if bank i has adopted APIs in or before year t , and zero if bank i has not adopted any APIs in year t . The regression model includes year-fixed effects ω_t and firm-fixed effect φ_i and standard errors are clustered at the firm level.

¹³We retrieve the data from FCC's semi-annual report on broadband adoption, this data includes information on the total number of broadband subscribers in a state, the prevalence of different broadband speeds, and adoption rates. Broadband information is gathered from: <https://www.fcc.gov/BroadbandData>.

For the dependent variable $Perf_{i,t}$, we apply *Tobin's Q* and Return on Assets (*ROA*). The results of the baseline regressions are shown in Table 4:

[Insert Table 4 about here]

Table 4 shows the effects of API adoption on bank performance. Column (0) shows the Heckman first-stage regression, and columns (1)-(4) illustrate the second-stage regression results of the API adoption on bank performance, including IMR to account for self-selection. Columns (1)- (4) report how the API affects *Tobin's Q* and *ROA*, respectively. We include firm and year-fixed effects in columns (2) and (4), while year-fixed effects are not included in columns (1) and (3). We further apply clustered standard error at the firm level.

We observe a consistently significant positive coefficient for API on bank performance, indicating that after banks adopt APIs, *ROA* and *Tobin's Q* are on average higher than before adoption. Robustness checks using various fixed effects and clustered standard errors provide consistent results on the positive influence of API implementation on banking performance. More specifically, the results for *Tobin's Q* and *ROA* consistently show statistically and economically significant positive coefficients of API_Adopt , indicating positive changes in bank performance after API adoption.

4.2.2 Lagged effects over time

While our previous results show that adopting APIs is followed by improvements in bank performance, we further analyze changes in bank performance in the years before and after API adoption. To address concerns about the reliability of OLS estimators and to consider the heterogeneity of API adoption effects across time and treatment units, we apply robust estimators to estimate staggered effects. We follow the estimation procedure introduced by Callaway and Sant'Anna (2021) that accounts for heterogeneity of treatment effects across time. As APIs are adopted in different years, observed covariates should be taken into account to satisfy the parallel trend assumption (Baker et al., 2022; Callaway and Sant'Anna, 2021), allowing us to deal more flexibly with heterogeneity across time. We thus re-estimate our regression model in Equation (4) to account for these dynamic effects.

$$Perf_{i,t} = \alpha_{i,t} + \sum_{k=-5}^2 \delta_k \times D_{i,t}^k + \gamma Control_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (4)$$

where dummy variables $D_{i,t}^k$ is one up to 5 periods preceding and 2 periods following the API event, and δ_k is the parameter of interest, with the binary variables $D_{i,t}^k$ capturing a window of 8 years around API adoption, rather than focusing on changes in the same year and after adoption as in Equation (3).

[Insert Figure 3 and Table 5 about here]

To focus on the dynamic changes around API adoption, Figure 3 and Table 5 present the results of the adapted regression of *ROA* and *Tobin's Q* in 5 years prior and 2 years after API adoption [-5, +2], based on Callaway and Sant'Anna (2021). Regardless of the chosen estimator, coefficients for the pre-adoption years of the API remain close to zero, suggesting no significant differences in *Tobin's Q* and *ROA* between the treatment and control groups before APIs were introduced. Consistent with the trend shown in Figures 3a and 3b, column (1) of Table 5 shows a persistent positive trend of *Tobin's Q* after API adoption over time. Results differ from our baseline model, as we take into account the staggered adoption of bank APIs and changes in *ROA* and *Tobin's Q* over time. In contrast, changes in *ROA* are comparably weaker, albeit positive and significant in the year when the API is adopted. Our results imply that increases in *Tobin's Q*, i.e. growth opportunities of the adopting banks, are positive and persistent, while increases in *ROA* are short-term and decrease after the first year of adoption.

4.2.3 Analysis of Bank Earnings, Costs, and Value

To better understand the impact of APIs on different types of bank earnings, costs, and market value, we analyze bank performance using cost-, income- and value-related components following Hirtle et al. (2020) and Benzell (2023). In particular, non-interest expenses (*NIE*) include staff costs, administrative expenses, branch maintenance, and operating costs, while the cost of loan-loss provision (*LLP*) reflects costs related to the bank's projected loan losses. In terms of bank income, we distinguish between non-interest income (*NII*) and net interest margin (*NIM*). Following Benzell et al. (2023), we further analyze banks' market value (*MRKTV*). We regress our performance variables on lagged variables of API adoption.

$$Perf_{i,t} = \alpha_{i,t} + \beta API\_Adopt_{i,t-j} + \gamma Controls_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (5)$$

where $API\_Adopt_{i,t-j}$ is a binary dummy value that includes up to 2 lags after API adoption, i.e. measuring the relationship with bank profitability in the year of adoption and in the two years after. We

also include year and firm-fixed effects in all models. The results are presented in Table 6.

[Insert Table 6 about here]

Results in Panel A show a significant decline in operating costs (*NIE*) and loan loss provision (*LLP*), while there is an insignificant decline in *NII* and *NIM*. As APIs allow real-time monitoring of borrowers' financial conditions and market dynamics, more accurate and up-to-date credit assessment and reduction in risk of bad debts might lead to a reduction in costs and losses related to non-performing loans. Panel B further shows an increase in banks' market value (in line with previous results of Benzell et al. (2023) who find positive effects of API adoption on firms' market value).

4.2.4 Influence of Different API Categories

We further analyze the differential effects of different types of APIs, in particular Read-only (which facilitate information sharing only) or Read-Write APIs (which allow data to be modified in (near) real-time in addition to allowing access to the data) (see Section 3.1). Using an OLS regression model based on the baseline model, we analyze the changes in performance after the adoption of Read-Write APIs and Read-only APIs.

$$Perf_{i,t} = \alpha_{i,t} + \beta API\ category_{i,t} + \gamma Controls_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (6)$$

where $API\ category_{i,t}$ is one of the two dummy variables R_Adopt or R/W_Adopt which is one if bank i has adopted Read-only APIs or Read/Write APIs in or before year t . The results for the adoption variables of the two API types are presented in Panel A of Table 7.

To analyze the influence of the relative proportion of adopted R-APIs and R/W-APIs, we also use the variables R_Ratio and R/W_Ratio which range from 0 to 1 and measure the relative proportion of Read-only APIs and Read-Write APIs relative to the total number of adopted APIs. The regression results for the relative proportion of R- and RW-APIs are shown in Panel B, Table 7.

[Insert Table 7 about here]

The results in Panel A demonstrate that adopting Read-Write APIs can lead to greater changes in *Tobin's Q* and *ROA* than adopting Read-only APIs. In particular, we find that after adopting Read-Write APIs, both *Tobin's Q* and *ROA* improve. As shown in Panel A column (2), this change represents around

a 1.6% increase compared to the average *Tobin's Q* of 1.018. The change in Tobin's *Q* and ROA is further related to the proportion of R/W APIs relative to the total number, illustrated by the positive coefficient of *R/W_Ratio*.

While Read-only APIs enable access to bank customers' transaction and credit information, they do not allow third-party providers to directly manipulate data and entities and are therefore somewhat limited in terms of value creation for the bank. In contrast, Read-Write APIs give banks greater flexibility and interactivity, allowing banks to manipulate data more proactively but also supporting dynamic real-time data sharing, which allows third parties to provide more detailed information about existing customers and possibly enable better assessment of financial credit risks.

4.2.5 Propensity Score Matching Analysis

To address potential self-selection bias and mitigate systematic differences in characteristics between treatment and control banks, we use propensity score matching (PSM) based on Rosenbaum & Rubin (1983). In particular, we include banks in our treatment group of "API banks" which have at least one API per bank during our sample period, whereas the control group of "non-API banks" has no APIs. We use year-by-year matching, using the bank characteristics from the year before the adoption of an API to match each API bank in the treatment group with a similar non-API bank in the control group. To balance the treatment and control groups, we use the nearest neighbor one-to-five matching with 1% caliper (without replacement) and identify bank-year observations in the treatment and control groups to match based on *Bank Size*, *Firm age*, *Capital Intensity*, *Cash Holding*, and *Cost of Capital*.

[Insert Table 8 about here]

To ensure that the treatment and control groups are balanced, we compare and report matching statistics based on control variables as in Equation (5), including diagnostic statistics for differences in bank characteristics between the treatment and control groups in Panel A of Table 8. Mean treatment effects are reported in Table A2. To estimate the propensity score of treated firms, we use a logistic regression of the treatment indicator (API_bank_i) on the relevant firm-level variables. We re-estimate the regression model in Equation (5) based on our matched sample, including year-fixed effects and firm-fixed effects.

The results from the OLS regression of PSM analysis are presented in Panel B of Table 8. The results based on the PSM sample are consistent with our baseline finding that API adoption has a positive relationship with bank performance. In particular, we examine the differences in *Tobin's Q* and *ROA* between API banks and non-API banks after API adoption and find that differences in *Tobin's Q* and *ROA* are positive and persistent up to 2 years after API adoption.

4.4 Cross-Sectional Analysis

We further explore the cross-sectional heterogeneity of the effects depending on bank characteristics. Specifically, we provide further evidence regarding the cross-sectional differences of the effects of API adoption on bank performance measures based on a variety of variables: (i) using the level non-performing loans (*NPL*) and loan loss provisions (*LLP*) to measure banks' credit risk and credit quality, (ii) banks' product similarity (*Similarity*) and product fluidity (*Fluidity*) to measure competitive pressure for individual banks (Hoberg et al., 2014; Hoberg & Phillips, 2016), (iii) banks' total asset (*Bank Size*) and banks' total deposit (*Deposit*) amount to measure the role of bank size.

In particular, we include a set of dummy variables (*Bank_Character_i*) based on different bank characteristics which equal one if: (i) bank *i*'s *NPL* is higher than the median of sample banks' (*High_NPL*) and the bank's *LLP* is higher than the median of sample banks' (*High_LL*), (ii) bank *i*'s similarity index is higher than the median of sample banks (*High_Similarity*) and product fluidity is higher than the median of sample banks (*High_Fluidity*). (iii) bank *i*'s total asset is higher than the median of sample banks (*High_Asset*) and bank *i*'s total deposit is higher than the median of sample banks (*High_Deposit*). We estimate the following regression model, which extends Equation (3) by incorporating an interaction term between API adoption and bank characteristics.

$$Perf_{i,t} = \beta API_{i,t} + \partial API_{i,t} \times Bank\_Character_i + \gamma Controls_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (7)$$

4.4.1 The Role of Bank Credit Risk

We report on the heterogeneity of results depending on the level of LLP and NPL in Table 9.

[Insert Table 9 about here]

According to Table 9, the increases in performance after API adoption for banks with a high level of non-performing loans ($High\_NPL=1$) as well as loan loss provision ($High\_LLP=1$) are lower compared to banks with low NPL ($High\_NPL=0$) and LLP ($High\_LLP=0$), particularly for ROA . In line with theoretical predictions of Parlour et al. (2022) and He et al. (2022), our results show that banks with lower credit risk experience greater performance increases.

4.4.2 The Role of Bank Product Similarity and Fluidity

To test the heterogenous effects for banks that are subject to different levels of competition, we include an interaction effect of API adoption and a dummy variable that indicates high levels of product similarity within sample banks ($High\_Similarity$) and high levels of product fluidity within the bank industry ($High\_Fluidity$). The results for both analyses are presented in Table 10.

[Insert Table 10 about here]

The results show the increase in bank performance is greater for banks with lower levels of product similarity ($High\_Similarity$) and lower levels of product fluidity ($High\_Fluidity$) but weaker for banks that experience greater competitive pressures, especially for *Tobin's Q*.

In line with previous discussions on banking competition, our results illustrate that higher levels of competition in the banking industry might disrupt internal information spillover according to Parlour et al. (2022). Thus, realizing additional benefits from data sharing with third-party providers might be more difficult when facing external competition. Furthermore, banks with a higher threat of existing competitors (measured by product similarity) as well as potential competitors (measured by product fluidity) might adopt APIs to retain clients and their market position rather than improve bank performance.

4.4.3 The Role of Bank Size

We examine whether the differential changes in bank performance after adopting APIs for banks of different sizes, using total assets as a measure for *Bank Size*. We divide our sample by applying two dummy variables which indicate whether the bank size is above the sample median of total assets ($High\_Asset=1$) and whether a bank's total deposit is higher than the median of bank deposits in the sample ($High\_Deposit=1$), respectively. The results are shown in Table 11.

[Insert Table 11 about here]

Columns (1) and (2) show the interaction effects of API adoption and the bank size dummy *High_Asset* on *Tobin's Q* and *ROA*, while Columns (3) and (4) show the interaction effects of *High_Deposit* and API adoption on bank performance. The results show that banks with a lower share in bank deposits and total assets are more likely to experience positive changes in *ROA* after API adoption, while the interaction effects are not significant for *Tobin's Q*. Thus, the potential improvement in bank *ROA* after API adoption is captured by smaller banks with fewer total assets and a smaller share in bank deposits, whilst larger banks might have other incentives for adopting APIs other than profitability and performance.

5. Conclusion

This paper provides an empirical analysis of bank performance for banks that adopt an open banking strategy. While there is an open banking mandate from regulators in European countries, our empirical results shed light on the implications of mostly voluntary adoption of open banking strategy and APIs by U.S. banks. We find that bank performance improves after API adoption, supporting recent literature that IT adoption and IT investment by banks can have positive effects on firm performance (Dadoukis et al., 2021). However, we illustrate that effects are heterogeneous, as smaller banks with lower levels of credit risk and competitive pressure experience greater increases in performances compared to banks with higher levels of credit risk and subject to more banking competition.

Our paper contributes to the literatures around the impact of technological innovations on the banking sector (Hernández-Murillo et al., 2010; D'Andrea & Limodio, 2023; Pierri & Timmer, 2022), and provides new evidence of open banking strategies and the adoption of external APIs, which facilitates enhanced connectivity and interaction between banks and a range of third parties. Moreover, our paper is an essential complement to previous theoretical frameworks on open banking, digital portability, and information spillover (He et al., 2022; Parlour et al., 2022). Simultaneously, our findings complement and expand upon existing research on FinTech and its impact on the lending industry (Berg et al., 2022; Buchak et al., 2018; Fuster et al., 2019; Gopal & Schnabl, 2022; Tang, 2019; Vives, 2019).

Meanwhile, our study has practical and policy implications, as open banking initiatives and policies can have significant consequences for the banking landscape as well as for FinTech competition. Compared with the open banking mandates adopted in Europe and the UK, our findings provide insights into the effects of open banking adoption in the U.S. banking industry. Our results show that open banking adoption has heterogeneous effects on different types of banks, as some banks experience increases in performance whilst other banks might adopt APIs due to competitive or compliance reasons which may or may not result in improvements in performance. Furthermore, our results are consistent with existing open banking research which shows that an increasing amount of data sharing and data portability can create certain unintended consequences and adverse effects on some banks. Thus, implementing excessively stringent regulations may add additional regulatory burdens on banks and increase discrepancies between banks even further. While it is beyond the scope of this paper, future work might explore the differences in open banking regulation in other countries besides the U.S. and the implications for the banking industry and bank customers.

References

- Agarwal, S., & Hauswald, R. (2010). Distance and Private Information in Lending. *The Review of Financial Studies*, 23(7), 2757–2788. <https://doi.org/10.1093/rfs/hhq001>
- Alstyne, M. W. V., Parker, G. G., & Choudary, S. P. (2016). Pipelines, Platforms, and the New Rules of Strategy. *Harvard Business Review*, 56-60.
- Babina, T., Buchak, G., & Gornall, W. (2022). Customer Data Access and Fintech Entry: Early Evidence from Open Banking. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4071214>
- Baker, A. C., Larcker, D. F., & Wang, C. C. Y. (2022). How much should we trust staggered difference-in-differences estimates? *Journal of Financial Economics*, 144(2), 370–395. <https://doi.org/10.1016/j.jfineco.2022.01.004>
- Beccalli, E. (2007). Does IT investment improve bank performance? Evidence from Europe. *Journal of Banking & Finance*, 31(7), 2205–2230. <https://doi.org/10.1016/j.jbankfin.2006.10.022>
- Benzell, S., Hersh, J. S., Van Alstyne, M. W., & Lagarda, G. (2023). How APIs Create Growth by Inverting the Firm. *Management Science*, 1-22. <https://doi.org/10.1287/mnsc.2023.4968>
- Berg, T., Burg, V., Gombović, A., & Puri, M. (2020). On the Rise of FinTechs: Credit Scoring Using Digital Footprints. *The Review of Financial Studies*, 33(7), 2845–2897. <https://doi.org/10.1093/rfs/hhz099>
- Berg, T., Fuster, A., & Puri, M. (2022). FinTech Lending. *Annual Review of Financial Economics*, 14(1), 187–207. <https://doi.org/10.1146/annurev-financial-101521-112042>
- Berger, A. N. (2003). The Economic Effects of Technological Progress: Evidence from the Banking Industry. *Journal of Money, Credit and Banking*, 35(2), 141–176. <http://dx.doi.org/10.2139/ssrn.332900>
- Branzoli, N., Rainone, E., & Supino, I. (2024). The role of banks' technology adoption in credit markets during the pandemic. *Journal of Financial Stability*, 71, 101230. <https://doi.org/10.1016/j.jfs.2024.101230>
- Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications of the ACM*, 36(12), 66–77. <https://doi.org/10.1145/163298.163309>
- Brynjolfsson, E., Rock, D., & Syverson, C. (2021). The Productivity J-Curve: How Intangibles Complement General Purpose Technologies. *American Economic Journal: Macroeconomics*, 13(1), 333–372. <https://doi.org/10.1257/mac.20180386>
- Buchak, G., Matvos, G., Piskorski, T., & Seru, A. (2018). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics*, 130(3), 453–483. <https://doi.org/10.1016/j.jfineco.2018.03.011>
- Callaway, Brantly, and Pedro H. C. Sant'Anna. 2021. "Difference-in-differences with Multiple Time Periods." *Journal of Econometrics*, 225 (2): 200–230. <https://doi.org/manchester.idm.oclc.org/10.1016/j.jeconom.2020.12.001>
- Clemons, E. K. (1986). Information systems for sustainable competitive advantage. *Information & Management*, 11(3), 131–136. [https://doi.org/10.1016/0378-7206\(86\)90010-8](https://doi.org/10.1016/0378-7206(86)90010-8)
- Craig, A. G., Bae, S.-H., Veeramacheneni, T. S., Taswell, S. K., & Taswell, C. (2016). Web Service APIs for Scribe Registrars, Nexus Diristries, PORTAL Registries, and DOORS Directories in the NPD System. *Working Paper*.
- Dadoukis, A., Fiaschetti, M., & Fusi, G. (2021). IT adoption and bank performance during the Covid-19 pandemic. *Economics Letters*, 204, 109904. <https://doi.org/10.1016/j.econlet.2021.109904>
- D'Acunto, F., Prabhala, N., & Rossi, A. G. (2019). The Promises and Pitfalls of Robo-Advising. *Review of Financial Studies*, 32(5), 1983–2020. <https://doi.org/10.1093/rfs/hhz014>
- D'Andrea, A., & Limodio, N. (2023). High-Speed Internet, Financial Technology, and Banking. *Management Science*, 70(2), 773-798. <https://doi.org/10.1287/mnsc.2023.4703>
- Degryse, H., & Ongena, S. (2005). Distance, Lending Relationships, and Competition. *Journal of Finance*, 60(1), 231–266. <https://doi.org/10.1111/j.1540-6261.2005.00729.x>
- DeYoung, R., Lang, W. W., & Nolle, D. L. (2007). How the Internet affects output and performance at community banks. *Journal of Banking & Finance*, 31(4), 1033–1060. <https://doi.org/10.1016/j.jbankfin.2006.10.003>
- Dinçkol, D., Ozcan, P., & Zachariadis, M. (2023). Regulatory standards and consequences for industry

- architecture: The case of UK Open Banking. *Research Policy*, 52(6), 104760. <https://doi.org/10.1016/j.respol.2023.104760>
- Florackis, C., Louca, C., Michaely, R., & Weber, M. (2022). Cybersecurity Risk. *Review of Financial Studies*, 36(1), 351–407. <https://doi.org/10.1093/rfs/hhac024>
- Furst, K., Lang, W. W., & Nolle, D. E. (2002). Internet Banking. *Journal of Financial Services Research*, 22(1/2), 95–117. <https://doi.org/10.1023/a:1016012703620>
- Fuster, A., Plosser, M., Schnabl, P., & Vickery, J. (2019). The Role of Technology in Mortgage Lending. *The Review of Financial Studies*, 32(5), 1854–1899. <https://doi.org/10.1093/rfs/hhz018>
- Goldstein, I., Huang, C., & Yang, L. (2022). Open Banking under Maturity Transformation. *Working Paper*. <https://papers.ssrn.com/abstract=4215016>
- Gopal, M., & Schnabl, P. (2022). The Rise of Finance Companies and FinTech Lenders in Small Business Lending. *The Review of Financial Studies*, 35(11), 4859–4901. <https://doi.org/10.1093/rfs/hhac034>
- Hauswald, R., & Marquez, R. (2003). Information Technology and Financial Services Competition. *The Review of Financial Studies*, 16(3), 921–948. <https://doi.org/10.1093/rfs/hhg017>
- Hauswald, R., & Marquez, R. (2006). Competition and Strategic Information Acquisition in Credit Markets. *The Review of Financial Studies*, 19(3), 967–1000. <https://doi.org/10.1093/rfs/hhj021>
- He, Z., Huang, J., & Zhou, J. (2023). Open banking: Credit market competition when borrowers own the data. *Journal of Financial Economics*, 147(2), 449–474. <https://doi.org/10.1016/j.jfineco.2022.12.003>
- Heckman, J. J. (1976). The Common Structure of Statistical Models of Truncation, Sample Selection, and Limited Dependent Variables and a Simple Estimator for Such Models. In *Annals of Economic and Social Measurement*, 5(4), 475–492. NBER.
- Hernández-Murillo, R., Llobet, G., & Fuentes, R. (2010). Strategic online banking adoption. *Journal of Banking & Finance*, 34(7), 1650–1663. <https://doi.org/10.1016/j.jbankfin.2010.03.011>
- Hirtle, B., Kovner, A., & Plosser, M. (2020). The Impact of Supervision on Bank Performance. *Journal of Finance*, 75(5), 2765–2808. <https://doi.org/10.1111/jofi.12964>
- Hoberg, G., & Phillips, G. (2016). Text-Based Network Industries and Endogenous Product Differentiation. *Journal of Political Economy*, 124(5), 1423–1465. <https://doi.org/10.1086/688176>
- Hoberg, G., Phillips, G., & Prabhala, N. (2014). Product Market Threats, Payouts, and Financial Flexibility. *Journal of Finance*, 69(1), 293–324. <https://doi.org/10.1111/jofi.12050>
- Koetter, M., & Noth, F. (2013). IT use, productivity, and market power in banking. *Journal of Financial Stability*, 9(4), 695–704. <https://doi.org/10.1016/j.jfs.2012.06.001>
- Marquez, R. (2002). Competition, Adverse Selection, and Information Dispersion in the Banking Industry. *The Review of Financial Studies*, 15(3), 901–926. <http://dx.doi.org/10.2139/ssrn.264531>
- Martín-Oliver, A., & Salas-Fumás, V. (2008). The output and profit contribution of information technology and advertising investments in banks. *Journal of Financial Intermediation*, 17(2), 229–255. <https://doi.org/10.1016/j.jfi.2007.10.001>
- Mithas, S., Tafti, A., Bardhan, I., & Goh, J. M. (2012). Information Technology and Firm Profitability: Mechanisms and Empirical Evidence. *MIS Quarterly*, 36(1), 205–224. <https://doi.org/10.2307/41410414>
- Oikonomou, M., Pierri, N., & Timmer, Y. (2023). IT shields: Technology adoption and economic resilience during the COVID-19 pandemic. *Finance and Economics Discussion Series*, (2023–010), 1–51. <https://doi.org/10.17016/feds.2023.010>
- Parlour, C. A., Rajan, U., & Zhu, H. (2022). When FinTech Competes for Payment Flows. *The Review of Financial Studies*, 35(11), 4985–5024. <https://doi.org/10.1093/rfs/hhac022>
- Pierri, N., & Timmer, Y. (2022). The importance of technology in banking during a crisis. *Journal of Monetary Economics*, 128, 88–104. <https://doi.org/10.1016/j.jmoneco.2022.04.001>
- Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41–55. <https://doi.org/10.1093/biomet/70.1.41>
- Sathye, M. (2005). The impact of Internet banking on performance and risk profile: Evidence from Australian credit unions. *Journal of Banking Regulation*, 6(2), 163–174. <https://doi.org/10.1057/palgrave.jbr.2340189>

- Scott, S. V., Van Reenen, J., & Zachariadis, M. (2017). The long-term effect of digital innovation on bank performance: An empirical study of SWIFT adoption in financial services. *Research Policy*, 46(5), 984–1004. <https://doi.org/10.1016/j.respol.2017.03.010>
- Serbout, S., Lauro, F. D., & Pautasso, C. (2022). Web APIs Structures and Data Models Analysis. 2022 *IEEE 19th International Conference on Software Architecture Companion (ICSA-C)*, 84–91. <https://doi.org/10.1109/ICSA-C54293.2022.00059>
- Staykova, K. S., & Damsgaard, J. (2015). The race to dominate the mobile payments platform: Entry and expansion strategies. *Electronic Commerce Research and Applications*, 14(5), 319–330. <https://doi.org/10.1016/j.elerap.2015.03.004>
- Tang, H. (2019). Peer-to-Peer Lenders Versus Banks: Substitutes or Complements? *The Review of Financial Studies*, 32(5), 1900–1938. <https://doi.org/10.1093/rfs/hhy137>
- Vives, X. (2019). Digital Disruption in Banking. *Annual Review of Financial Economics*, 11(1), 243–272. <https://doi.org/10.1146/annurev-financial-100719-120854>
- Vives, X., & Ye, Z. (2023). Information Technology and Lender Competition. *Working Paper*. <https://doi.org/10.2139/ssrn.3863988>
- Zachariadis, M., & Ozcan, P. (2016). The API Economy and Digital Transformation in Financial Services: The case of Open Banking. *Working Paper*. <http://dx.doi.org/10.2139/ssrn.2975199>
- Zhu, F., & Liu, Q. (2018). Competing with complementors: An empirical look at Amazon.com. *Strategic Management Journal*, 39(10), 2618–2642. <https://doi.org/10.1002/smj.2932>

Figures and Tables

Figure 1. Number of API-banks and APIs by year

This figure shows the growth and cumulative number of API-banks and growth and cumulative number of adopted bank APIs during the sample interval from 2007 to 2022. The bar chart shows the cumulative number of API-bank (APIs), and the line chart shows the number of new API-banks (APIs) for each year.

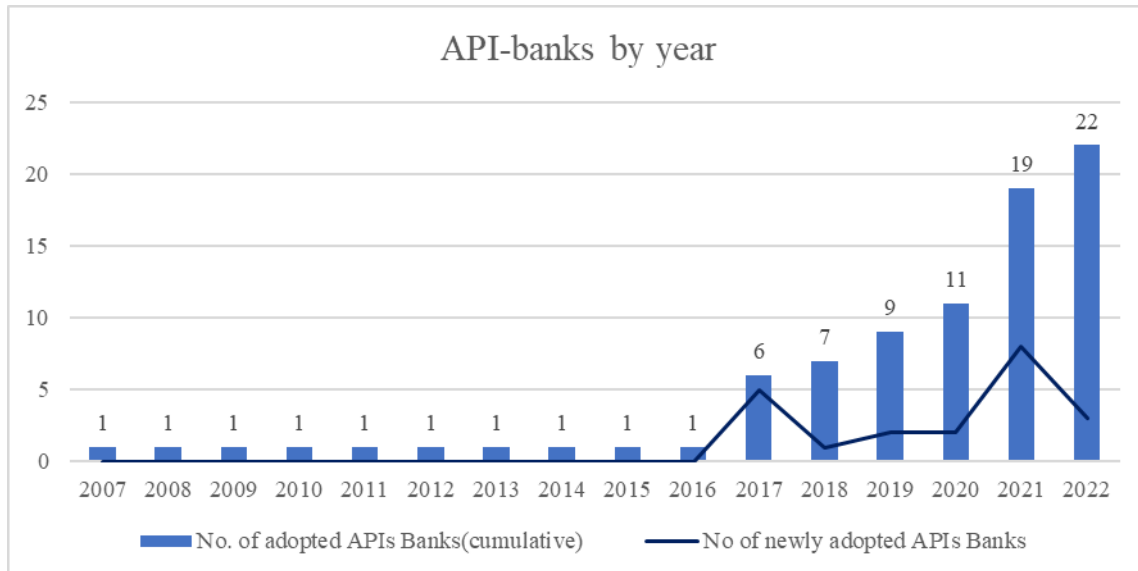


Figure 1a. Number of API-banks over time

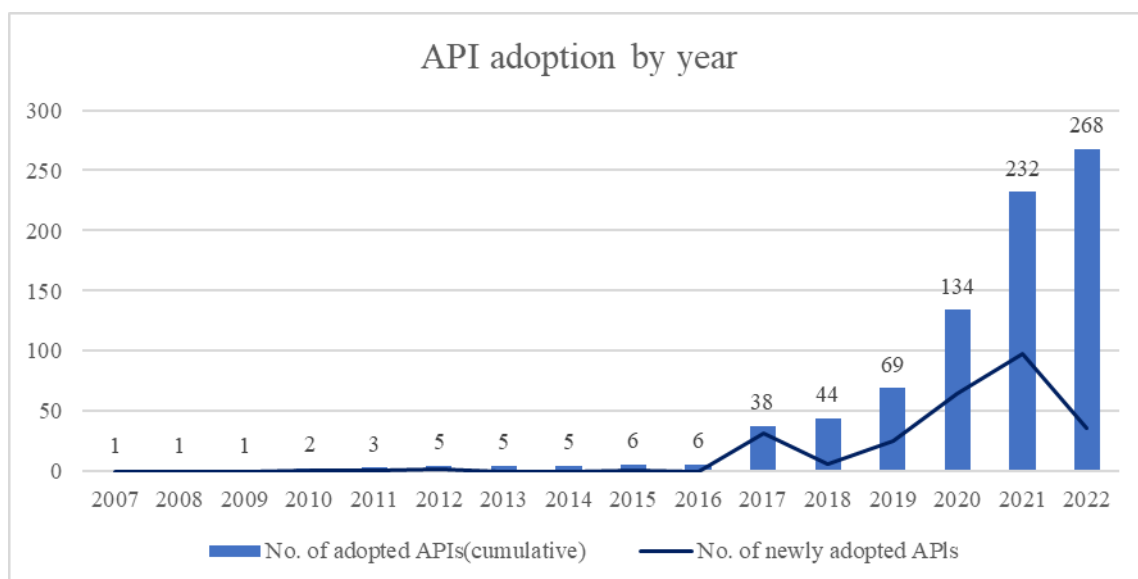


Figure 1b. Number of adopted APIs over time

Figure 2. Distribution of API banks in the U.S.

This map displays the distribution of banks that adopted APIs (API banks) by each state. The banks in 14 states (California, New York, North Carolina, Pennsylvania, Tennessee, Kansas, Michigan, Minnesota, Missouri, Nevada, Ohio, Rhode Island, Texas) adopted at least one API from 2007 to 2022.

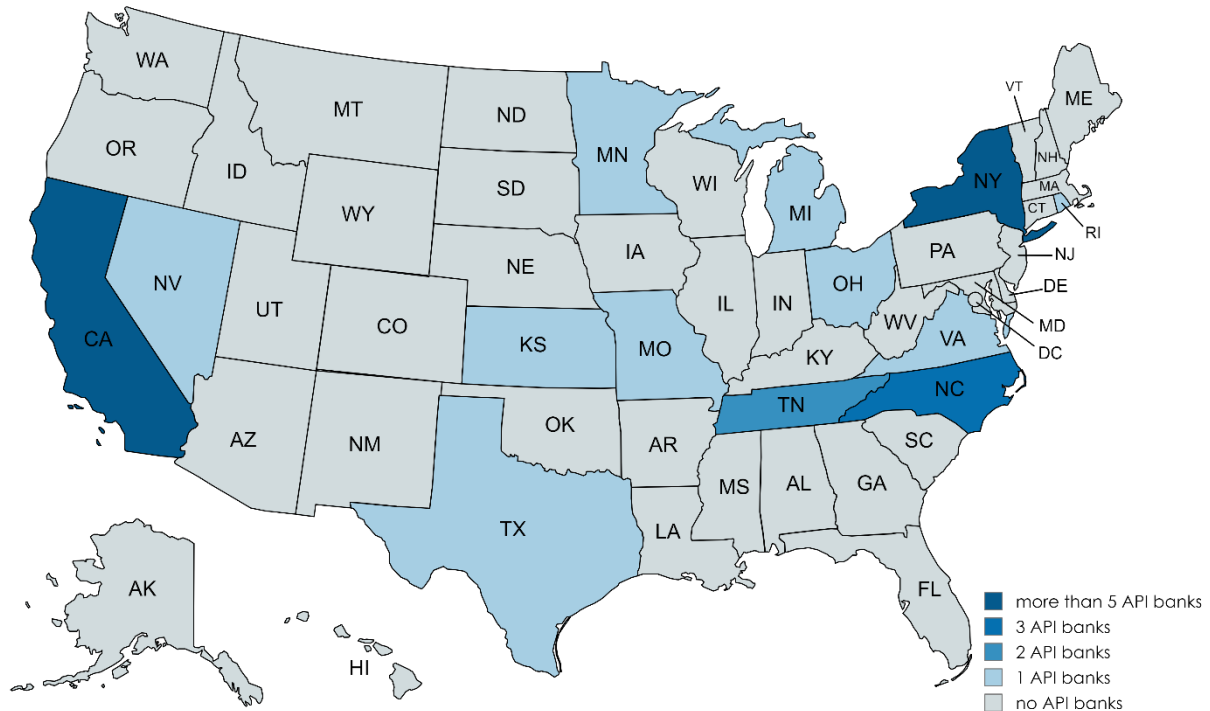


Figure 3. Changes in Tobin's Q and ROA around API adoption

This figure presents the changes in *Tobin's Q* and *ROA* around API adoption during our sample period from 2007-2022. We report the lag and lead for a binary variable that captures the change in bank performance before and after API adoption, and the graph shows the coefficient from -5 to +2 years. The outcome variable of the upper figure is the bank's overall growth metric *Tobin's Q*, while the lower figure is *ROA*. The control variables and fixed effects are the same as in column (2) of Table 4 and are not reported here for brevity. The bar chart represents a 95% confidence interval. The Y-axis represents the average changes in *Tobin's Q* and *ROA* of API banks after adopting APIs relative to non-API banks.

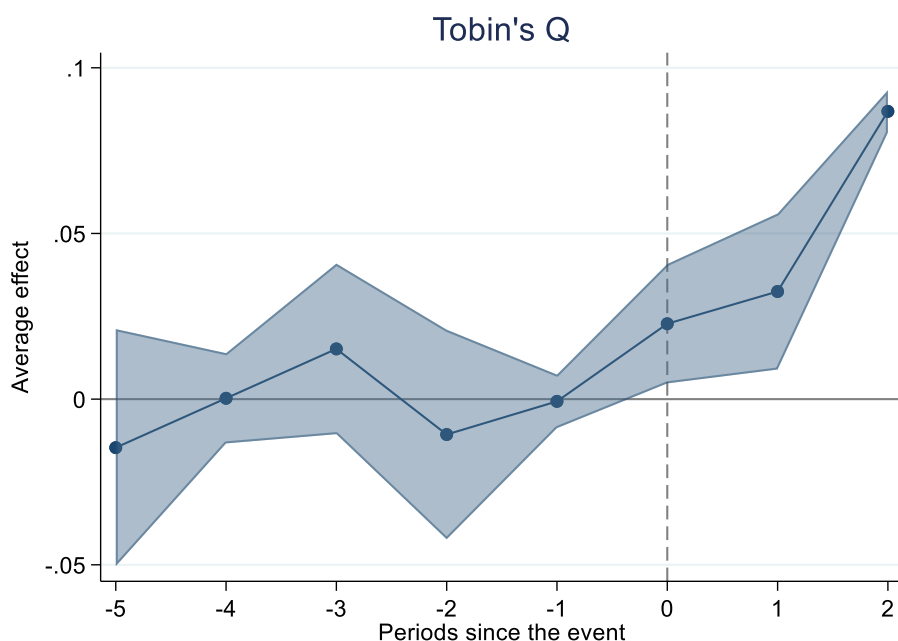


Figure 3a. Change in Tobin's Q around API adoption

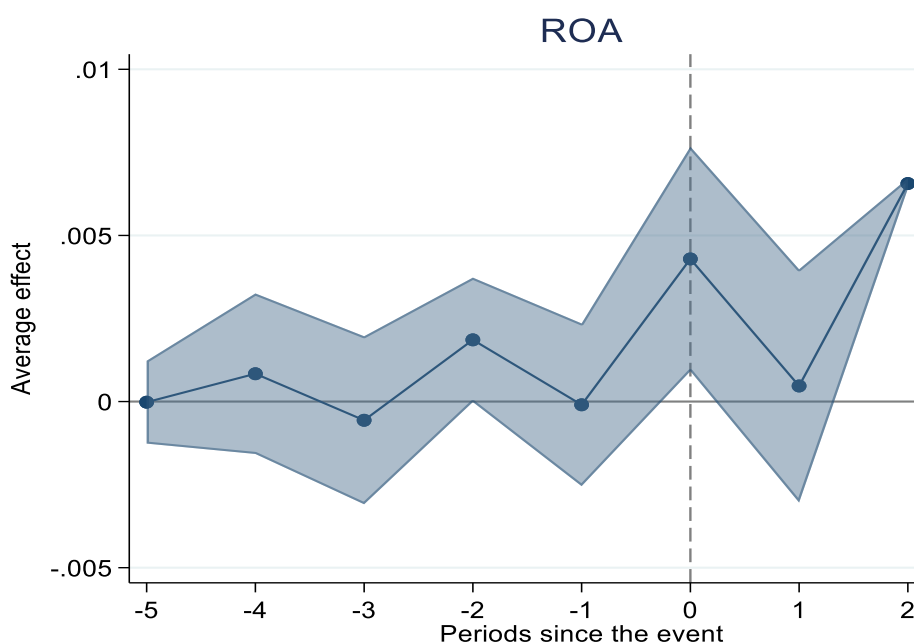


Figure 3b. Change in ROA around API adoption

Table 1. Variable description

Variable name	Definition	Source
Variables for API Adoption and Instrumental Variable		
<i>API_Adopt_{i,t}</i>	The dummy variable equals 1 if the bank <i>i</i> has operating APIs in period <i>t</i>	Bank websites and API platforms
<i>API_Intensity_{i,t}</i>	Number of APIs owned by bank <i>i</i> in year <i>t</i>	
<i>API_bank_i</i>	Dummy variable indicating if bank <i>i</i> has operating APIs during the sample period (2007-2022)	
<i>R_Ratio</i>	The number of adopted Read-only APIs to the total number of APIs in the bank <i>i</i> in <i>t</i> years	
<i>R/W_Ratio</i>	The number of Read-Write APIs to the total number of APIs in the bank <i>i</i> in <i>t</i> years	
Measures of Bank Performance		
<i>Tobin's Q</i>	The ratio of the market value of bank shares to the replacement cost of the assets represented by the shares	Compustat, BankFocus
<i>MRKTV</i>	Natural logarithm of market value of equity	
<i>NIM</i>	Net interest margin (<i>NIM</i>)	
<i>NIE</i>	The ratio of other noninterest expenses to total assets (<i>NIE</i>)	
<i>NII</i>	The ratio of noninterest income to total asset (<i>NII</i>)	
<i>LLP</i>	The ratio of loan loss provision to total loans	
Bank and Industry Characteristics		
<i>Firm Age</i>	Year minus the IPO year or the first year Compustat reports data for the firm	Compustat, BankFocus
<i>Bank Size</i>	Logarithm of total assets	
<i>Capital Intensity</i>	The ratio of capital expenditures to total assets	
<i>Leverage</i>	Long-term debt plus debt in current liabilities, divided by total assets	
<i>Cash Holding</i>	Cash and short-term investments are divided by total assets	
<i>Cost of Capital</i>	Total interest expense divided by the total amount of debt	
<i>Tier 1</i>	Tier 1 capital ratio of a bank's equity capital with its total risk-weighted assets (RWAs)	
<i>Deposit Ratio</i>	The ratio of total deposit to total assets	
<i>Loan Ratio</i>	The ratio of total loans to total assets	
<i>Employee</i>	We use the natural logarithm of 1 plus the number of employees in the regression, the number of employees in thousands.	
<i>Efficiency</i>	Operational efficiency is the ratio of the bank's inputs to outputs, (input measured by deposits, non-interest expenses (net of loan losses), fixed assets, and loan loss provisions) and output by total loans and leases, other earning assets	
<i>RWA</i>	The logarithm of the bank's Risk-weighted asset	
<i>NPL</i>	The ratio of non-performing loans to total loans	
<i>Similarity</i>	The pairwise product similarities for each firm with competitor firms in 10-k filings. See Hoberg and Phillips (2016)	
<i>Fluidity</i>	The overlap between the product descriptions of firms and corresponding rivals. See Hoberg et al. (2014)	
<i>Cybersecurity</i>	Based on textual analysis and a comparison of cybersecurity risk disclosures of banks. See Florackis (2022)	Cybersecurity score
<i>Broadband</i>	State-level broadband subscription rates for Internet access within the range [0,1], with values near 0 indicating low broadband subscription and near 1 indicating high residential broadband subscription	FCC's semi-annual report

Table 2. Summary statistics

This table presents summary statistics for the main variables in the regressions for 5,692 firm-year observations for 713 banks from 2007 to 2022. Variable descriptions are provided in Table 1. Column (1) shows the descriptive statistics number of observations (N), mean, and standard deviation (SD) for the overall sample, columns (2) and (3) show the descriptive statistics for the 691 banks without APIs and the 22 banks with APIs, respectively.

	(1) Full-Sample (N=713)			(2) Banks with APIs (N=22)		(3) Banks without APIs (N=691)	
No. of banks	N	Mean	SD	Mean	SD	Mean	SD
Panel A: Variables for API adoption							
<i>API_Adopt</i>	5692	0.008	0.091	0.222	0.416	0.000	0.000
<i>API_Intensity</i>	5641	0.060	0.969	1.590	4.762	0.000	0.000
<i>API_bank</i>	5692	0.037	0.189	1.000	0.000	0.000	0.000
<i>R_Ratio</i>	5692	0.034	0.532	0.896	2.618	0.000	0.014
<i>R/W_Ratio</i>	5692	0.028	0.473	0.745	2.347	0.000	0.000
Panel B: Measures of bank performance							
<i>Tobin's Q</i>	5657	1.018	0.049	1.037	0.043	1.017	0.049
<i>MRKTV</i>	5657	2.195	9.147	31.18	33.43	1.072	3.163
<i>ROA</i>	5692	0.005	0.012	0.008	0.005	0.005	0.012
<i>NIM</i>	5636	3.508	0.687	3.249	0.828	3.518	0.679
<i>NIE</i>	5641	0.032	0.013	0.030	0.010	0.032	0.014
<i>NII</i>	5641	0.010	0.009	0.017	0.009	0.010	0.009
<i>LLP</i>	5211	0.587	1.020	0.638	0.849	0.585	1.026
Panel C: Bank and industry characteristics							
<i>Firm Age</i>	5692	2.704	0.696	3.448	0.687	2.675	0.68
<i>Bank Size</i>	5692	7.947	1.612	11.43	2.235	7.812	1.422
<i>Capital Intensity</i>	5692	0.107	0.038	0.103	0.019	0.107	0.038
<i>Leverage</i>	5692	1.207	1.234	1.488	1.139	1.196	1.236
<i>Cash Holding</i>	5692	0.056	0.053	0.096	0.083	0.054	0.051
<i>Cost of Capital</i>	5692	3.269	40.80	0.477	1.359	3.377	41.58
<i>Tier 1</i>	5692	12.480	4.119	11.640	2.120	12.520	4.174
<i>RWA</i>	5692	4.753	6.273	8.404	8.306	4.612	6.138
<i>Employee</i>	5692	6.275	1.485	9.359	2.339	6.156	1.303
<i>Efficiency</i>	5692	0.122	0.010	0.024	0.016	0.012	0.009
<i>Broadband</i>	5692	0.722	0.125	0.759	0.100	0.721	0.126
<i>Deposit Ratio</i>	5692	0.765	0.096	0.711	0.106	0.767	0.095
<i>Loan Ratio</i>	4164	0.043	0.267	0.060	0.048	0.043	0.271
<i>NPL</i>	5328	1.539	1.060	1.468	0.781	1.542	1.070
<i>Similarity</i>	5692	51.21	16.68	41.77	15.38	51.58	16.62
<i>Fluidity</i>	5692	10.63	3.521	9.404	3.453	10.68	3.516
<i>Cybersecurity</i>	5215	0.094	0.032	0.112	0.021	0.093	0.032

Table 3. Logistic regression of API adoption on bank characteristics

This table shows the results of a logistic regression of banks' API adoption (*API_bank*) on bank characteristics:

$$API\_bank_i = \alpha_i + \beta Bank\ Characteristics_{i,t} + \omega_t + \epsilon_{i,t} \quad (1)$$

The table reports regression coefficients and t-statistics (in parentheses). The regression model is shown in Equation (1), with the dependent variable *API_bank_i* (a dummy variable indicating if bank *i* adopts APIs during the sample period) regressed on variables of bank characteristics before the adoption of the first API. The independent variable definitions are provided in Table 1. All models include year-fixed effects. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	<i>API_bank</i>	
	(1)	(2)
<i>Firm Age</i>	-0.665*** (-2.94)	-0.608*** (-2.81)
<i>Bank Size</i>	1.232*** (10.12)	1.271*** (10.52)
<i>Cash Holding</i>	-1.052 (-0.63)	-0.718 (-0.45)
<i>Efficiency</i>	24.800*** (2.72)	20.284** (2.08)
<i>Capital Intensity</i>	-18.775*** (-3.30)	-17.212*** (-3.21)
<i>Leverage</i>	-0.002 (-0.02)	0.075 (1.08)
<i>Cybersecurity</i>	-3.078 (-0.50)	-1.368 (-0.24)
<i>Tier 1</i>	-0.101** (-2.08)	-0.074* (-1.65)
<i>RWA</i>	-0.085*** (-3.13)	-0.094*** (-3.40)
<i>NPL</i>	-0.573*** (-5.10)	
<i>Similarity</i>	-0.023*** (-2.93)	
<i>LLP</i>		-0.509*** (-4.98)
<i>Fluidity</i>		-0.034 (-0.93)
<i>Constant</i>	-8.195*** (-8.87)	-10.669*** (-12.41)
Year FE	Yes	Yes
Observations	3,911	3,911

Table 4. Regression of bank performance on API adoption

The table reports baseline regression coefficients and t-statistics (in parentheses) using the Heckman two-stage analysis.

$$Pr(API_{i,t}) = \alpha_{i,t} + \beta Broadband_{i,t} + \gamma Controls_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (2)$$

$$Perf_{i,t} = \alpha_{i,t} + \beta API\_Adopt_{i,t} + \gamma Controls_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (3)$$

This table shows the effect of API adoption on the bank's performance. Column (0) shows the Heckman first-stage Probit regression of API adoption by the bank i (API_i) on control variables and variable $Broadband_i$ that measures the strength of Internet access in the state where the bank i is headquartered. IMR denotes the inverse Mills ratio generated from the first step regression. In the second-stage OLS regression, we regress *Tobin's Q* and *ROA* on variable $API\_Adopt_{i,t}$ (a dummy variable representing whether bank i adopted APIs in or before year t) and control variables, as defined in Table 1. Firm FE and Year FE indicate whether the model includes firm- or year-fixed effects. Standard errors clustered at the firm level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	API_i	<i>Tobin's Q</i>		<i>ROA</i>	
	(0)	(1)	(2)	(3)	(4)
<i>Broadband</i>	0.545 (0.63)				
API_Adopt_t		0.018* (1.93)	0.015* (1.65)	0.004*** (2.84)	0.002* (1.66)
<i>IMR</i>		-0.010*** (-3.59)	-0.010*** (-3.93)	-0.001 (-1.23)	-0.002* (-1.90)
<i>Firm Age</i>	-0.177 (-1.50)	0.027*** (6.78)	0.007 (1.32)	0.012*** (6.99)	0.010*** (6.27)
<i>Bank Size</i>	0.735** (2.52)	-0.016*** (-4.13)	-0.028*** (-5.60)	-0.003*** (-2.78)	-0.005*** (-3.35)
<i>Cash Holding</i>	1.749 (1.29)	-0.143*** (-7.37)	-0.020 (-1.01)	-0.026*** (-3.99)	-0.028*** (-3.95)
<i>Cost of Capital</i>	-0.008 (-1.12)	0.000** (2.16)	0.000*** (3.58)	0.000 (1.02)	0.000* (1.88)
<i>Employee</i>	-0.284 (-0.93)	0.014*** (2.95)	0.019*** (3.96)	-0.000 (-0.03)	0.001 (0.45)
<i>Leverage</i>	-0.124 (-1.47)	-0.001 (-1.03)	0.001 (0.98)	0.140*** (2.64)	0.140*** (2.64)
<i>Capital Intensity</i>	-10.023*** (-2.64)			0.307*** (6.37)	0.289*** (6.26)
<i>Deposit Ratio</i>				-0.015*** (-3.41)	-0.020*** (-3.87)
<i>Loan Ratio</i>				0.004 (1.33)	0.004 (1.33)
<i>Constant</i>	-4.923*** (-5.58)	1.021*** (43.90)	1.131*** (35.13)	-0.144*** (-2.73)	-0.120** (-2.31)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No	Yes
Firm cluster	Yes	Yes	Yes	Yes	Yes
Observations	5,613	5,613	5,613	4,098	4,098
R-squared	0.3635	0.584	0.718	0.551	0.618

Table 5. Dynamic regression of bank performance on lagged API adoption

This table reports the changes in *Tobin's Q* and *ROA* around API adoption during our sample period from 2007-2022 using the estimation procedure introduced by Callaway and Sant'Anna (2021) (variables are defined as in Table 4):

$$Perf_{i,t} = \alpha_{i,t} + \sum_{k=-5}^2 \delta_k \times D_{i,t}^k + \gamma Control_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (4)$$

We report the lag and lead for a binary variable that captures the change in bank performance before and after API adoption, and the table shows the coefficient from -5 to +2 years. For the dependent variables, we apply *Tobin's Q* in column (1) and *ROA* in column (2). We report t-statistics in parentheses. We include control variables as defined in Table 1. All models include year-fixed and firm-fixed effects, and the standard errors are clustered by firm level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	<i>Tobin's Q</i>	<i>ROA</i>
	(1)	(2)
<i>Pre_avg</i>	-0.002 (-0.47)	0.000 (1.17)
<i>Post_avg</i>	0.047*** (8.15)	0.003*** (4.40)
<i>Pre</i> ⁵	-0.015 (-0.80)	-0.000 (-0.03)
<i>Pre</i> ⁴	0.000 (0.04)	0.001 (0.68)
<i>Pre</i> ³	0.015 (1.15)	-0.001 (-0.44)
<i>Pre</i> ²	-0.011 (-0.66)	0.002* (1.95)
<i>Pre</i> ¹	-0.001 (-0.16)	-0.000 (-0.08)
<i>Post</i>	0.023** (2.48)	0.004** (2.49)
<i>Post</i> ¹	0.032*** (2.70)	0.000 (0.26)
<i>Post</i> ²	0.087*** (26.63)	0.007*** (80.97)
<i>Control Variables</i>	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Firm cluster	Yes	Yes
Observations	5,534	4,305

Table 6. Regression of bank earnings, costs, and market value on lagged API adoption

This table shows the changes in bank earnings and costs up to three years after API adoption based on the OLS regression below (variables are defined as in Table 4):

$$Perf_{i,t} = \alpha_{i,t} + \beta API\_Adopt_{i,t-j} + \gamma Controls_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (5)$$

We apply contemporaneous and lagged variables of API adoption: API_Adopt_t , API_Adopt_{t-1} , and API_Adopt_{t-2} . The dependent variables are net interest margin (NIM), other noninterest expenses to total asset (NIE), noninterest income to total asset (NII), loan loss provisions to total asset (LLP), and market value ($MRKTV$). We report regression coefficients and t-statistics in parentheses. The control variables are defined in Table 1. All models include year and firm fixed effects, and standard errors are clustered by firm level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Regression of bank earnings and costs on lagged API adoption												
VARIABLES	<i>NIM</i>		<i>NIE</i>			<i>NII</i>			<i>LLP</i>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>API_Adopt_t</i>	-0.040 (-0.18)			-0.002 (-1.09)			-0.001 (-0.79)			-0.363** (-2.36)		
<i>API_Adopt_{t-1}</i>		-0.214 (-1.01)			-0.003** (-2.15)			-0.002** (-2.02)			-0.317 (-1.64)	
<i>API_Adopt_{t-2}</i>			-0.275 (-1.49)			-0.004*** (-3.39)			-0.004*** (-3.06)			-0.342* (-1.76)
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,071	3,799	3,528	4,073	3,799	3,528	4,073	3,799	3,528	4,038	3,767	3,494
R-squared	0.789	0.805	0.818	0.766	0.778	0.778	0.727	0.73	0.76	0.615	0.633	0.616

(continued next page)

Table 6. Regression of bank earnings, costs, and market value on lagged API adoption (cont'd)

Panel B. Regression of bank value on lagged API adoption			
VARIABLES	MRKTV		
	(1)	(2)	(3)
<i>API_Adopt_t</i>	3.441* (1.83)		
<i>API_Adopt_{t-1}</i>		1.962 (1.11)	
<i>API_Adopt_{t-2}</i>			-0.361 (-0.54)
<i>Controls</i>	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes
Observations	5,613	5,100	4,602
R-squared	0.960	0.960	0.962

Table 7. API category and bank performance

The table reports OLS regression coefficients of bank performance on adoption and relative adoption variables for API types R and R/W (see Section 3) as follows:

$$Perf_{i,t} = \alpha_{i,t} + \beta API\ category_{i,t} + \gamma Controls_{i,t} + \delta IMR_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (6)$$

The regression model is shown in Equation (6). For the dependent variables, we apply *Tobin's Q* in columns (1) and (2) and *ROA* in columns (3) and (4). Panel A and Panel B illustrate the influence of the adoption of each specific API type on bank performance and the ratio of different API types relative to the total number of APIs, respectively.

Panel A shows the results for the regression of bank performance on dummy variables *R_Adopt* and *R/W_Adopt* to represent whether bank *i* has adopted Read-only or Read/Write APIs in or before year *t*. Panel B shows the regression results with continuous variables *R/W_Ratio* and *R_Ratio* which measure the number of R/W- and R-APIs relative to the total number of APIs of bank *i* in year *t*, ranging from 0 to 1. All models control for a year and firm fixed effects. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Results of API category Adoption				
VARIABLES	Tobin's Q		ROA	
	(1)	(2)	(3)	(4)
<i>R_Adopt_t</i>	0.021 (1.43)		0.000 (0.21)	
<i>R/W_Adopt_t</i>		0.016* (1.68)		0.002* (1.84)
<i>Control Variables</i>	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	Yes
Observations	5,613	5,613	4,098	4,098
R-squared	0.718	0.718	0.618	0.618
Panel B. Results of API category ratio				
VARIABLES	Tobin's Q		ROA	
	(1)	(2)	(3)	(4)
<i>R_Ratio</i>	0.021 (1.01)		-0.000 (-0.08)	
<i>R/W_Ratio</i>		0.018* (1.92)		0.004*** (3.45)
<i>Control Variables</i>	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	Yes
Observations	5,613	5,613	4,098	4,098
R-squared	0.718	0.718	0.618	0.618

Table 8. Propensity scores matching results

This table reports OLS regression results of bank performance on API adoption based on the matched sample using propensity scores matching (PSM). The model is shown in Equation (3), adopted for the PSM sample. The covariate balance checks are presented in Panel A. We balance the treated and control banks using firm-level controls, namely, *Bank Size*, *Firm age*, *Capital Intensity*, *Cash Holding*, and *Cost of Capital*. The regression results based on matched samples are shown here and OLS regression coefficients and t-statistics are in parentheses. We regress *Tobin's Q* in columns (1) - (3) and ROA in columns (4) - (6) on three-year lagged terms of API adoption dummy API_Adopt_t , API_Adopt_{t-1} and API_Adopt_{t-2} (which represent whether bank i adopted APIs in or before year t , $t-1$ and $t-2$). Variables are defined in Table 1. ***, ** and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Results of covariate balance checks						
	Treatment group		Control group			
	Banks with APIs		Banks without APIs		Difference	t-stat
VARIABLES	Mean		Mean			
Bank Size	10.068		10.251		-0.183	-0.26
Firm Age	2.5656		2.472		0.094	0.25
Capital Intensity	0.103		0.1002		0.003	0.12
Cash Holding	0.1022		0.0817		0.021	0.68
Cost of Capital	1.4667		0.7966		0.67	0.58
Panel B. Regression results using PSM procedure						
	Tobin's Q				ROA	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
API_Adopt _t	0.015** (2.02)			0.003** (2.21)		
API_Adopt _{t-1}		0.016* (1.85)			0.003 (1.61)	
API_Adopt _{t-2}			0.013 (1.00)			0.005* (1.85)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	786	728	675	586	546	513
R-squared	0.774	0.780	0.798	0.812	0.815	0.779

Table 9. The role of bank credit risk (Non-Performing Loans and Loan Loss Provisions)

$$Perf_{i,t} = \beta API_{i,t} + \partial API_{i,t} \times Bank\_Character_i + \gamma Controls_{i,t} + \varphi_i + \omega_t + \epsilon_{i,t} \quad (7)$$

This table shows results of the extended regression model for bank performance after API adoption in Equation (7), including interaction effects with the level of non-performing loans (NPL) and loan loss provision (LLP). We include interaction effects of *API_Adopt* (a dummy variable representing whether bank *i* adopted APIs in and before year *t*) and *High_NPL* (which equals one for banks with *NPL* above the average of all sample banks) as well as *High_LL*P (which equals one for banks with *LLP* above the average of all sample banks). The dependent variables are *Tobin's Q* in columns (1) and (2) and *ROA* in columns (3) and (4). The control variables are defined in Table 1. We report t-statistics in parentheses. All models include year- and firm-fixed effects. The standard errors are clustered by firm level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	Tobin's Q		ROA	
	(1)	(2)	(3)	(4)
<i>API_Adopt</i>	0.024** (2.08)	0.015 (1.43)	0.005*** (4.94)	0.005*** (4.19)
<i>API_Adopt * High_NPL</i>	-0.015 (-0.85)		-0.005*** (-3.07)	
<i>API_Adopt * High_LL</i> P		0.001 (0.06)		-0.004** (-2.17)
<i>Control Variables</i>	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	Yes
Observations	5,613	5,613	4,098	4,098
R-squared	0.718	0.718	0.618	0.618

Table 10. The role of bank competition (Product Similarity and Fluidity)

This table shows results of the extended regression model for bank performance after API adoption in Equation (7), including interaction effects with the level of bank product fluidity and product similarity. We include interaction effects of *API_Adopt* (a dummy variable representing whether bank *i* adopted APIs in and before year *t*) and *High_Fluidity* (which equals one for banks with *Fluidity* above the average of all sample banks) as well as *High_Similarity* (which equals one for banks with *Similarity* above the average of all sample banks). The dependent variables are *Tobin's Q* in columns (1) and (2) and *ROA* in columns (3) and (4). The control variables are defined in Table 1. We report t-statistics in parentheses. All models include year- and firm-fixed effects. The standard errors are clustered by firm level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

<i>VARIABLES</i>	<i>Tobin's Q</i>		<i>ROA</i>	
	(1)	(2)	(3)	(4)
<i>API_Adopt</i>	0.028*** (3.36)	0.027*** (2.96)	0.002 (1.61)	0.002*** (2.62)
<i>API_Adopt * High_Fluidity</i>	-0.035** (-2.44)		0.000 (0.15)	
<i>API_Adopt * High_Similarity</i>		-0.027* (-1.83)		0.000 (0.24)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	Yes
Observations	5,613	5,613	4,098	4,098
R-squared	0.719	0.718	0.618	0.618

Table 11. The role of bank size

This table shows results of the extended regression model for bank performance after API adoption in Equation (7), including interaction effects with the level of total assets and bank deposits. We include interaction effects of *API_Adopt* (a dummy variable representing whether bank *i* adopted APIs in and before year *t*) and *High_Asset* (which equals one for banks with *Total Assets* above the average of all sample banks) as well as *High_Deposit* (which equals one for banks with *Deposits* above the average of all sample banks). The dependent variables are *Tobin's Q* in columns (1) and (2) and *ROA* in columns (3) and (4). The control variables are defined in Table 1. We report t-statistics in parentheses. All models include year- and firm-fixed effects. The standard errors are clustered by firm level. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	Tobin's Q		ROA	
	(1)	(2)	(3)	(4)
<i>API_Adopt</i>	0.016*** (2.87)	0.026** (2.25)	0.006*** (3.93)	0.006*** (4.97)
<i>API_Adopt * High_Size</i>	-0.001 (-0.07)		-0.004** (-1.97)	
<i>API_Adopt * High_Deposit</i>		-0.012 (-0.78)		-0.005*** (-2.63)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm cluster	Yes	Yes	Yes	Yes
Observations	5,613	5,613	4,098	4,098
R-squared	0.718	0.718	0.618	0.618

“The effects of voluntary open banking adoption”

In this online appendix, we provide additional discussions and robustness tests that supplement the empirical analysis in the main body of the manuscript.

Figure A1. Deviations Before and After PSM

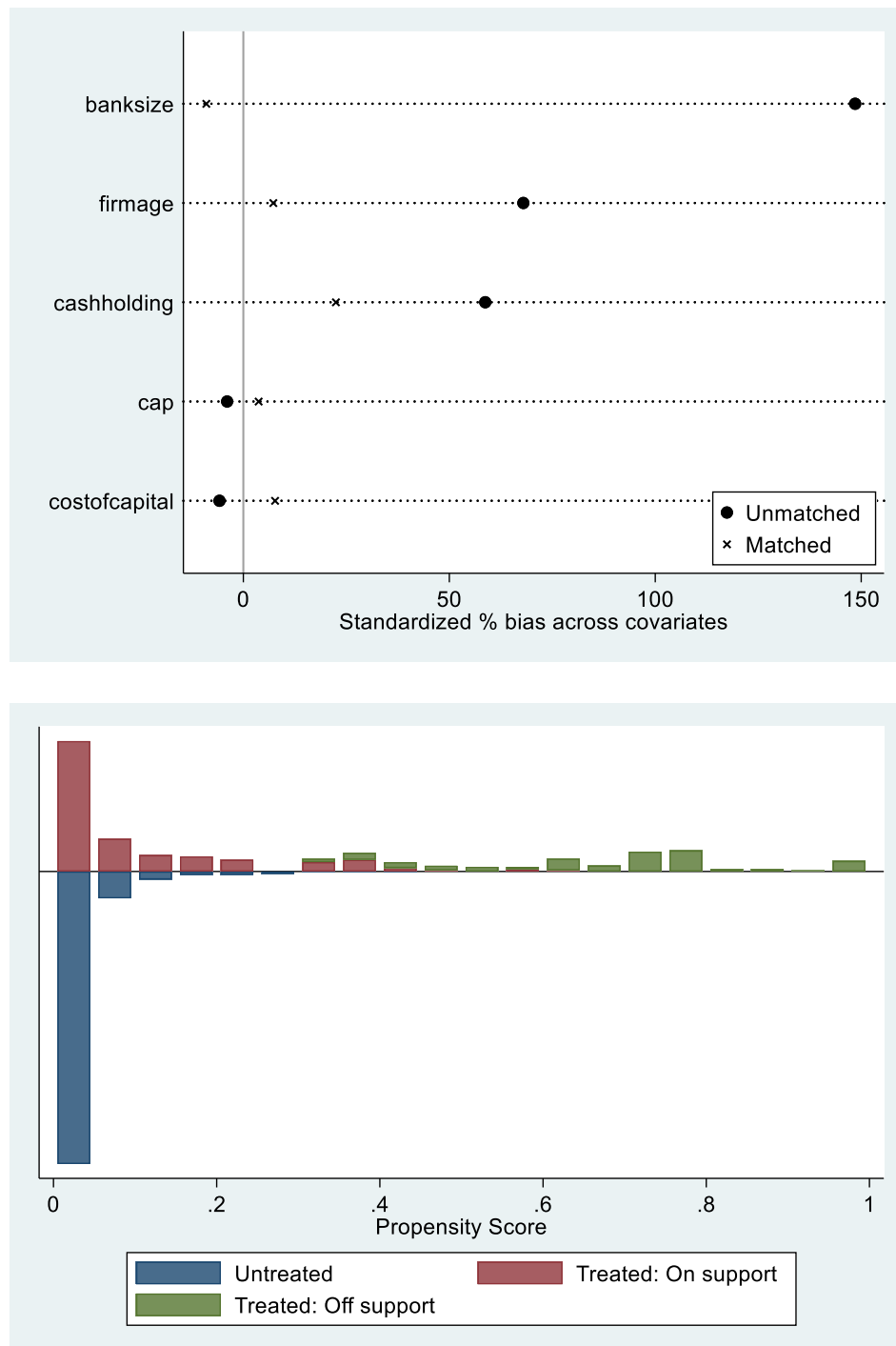


Table A1. Correlation matrices of the key variables

We calculated the correlation coefficient for each pair of key variables and demonstrated its significance. We have included independent and dependent variables and interaction variables in our analysis. (1)-(2) respectively represent the bank's ownership of the API; (3)-(9) represent the bank performance. Among the key variables of our cross-sectional analysis are (10)-(12). All variables are defined in Table 1. * indicates statistical significance at the 1% level.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	<i>API_bank</i>	1											
(2)	<i>API_Adopt</i>	0.4837*	1										
(3)	<i>Tobin's Q</i>	0.0715*	0.0446*	1									
(4)	<i>MRKTV</i>	0.5059*	0.4147*	0.1424*	1								
(5)	<i>ROA</i>	0.0014	0.0032	0.4311*	0.0915*	1							
(6)	<i>NIM</i>	-0.1088*	-0.0942*	0.1008*	-0.1754*	0.2317*	1						
(7)	<i>NIE</i>	-0.0466*	-0.0410*	-0.1605*	-0.0375*	-0.3541*	0.2383*	1					
(8)	<i>NII</i>	0.0375*	0.0103	0.0580*	0.0807*	0.1537*	0.0903*	0.7779*	1				
(9)	<i>LLP</i>	-0.0009	-0.0184	-0.2185*	0.0290*	-0.4385*	0.0462*	0.4102*	0.0561*	1			
(10)	<i>NPL</i>	-0.0056	-0.0141	-0.1439*	0.016	-0.2687*	0.0127	0.1835*	-0.0161	0.3936*	1		
(11)	<i>Similarity</i>	-0.0783*	-0.0554*	-0.2310*	-0.1775*	-0.3174*	-0.0399*	0.0066	-0.1685*	0.0786*	0.1833*	1	
(12)	<i>Fluidity</i>	-0.0474*	-0.0371*	-0.2643*	-0.1291*	-0.2356*	-0.1083*	0.0704*	-0.0553*	0.1781*	0.1488*	0.5191*	1

Table A2. Propensity Scores Matching

The Propensity score matching indicates that all univariate differences in bank characteristics are statistically insignificant, suggesting that any differences in bank performance between the treatment and control groups should be driven by the presence or absence of an API rather than observable bank characteristics. The means of the five measures of bank performance for the treated banks: *Tobin's Q* and *ROA* are significantly higher than those of the control banks, which are consistent with our main results. In addition, we also show by visualization in Appendix Figure 1 that there are no significant differences between the means of the variables before and after matching (minor deviations from the mean, small t-values are not significant), i.e., the matched data pass the balance test.

	Treatment group (Banks with APIs)	Control group (Banks without APIs)		
<i>VARIABLES</i>	Mean	Mean	Difference	t-stat
<i>Tobin's Q</i>	1.0455	1.0265	0.0189***	4.30
<i>ROA</i>	1.5572	1.1846	0.3725***	3.17

Circular economy application in pharmaceutical supply chains in the UK: a holistic evolutionary game approach

Abstract

The environmental hazards of improperly managed waste have gained universal recognition among scholars and stakeholders. These hazards are especially critical in the pharmaceutical sector since leftover medications contain active chemicals that threaten the environment and human health. Nonetheless, implementation of adequate measures to ensure proper collection and treatment of pharmaceutical leftovers remains insufficient, and tons of unwanted medications are discarded in landfills and wastewater annually. Such outcomes are due to lack of coordination between the parties involved and poor incentive systems in place. To address this issue, we study coordination in pharmaceutical reverse supply chains and government incentive strategies. We employ the evolutionary game methodology to evaluate strategic behaviour of pharmacies and a waste recycler under different incentive plans. We are focusing on both reward- and awareness-driven customer segments to boost the return volume of unwanted medications. Moreover, supply chain coordination is investigated as a tool to enhance the economic viability of the system. We compare the incentive plans based on return volume, participation rate, budget spend, and implementation time, to recommend the most effective plan. An extensive numerical study provides insights into the performance of the incentive plans in different conditions. The results reveal that a plan that provides proper incentives to pharmacies for targeting both, reward- and awareness-driven customers, coupled with contract-based coordination, outperforms other plans, and does not necessarily require a budget allocation. Our study is motivated by the UK's National Health System but it is generalisable to pharmaceutical reverse supply chains in other countries as well.

Keywords: supply chain management; evolutionary game; numerical simulation; OR in government; OR in health services

1. Introduction

Pharmaceutical waste, such as expired, unsold, unused, and unwanted pharmaceuticals, has significantly increased in recent years as the number of patients and prescriptions grows. In the United States, people waste prescription drugs worth almost \$1 billion each year, discarding them as general domestic wastes or stocking them at home (Han, 2022b). The equivalent amount in the United Kingdom is more than £300 million (Xie and Breen, 2014). These large numbers indicate a significant waste of resources in the pharmaceutical sector. Also, the outbreak of the COVID-19 pandemic has significantly affected the demand for medications, leading to even more waste than before (Dai et al., 2021). The high costs of pharmaceutical waste applies to many other countries: research in Ethiopia (Ayele and Mamu, 2018), Kuwait (Abahussain and Ball, 2007), Poland (Rogowska et al., 2019), Qatar (Kheir et

al., 2011), Saudi Arabia (Abdallah et al., 2014), the UK (Bound and Voulvoulis, 2005), and the United States (Law et al., 2015) shows that most of the pharmaceutical residues are disposed of in the household garbage, due to the lack of clear guidance on proper medications disposal.

Moreover, pharmaceutical waste contains bioactive substances and can contaminate land, water, and air (Weraikat et al., 2016a). These active ingredients potentially harm aquatic biota at the molecular level and change bacterial species on land, putting the environment and human health at risk (Han, 2022a). This has led several countries to think of implementing circular economy (CE) principles in the pharmaceutical sector. CE is a holistic view that aims to use materials and products as long as possible through reuse and recovery (Alshemari et al., 2020). The CE approach emphasises eliminating and transforming waste and improving recycling and reuse.

According to CE, several take-back programs have been started by governments worldwide to mitigate the introduction of pharmaceutical waste into the environment, such as in France, Australia, Canada, and China (Chung and Brooks, 2019). The United States has long been taking advantage of the redistribution of unused, unexpired medicines to support needy patients (Han, 2022a). France not only recycles drug packaging but recycles pharmaceutical substances. The government placed recycling bins at almost 90% of retail pharmacies to collect waste for free. In 2018, 80% of the people in France returned unused drugs to pharmacies. Then, wholesalers and manufacturers collect the returned waste, check their quality, and donate unopened, unexpired items to be redistributed to individuals in need. From the expired drugs, those that have reusable materials are delivered to companies and laboratories for extraction, and the remaining is incinerated in specialised facilities (Alshemari et al., 2020).

France is a successful example of implementing the CE approach in the pharmaceutical sector, but the efficiency of some other take-back programs is questionable. For instance, the domestic waste system is still the most common place for medication disposal for 63% of US households (Law et al., 2015). One-third of Canadians do not know about proper medication disposal, while 90% of pharmacies accept unwanted drugs from patients (Han, 2022a). 62% of Brazilians discard medicine waste with other ordinary garbage (de Campos et al., 2021). Similarly, 74.7% of people in the UK throw their unwanted drugs in household waste or in the sink or toilet, and only 21.8% return them to a pharmacy (Xie and Breen, 2014).

Unlike in other industries, many returned pharmaceutical products are of a zero-salvage value and have to go through the costly process of safe disposal via certified incineration (Weraikat et al., 2016b), which is why pharmaceutical companies would be reluctant to deal with unwanted medications. Therefore, it is essential for governments to hedge against the introduction of medical waste into the environment by encouraging businesses to collect their end-of-life/end-of-use items. The UK government, Department of Health issued a series of guidance on “Disposal of Pharmaceutical Waste in Community Pharmacies” (Health, 2013) and “Safe Management of Healthcare Waste” (Health, 2007). In line with this guidance,

community pharmacies in the UK are obliged to accept unwanted medications from customers. Nevertheless, with no supportive programs, this imposes an extra disposal cost on the pharmacies. Pharmacies do not make any further effort to increase the returned amount or improve customer awareness about the adverse effects of pharmaceutical waste on the environment. In fact, this program does not have any commercial value or financial motivation for the pharmacies. Unsurprisingly, customer compliance in returning the pharmaceuticals is low, hindering effective waste management in this sector (Xie and Breen, 2012).

Furthermore, the reuse of pharmaceuticals is not allowed in the UK – even if the medications are completely unused and in good condition. However, based on several interviews, Alhamad et al. (2018) suggest that reusing medicines can decrease National Health Service (NHS) spending as well as manufacturing costs. The UK has also banned the extraction of active materials from pharmaceutical waste. Moreover, pharmaceutical manufacturers are not responsible by law for managing the pharmaceutical leftovers, and they are not allowed to use recycled materials in their production line due to safety concerns. Accordingly, there is poor commercial motivation for parties in the pharmaceutical supply chain (PSC) to collect or return residues. With regard to CE applications, recycling the medication packaging is possible in the UK, but in practice, only a few recyclers are currently involved in this process – e.g., TerraCycle, which cooperates with the Superdrug pharmacy to recycle the blister packaging of tablets. Our interviews with waste managers and recyclers reveal that the low recycling rate is due to the costly and time-consuming process of segregating recyclable items from non-recyclable ones.

Further to this, to pre-empt disposal of medications in household waste customers' awareness of the adverse effect of medications on the environment needs to be improved. Customers need to be educated to dispose of medications properly, e.g., return the medication to a pharmacist or collection site instead of throwing them into water or domestic waste (Xie and Breen, 2014). Educational initiatives about pharmaceutical waste handling in Bihor County (Romania) led to a notable surge in the number of patients returning expired and/or unused drugs to pharmacies, growing from 1.1% to 87.3% in just half a year (Tit et al., 2016). In the meantime, CE applications, improving the recycling of medications, and sustainability in the whole PSC are mentioned in the UK's NHS long-term sustainability plan (Alderwick and Dixon, 2019). To meet this aim under the surging demand and inefficient collection programs, a new plan is needed to manage expired, unused, and other unwanted pharmaceuticals in households.

Previous studies addressing reverse logistics in the healthcare system (Breen and Xie, 2009; Xie and Breen, 2012; Xie and Breen 2014) suggested plans to tackle unwanted medications that involved pharmaceutical manufacturers and medicine reuse. The recommendations provided have not been implemented in the UK thus far, as they necessitate alterations to existing laws. These changes have

faced substantial opposition, particularly concerning health-related matters. Our investigation aims to tackle this challenge by presenting a more pragmatic approach. We study the evolutionarily stable strategies of the involved stakeholders to demonstrate the enduring effectiveness of the suggested scenarios, along with their feasibility and practical applicability.

Apart from the practical contribution of this study, we also address a significant gap in the literature. Waste management is a well-known issue associated with the sustainable development paradigm and has attracted attention in many industries (Atasu and Subramanian, 2012). However, based on the literature review of Viegas et al. (2019), this topic surprisingly lacks coverage in the pharmaceutical sector, and only a few studies have dealt with it (Taleizadeh et al., 2019b; Tat et al., 2020; Weraikat et al., 2016b; Weraikat et al., 2016a; Yousef et al., 2018; Wang et al., 2015). According to Viegas et al. (2019), waste management in the pharmaceutical industry, as well as sustainability in terms of economic, environmental, and social aspects, represent urgent research challenges that require further investigation. The literature also disregards CE as an effective approach to recycling pharmaceutical waste products. There are only a few studies that focused on medical waste management through CE (Hosseini-Motlagh et al., 2020a; Moslemi et al., 2017; Ahlaqqach et al., 2020; Liu et al., 2020; Ranjbar and Mirzazadeh, 2019) and they all limited their investigation to the short-term effects, which indeed shows a significant research gap.

In line with the sustainability goals of the UK's government and the NHS, we investigate how they can design a proper incentive plan for pharmacies and recyclers to trigger their further effort in this regard. Our aim is to propose a plan that helps to decrease excessive storage of medicines in customer zones, enhance the CE application in this industry through the recycling of medications, and minimise the environmental damage from inappropriate waste disposal in this sector. This research proposes four different plans to improve the recycling of medications in the UK according to the guidelines, challenges, and current practices regulated by the government. We analyse the proposed plans to identify a solution that maximises medication return volume, encourages high participation rates, and can be implemented within a short timeframe. In contrast to the previous studies, we focus on a population of SC members and track their strategic behaviour over time. In order to evaluate the long-run success of the proposed plans and track the behaviour of the population, this study applies the Evolutionary Game Theory (EGT).

We propose efficient and effective incentive plans to help the NHS and the government deal with the significant issue of household medical waste and contribute to the UK's social welfare. We model, evaluate, and compare the PSC performance under each plan. The outcomes of this study provide practical insights for managing pharmaceutical waste in the UK and help to increase people's awareness of proper medication disposal and prevent environmental damage. While our study is motivated by the UK's NHS, it is generalisable to PSCs in other countries as well. The rest of the paper is structured as

follows: Section 2 explains the methodology and research design. The model development and solution are presented in Section 3. Section 4 reports the results and finally, Section 5 offers the managerial implications and a conclusion.

2. Literature review

To detail how this paper's contributions stand in relation to previous studies, we review the relevant literature in the following research streams: (a) tackling unwanted medications and CE, (b) supply chain (SC) coordination in the pharmaceutical sector, and (c) evolutionary game theory.

2.1. Unwanted medications and CE

Reverse logistics in the pharmaceutical sector presents unique challenges. A few studies have addressed unwanted medications and reverse logistics applications in the pharmaceutical sector. Breen and Xie (2009), Xie and Breen (2012), and Xie and Breen (2014) suggested plans to tackle unwanted medications in the UK that involved pharmaceutical manufacturers and medicine reuse. Their suggestions are not yet applied in the UK, as they require several laws to be changed, which has some serious opponents due to health-related issues. In other countries, Smale et al. (2021) examined qualitative measures to prevent waste of potentially viable medication and called for the collective responsibility of manufacturers, distributors, pharmacists, patients, and health authorities. The literature has largely overlooked the concept of CE in managing pharmaceutical waste. A mere handful of studies have ventured into applying CE to medical waste management (Moslemi et al., 2017; Ahlaqqach et al., 2020; Liu et al., 2020; Ranjbar and Mirzazadeh, 2019), and they have only looked at the short-term effects. Hua et al. (2016) constructed a reverse PSC model considering two unwanted medication categories, recovery rates, and roles of different entities. Sazvar et al. (2022) investigated a closed-loop PSC for unwanted medicines using a scenario-based model, where medicines were categorised based on disposal, remanufacturing, and recycling. Hua et al. (2017, 2019) explored recycling of unwanted household medications by considering advertising and take-back pricing policies and proposed two models for a two-level PSC. Luo and Wan (2022) designed a recycling system for unwanted medicines using a bi-level programming model. The previous studies underscore a considerable and unresolved research void in this area. The limited focus of these studies on short-term effects leaves a significant opportunity for investigating how CE can provide long-term solutions for pharmaceutical waste management, which could lead to more sustainable and efficient practices.

Our research addresses this issue with a realistic approach and studies the long-term stable strategy of the stakeholders to prove the long-run efficiency of the proposed plans as well as their feasibility and applicability in practice. An efficient and collaborative SC is integral to both addressing medication waste and ensuring sustainability (Ding, 2018). This leads us to examine the intricacies of SC coordination within the pharmaceutical sector.

2.2. Supply chain coordination in the pharmaceutical sector

The utilisation of coordination mechanisms for SC collaboration is a vital strategy to address the interdependencies, hazards, and conflicting interests within SC (Yan et al., 2017). In a coordinated framework, the members of the SC work collectively to reach shared goals, culminating in optimal system performance (Cachon, 2003). More specifically, a traditional decision-making approach sees SC participants striving to boost their own gains, regardless of the outcomes for others (Yu et al., 2023), resulting in an inefficient operation. Conversely, centralised decision-making leads to universally optimal outcomes and better functioning of the entire chain (Cachon, 2003). However, this centralised model is often unrealistic in practice as it prioritises overall SC profitability at the expense of individual member gains (Heydari et al., 2018). Therefore, an approach that agrees global optimisation with individual member benefits is essential. Coordination mechanisms effectively motivate members to adopt universal solutions (centralised model) over locally-focused ones (decentralised decision-making) (Pishchulov et al., 2023), aligning their incentives with that of the entire SC (Cachon, 2003). In reverse supply chains (RSC), coordination stands as a pivotal element. Given the complexity inherent in managing product returns, recycling, remanufacturing, and other associated activities, a cohesive and coordinated approach is imperative to ensure harmonious operations across all members (Krapp and Kraus, 2019). Coordinating all involved parties is an adequate approach to managing RSC efficiently, ensuring high profits and return rates (Govindan and Popiuc, 2014).

In the context of the pharmaceutical sector, literature specifically addressing channel coordination is notably limited. Moreover, some review studies, such as Ding (2018), Marques et al. (2020), and Viegas et al. (2019), identified improper coordination as the pivotal problem in the pharmaceutical industry, which affects both forward and reverse flows. Weraikat et al. (2016a, 2016b) explored negotiation and incentive-based coordination mechanisms within the pharmaceutical RSCs, and Sabouhi et al. (2018) developed a resilient RSC model using quantity discount contracts. Nematollahi et al. (2018) focused on inventory decisions within a socially responsible pharmaceutical system. Recent studies also explore coordination within the PSC under various conditions. Tat and Heydari (2021) coordinated a two-level PSC, preventing medicine waste entry into the environment using a bi-level optimisation model. Weraikat et al. (2019) employed vendor-managed inventory to enhance coordination, Sabouhi et al. (2018) considered coordination under the risk of disruptions, and Hosseini-Motlagh et al. (2020a) examined stochastic production disruption using channel coordination contracts. Tat et al. (2020) formulated a mathematical model to coordinate PSC with reselling options.

Despite these efforts, the literature regarding RSC, particularly in the pharmaceutical sector, is underrepresented. This lack of coverage, especially considering the essential aspect of time, represents a significant focus of our ongoing investigation. In fact, the previous research on SC coordination has merely addressed the short-term optimisation of decisions for a limited number of members, while we focus on the structure of decision-making and its evolutionary trend in a population of players.

2.3. Evolutionary Game Theory

EGT was originally proposed by mathematicians and biologists to study evolutionary biology (Friedman, 1998). Gradually, economists began to apply EGT to address strategic interactions over time on the grounds that behaviours may depend not only on the decision-makers' environment but on the prevalence of the behaviour among the current population (Friedman, 1998). It assumes that by the passage of time, interacted decisions of actors accumulate over time, evolutionarily. Economic theorists have found evolutionary games to be very useful for evaluating strategies and addressing what firms would do eventually in terms of specific marketing strategy, investment, etc., on a large scale (Friedman, 1998). With the EGT approach, we would be able to forecast what the evolutionarily stable strategy — a strategy that, once adopted, cannot be bettered by any alternative strategy—of large-scale players would be and how they would behave in the long term (Keivanpour et al., 2017).

Several studies have utilised EGT to examine the long-term effects of different strategies on firms' behaviour in a large scale. For example, Sun et al. (2019) explored the evolutionary behaviour of manufacturers towards green investment under government subsidies, while Johari et al. (2019) investigated the long-term effect of corporate social responsibility (CSR) on manufacturers' population behaviour. In another study, da Silva Rocha and Salomão (2019) developed an agent-based model to investigate the impact of environmental regulations on the behaviour of production firms and policymakers. Hosseini-Motlagh et al. (2021) explored a sustainable financing scheme for financially constrained manufacturers using a one-population evolutionary game. Xing et al. (2023) investigated the evolutionarily stable strategy for logistics firms and governments regarding the sharing and management of logistic information using an evolutionary game model. Similarly, Chen and Hu (2018) studied the effects of carbon taxes and subsidies on manufacturers' strategies, while Zhang et al., (2019) examined the impact of environmental policies on carbon trading prices using EGT among governments and manufacturers. Long-term pricing and trade credit strategies of a population of pharma-distributors are studied by Johari and Hosseini-Motlagh (2022), using EGT. Chen et al. (2018) analysed the evolutionary behaviours of hospitals and patients for mobile health in China, and Babu and Mohan (2018) investigated the evolutionary trend of sustainability for a public health insurance system. These studies demonstrate that EGT is an effective tool in studying settings with complex strategic interactions between multiple agents that evolve over time.

This paper is the first to apply this methodology to study the medical waste return strategies of the NHS and coordination in a reverse PSC. We demonstrate how the methodology can be applied to evaluate the long-run effectiveness of the incentive plans in terms of time, return volume, participation rate, and budget spend, by leveraging Simpson's Diversity Index and incorporating SC coordination. We investigate performance of a population of pharmacies instead of studying a limited number of SC members – which is in contrast to the methodologies commonly used in the literature. Using EGT, we

are able to compare the outcome of each proposed plan over time and suggest the most efficient plan. It also helps us investigate coordination over time, which is one of the contributions of our study.

2.4. Research contributions

The literature review of this study provides a foundation for several unique contributions as follows:

- 1- The research addresses a notable gap in PSC coordination by introducing a novel approach that focuses on both short-term and long-term optimisation and coordination within a large population of players.
- 2- An innovative application of CE principles is introduced to the pharmaceutical industry, presenting more realistic and feasible solutions to existing challenges and moving beyond qualitative analyses to formulate actionable, long-term efficient strategies.
- 3- Our study pioneers the use of EGT to evaluate medical waste return strategies within the NHS and coordination in a reverse PSC and allowing a prediction of the evolutionarily stable strategies of numerous players over time.
- 4- By integrating these areas, our study provides a holistic approach that not only contributes to improving the performance of individual actors but offers a comprehensive framework, capturing the complexities and interdependencies within the reverse system of pharmaceuticals. This integration provides both theoretical and practical insights that have far-reaching implications for policymaking, industry practice, and sustainable development in the pharmaceutical sector.

3. Methodology and research design

We have conducted interviews with eight pharmacies operating in the UK and five pharmaceutical recyclers that cover the Greater London region to acquire more information about the status quo, implemented steps, and challenges in the recycling process of medication packaging. Most of the collected responses suggest that customers, pharmacies, and recyclers lack sufficient motivation to return, collect and recycle unwanted medications, respectively, making the reverse flow of unwanted drugs ineffective. Accordingly, we propose four alternative incentive plans to be implemented by the NHS, and we model, evaluate, and compare the performance of the PSC under each plan using EGT. Finally, we recommend the best plan based on the results to assist the NHS and policymakers.

EGT is a theoretical framework that extends traditional game theory by accounting for the evolutionary dynamics of strategy adoption in populations over time (Barron, 2013). In contrast to the traditional game theory, which assumes fixed strategies, EGT incorporates the concept of bounded rationality behaviour of players to identify their evolutionary stable strategies (Barron, 2013). This approach enables a time-dynamic examination of the strategic behaviours of groups of players with shared characteristics, termed *populations*, towards different strategic options. Our problem setting comprises the NHS and a population of pharmacies that contract with a common recycler for pharmaceutical waste collection. Below we present the proposed incentive plans.

As discussed in Section 1, there is an urgent need to increase customer awareness of the proper disposal of unwanted medications (Xie and Breen, 2012). Moreover, the literature suggests that the effort to increase returns is more effective when made by the party who is closer to customers, such as retailers (Dong et al., 2021; Savaskan et al., 2004). Hence in Plan 1, we suggest that pharmacies endeavour to increase returns by promoting customer awareness. Yet, based on our interviews with the pharmacies, collecting waste is currently an obligation imposing disposal costs on them, and pharmacies are not inclined to increase the return volume without further support. Also, almost 80% of a pharmacy's annual revenue is through contracts with the NHS, while about 20% is from over-the-counter sales. Therefore, the NHS can offer contractual incentives to pharmacies for eliciting return of unwanted medications, as follows:

Plan 1: The NHS offers a premium to the pharmacies that collect unwanted medications above a certain amount, to give pharmacies an incentive to increase customer awareness of returning unwanted medications through face-to-face instructions to patients, online advertisements, and other means. Accordingly, awareness-driven customers are motivated to return their unwanted medications.

In Plan 2, in order to enhance the customer's willingness to return the unwanted drugs, we suggest that the pharmacies offer customers a discount on their next purchase if they bring their medical waste to a collection centre. In return, the NHS offers a premium to the pharmacies that collect unwanted medications above a certain amount. In fact, while Plan 1 focuses on awareness-driven customers, Plan 2 addresses reward-driven customers to boost the return volume. This approach is also supported by the studies that sought to increase the return volume by offering discounts and coupons for customers' future purchases (Taleizadeh et al., 2019a; Zeng, 2013). Therefore,

Plan 2: The NHS offers a premium to the pharmacies that collect unwanted medications above a certain amount, by offering the customers who return their medications a discount on their next purchase.

Plan 3 intends to tackle all the above issues by combining Plans 1 and 2 and thus targeting both, awareness-driven and reward-driven customers (Zeng, 2013). In addition, Plan 3 addresses an issue in recycling medications identified through interviews with the recyclers and waste managers in the UK which suggest that the low recycling rate is due to the costly and time-consuming process of segregating recyclable items from non-recyclable ones. Motivated by the successful case in France, we suggest placing special recycling bins at pharmacies so that customers do the larger part of segregation. This will not only mitigate the segregation cost but would also contribute to improving customer awareness of pharmaceutical waste. In turn, reducing the segregation cost for the recycler will help to boost medication recycling by making it more attractive. Hence,

Plan 3: The NHS places dedicated recycling bins at pharmacies to be easily seen by customers. The instructions would be written on the bins for unexpired and expired medicines and for plastic, glass, paper, and metal packaging. Further, the NHS implements Plan 1 and Plan 2 concurrently.

In Plan 4, a coordinated decision-making structure is proposed to boost the efficiency of the PSC through coordination. Because pharmacies' efforts in raising customer awareness affect the recyclers' profit, the parties' self-serving decisions may cause inefficiency, which can be mitigated if the parties engage in a contract-based coordination (Cachon, 2003). Indeed, lack of coordination has been identified as the pivotal problem in the pharmaceutical industry, which affects both forward and reverse flows (Ding, 2018; Marques et al., 2020; Viegas et al., 2019). Contract-based coordination can eliminate the adverse effects of the uncertain environment and firms' relative power, facilitate information sharing, and so improve the system-wide performance (Yan et al., 2017; Sbihi and Eglese, 2007). Hence, coordinating all SC parties through designing appropriate contracts (Cachon, 2003) is a practical approach to managing CE systems efficiently, which improves profits and recovery rates (Sadeghi et al., 2019; Govindan and Popiuc, 2014). Accordingly, we suggest Plan 4 as follows:

Plan 4: The pharmacies, and the recycler act in a coordinated fashion by contracting with one another on return volumes and payments, to align their objectives with that of the SC.

A schematic representation of Plans 1 to 4 and the SC structure under study is provided in Figure 1.

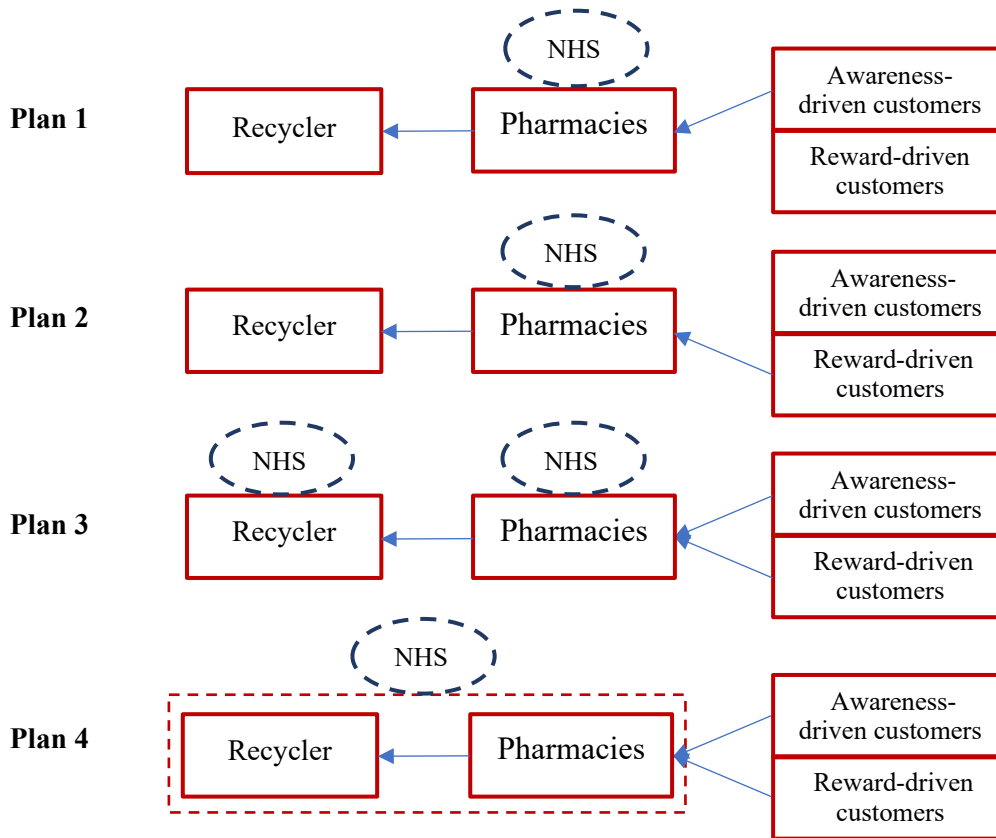


Figure 1. Applying the proposed incentive plans to the RSC under investigation. *Note:* ‘NHS’ indicates the parties receiving the incentives.

According to Plans 1 to 4, we study the evolutionary behaviour of pharmacies and the recycler. In Plan 1, through a one-population evolutionary game setting, we evaluate how the rewarding policy of the NHS affects the pharmacies' strategy regarding raising customer awareness and how this effort affects

the recycling of unwanted medications. It is important to take into account the uncertainty of customer returns: we do not know exactly when and where the customer would return their unwanted medications. Therefore, our models have a dynamic nature, exploring the long-run effect of strategies. The NHS strategy to influence reward-driven customers through offering discounts is examined in Plan 2. In Plan 3, we explore the effectiveness of mitigating recycling costs, while combining the strategies of Plans 1 and 2. In Plan 4, the pharmacies and the recycler adopt a coordinated decision-making.

4. Model development

This section provides mathematical modelling of Plans 1 to 4. EGT assumes that players are boundedly rational, trying to reach game equilibrium in a trial-and-error fashion, according to the biological evolution principles (Friedman, 1998). Based on the EGT approach, first, two random players are selected from each population, and a noncooperative game will be considered between them. The expected payoff of players with regard to each strategy is specified at each moment in time by the Nash equilibrium (Friedman, 1998). Gradually, players choose strategies with a higher payoff over those with a lower payoff until there is no strategy that can provide a better result (Friedman, 1998). Thus, players' strategies eventually converge to the Evolutionarily Stable Strategy (ESS).

As shown in Figure 1, the players in our problem are the NHS, a population of pharmacies, and a recycler that collects the pharmacies' waste. Considering a joint recycler instead of a population of recyclers is in line with many real-world cases, such as the Netherlands and Iceland (Mager et al., 2022). Using the EGT methodology, we proceed in the following steps.

First, we develop non-evolutionary game models of players under each plan, considering distinct *strategy profiles*. Each strategy profile comprises the strategies adopted by two symmetrical, random pharmacies in their interaction at a particular moment in time. Specifically, strategy profile 1 corresponds to the scenario where both pharmacies choose not to participate in the NHS plan. Strategy profile 2 pertains to the case where one pharmacy opts out, while its rival chooses to participate. Strategy profile 3 represents the situation where both pharmacies choose to participate in the plan.

Second, in each strategy profile, the pharmacies are assumed to engage in a one-shot non-zero-sum game, representative of interaction of any pair of pharmacies in the population. We accordingly derive the players' payoff matrix in each strategy profile.

Third, based on the game outcomes in each strategy profile, we examine the long-term strategy preferences across the entire population of pharmacies, considering that each player aims to get a better outcome than the average one across all strategies (Barron, 2013).

We conduct this analysis separately for Plans 1 to 4. To proceed, we make the following assumptions: (a) pharmacies are homogeneous and operate in the same market; (b) the NHS is the most powerful party of the PSC who moves first by proposing the respective plan as a take-it-or-leave-it offer; (c) the

recycler sells the recycled medication packages in the market. Further, let D_0 denote each pharmacy's initial market demand before any plan has been proposed, R_0 – the pharmacies' revenue per unit sold, r_0 – each pharmacy's initial amount of returns, ω_0 – the collection fee charged by the recycler to the pharmacies, s – the segregation cost of the recycler, ρ – the percentage of recyclable packaging, c – the unit recycling cost of the recycler, C_{dis} – the unit disposal cost of the recycler, and p – the selling price of recycled products. Figure 2 provides a schematic representation of the system under the status quo. For clarity, we summarise model notations in Appendix A and provide all proofs and closed-form solutions in Online Appendix B.

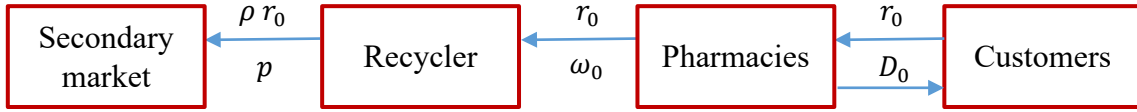


Figure 2. Schematic representation of the system under the status quo. *Note:* the quantity of products exchanged between members is shown above the arrows and the unit transfer payments are detailed below the arrows.

4.1. One-shot game models

4.1.1. Plan 1

In Plan 1, the NHS pays a premium to pharmacies that (i) opt in to increase customer awareness about the hazards of improper medication disposal through face-to-face instructions to patients, online advertisements, and other means, and (ii) collect unwanted medications beyond the initial amount r_0 . These efforts can motivate awareness-driven customers to return their unwanted medications. Under this plan, the decisions are made in the following order: the NHS chooses the pharmacies' premium per unit returned (G), the recycler chooses the collection fee (ω), and the participating pharmacies choose the level of awareness-increasing effort (e). We shall refer to the players of the one-shot game in each strategy profile as Pharmacies 1 and 2. When both pharmacies participate in a plan, index i is used to show their strategy, index j represents the strategy of a pharmacy when they do not participate in a plan.

Strategy profile 1: $j, j = \{nCE, nCE\}$, where nCE stands for “no Customer-awareness Effort”. Hence, none of the pharmacies participate in Plan 1, which represents the status quo. Therefore, none of them make any effort to increase customer awareness. As a result, the return amount of Pharmacy 1, whose strategy is i and whose rival's strategy is j , does not change: $r_{j,j} = r_0$. The same holds for Pharmacy 2. Given the symmetry of the game, it suffices to present the outcomes for Pharmacy 1 only. The players' payoffs are accordingly:

$$\text{Pharmacy 1's profit: } \Pi_{j,j}^P = R_0 D_0 - \omega_0 r_0$$

$$\text{Recycler's profit: } \Pi_{j,j}^R = 2r_0(\omega_0 - C_{dis} - s + \rho(p - c + C_{dis}))$$

Strategy profile 2: $i, j = \{CE, nCE\}$, where CE stands for “Customer-awareness Effort”. In this strategy profile, Pharmacy 1 participates in Plan 1, while Pharmacy 2 does not. Thus, Pharmacy 1 makes effort

to increase customer awareness. The effort cost is assumed to be quadratic, which is a common assumption in the literature (Zeng, 2013; Cheng and Ding, 2021). The return amount received by Pharmacy 1 under this profile is $r_{i,j} = r_0 + \alpha e_{i,j}$ and that by Pharmacy 2, $r_{j,i} = r_0 + \beta e_{i,j}$, where $e_{i,j}$ is the effort level of Pharmacy 1 and α and β are the return rates at Pharmacies 1 and 2 per unit effort, respectively. Note that the effort of Pharmacy 1 also increases the return volume received by its rival because the pharmacies operate in the same market, and customers may return their medications to any of the pharmacies. We assume that customers would still be more likely to return unwanted medications to Pharmacy 1, and hence that $\alpha > \beta$.

According to the plan, the NHS pays a premium G to the participating Pharmacy 1 per each item collected beyond the initial return volume. As the increase of returns at Pharmacy 1 affects the profit of the recycler, the latter may revise the collection fee. Therefore, let $\omega_{i,j}$ represent the recycler's collection fee charged to Pharmacy 1 under this strategy profile.

Further, we assume that the awareness-increasing efforts of Pharmacy 1 also boost the market demand of Pharmacy 1 (at the rate ε_1) and at the same time, decrease the market demand of Pharmacy 2 (at the rate $\varepsilon_2 < \varepsilon_1$), as they operate in the same market (Hosseini-Motlagh et al., 2020a). Therefore, the demand of Pharmacy 1 becomes $D_{i,j} = D_0 + \varepsilon_1 e_{i,j}$, and that of Pharmacy 2, $D_{j,i} = D_0 - \varepsilon_2 e_{i,j}$. Accordingly, the players' payoffs are as follows:

$$\text{Pharmacy 1's profit: } \Pi_{i,j}^P = R_0 D_{i,j} - \omega_{i,j} r_{i,j} + G(r_{i,j} - r_0) - \frac{1}{2} \lambda e_{i,j}^2$$

$$\text{Pharmacy 2's profit: } \Pi_{j,i}^P = R_0 D_{j,i} - \omega_0 r_{j,i}$$

$$\text{Recycler's profit: } \Pi_{i,j}^R = (r_{j,i} + r_{i,j})(-C_{dis} - s + \rho(p - c + C_{dis})) + r_{i,j} \omega_{i,j} + \omega_0 r_{j,i}$$

The recycler is considered to have the full bargaining power against the pharmacies; thus the recycler is the leader, and the pharmacies are followers (Hosseini-Motlagh et al., 2021). We therefore obtain the optimum decisions of the pharmacies and the recycler based on backward induction.

Strategy profile 3: $i, i = \{CE, CE\}$. In this strategy profile, both pharmacies participate in Plan 1 and make efforts to increase awareness. The NHS will, in turn, pay a premium to each pharmacy per unit collected beyond the initial amount. When both pharmacies make efforts, they boost their return volume and demand, while increasing returns and decreasing the demand of the rival. Accordingly, the return amount of each pharmacy becomes $r_{i,i} = r_0 + \alpha e_{i,j} + \beta e_{j,i}$, and the demand, $D_{i,i} = D_0 + \varepsilon_1 e_{i,i} - \varepsilon_2 e_{i,i}$. Due to the game symmetry, it suffices to present the outcomes for Pharmacy 1 only. The players' payoffs are as follows:

$$\text{Pharmacy 1's profit: } \Pi_{i,i}^P = R_0 D_{i,i} - \omega_{i,i} r_{i,i} + G(r_{i,i} - r_0) - \frac{1}{2} \lambda e_{i,i}^2$$

$$\text{Recycler profit: } \Pi_{i,i}^R = 2r_{i,i}(\omega_{i,i} + \rho(p + C_{dis} - c) - s - C_{dis})$$

4.1.2. Plan 2

In Plan 2, the NHS pays a premium to pharmacies that collect unwanted medications beyond a certain amount. In turn, pharmacies would offer coupons to customers that return their medications, which they can redeem to secure a discount on their next purchase (Zeng, 2013). Under this plan, the NHS chooses the pharmacies' premium (G), the recycler chooses the collection fee (ω), and the pharmacies choose the coupon value (τ).

Strategy profile 1: $j, j = \{nd, nd\}$, where nd stands for “no discounts”. In this case, none of the pharmacies participate in Plan 2. Therefore, none of them offer any coupons to boost the return volume. Hence we have $r_{i,j} = r_0$, and the players' payoffs are same as in strategy profile 1 of Plan 1.

Strategy profile 2: $i, j = \{d, nd\}$, where d stands for “discounts”. In this profile, Pharmacy 1 offers coupons to customers, while Pharmacy 2 does not. Assuming that some coupons will not be redeemed, let θ denote the coupon redemption rate at a pharmacy.

Following Heydari et al. (2018), the return amount of Pharmacy 1 is assumed to increase in proportion to the coupon value $\tau_{i,j}$, as follows: $r_{i,j} = r_0 + a \frac{\tau_{i,j}}{\tau_{max}}$, whereas that of Pharmacy 2, decrease: $r_{j,i} = r_0 - b \frac{\tau_{i,j}}{\tau_{max}}$, where τ_{max} is the maximum coupon value. Note that the value of coupons issued by Pharmacy 1 increases its return amount at the rate a and decreases that of its rival at the rate b ($a > b$). This is because the pharmacies operate on the same market and the customers are more inclined to return their products to the pharmacy that offers discounts.

Furthermore, we assume that the discounts offered by Pharmacy 1 boost its market demand at the rate φ_1 and at the same time, decrease the market demand of Pharmacy 2 at the rate φ_2 ($\varphi_1 > \varphi_2$), as the pharmacies operate on the same market. Therefore, the demand of Pharmacy 1 is $D_{i,j} = D_0 + \varphi_1 \tau_{i,j}$, and that of Pharmacy 2, $D_{j,i} = D_0 - \varphi_2 \tau_{i,j}$. Similar to Plan 1, the NHS pays a premium to pharmacies for each item collected beyond the initial return volume. Moreover, when a pharmacy increases the returns, the recycler may revise its collection fee. Let $\omega_{i,j}$ denote the recycler's collection fee under this strategy profile. Accordingly, the players' payoffs are as follows:

$$\text{Pharmacy 1's profit: } \Pi_{i,j}^P = R_0 D_{i,j} - \omega_{i,j} r_{i,j} + G(r_{i,j} - r_0) - \theta r_{i,j} \tau_{i,j}$$

$$\text{Pharmacy 2's profit: } \Pi_{j,i}^P = R_0 D_{j,i} - \omega_0 r_{j,i}$$

$$\text{Recycler's profit: } \Pi_{i,j}^R = (r_{i,j} + r_{j,i})(\rho(C_{dis} + d - c) - C_{dis} - s) + r_{i,j} \omega_{i,j} + \omega_0 r_{j,i}$$

Strategy profile 3: $i, i = \{d, d\}$; in this scenario, both pharmacies participate in the NHS plan and offer discounts to customers that return their unwanted medications. Therefore, the return amount $r_{i,i}$ of each

pharmacy is increasing in the value of their own coupons and decreasing in that of their rival, as follows: $r_{i,i} = r_0 + a \frac{\tau_{i,i}}{\tau_{max}} - b \frac{\tau_{i,i}}{\tau_{max}}$. Similarly, pharmacies boost their demand and decrease their rival's demand by providing discounts, so that the market demand of each pharmacy becomes $D_{i,i} = D_0 + \varphi_1 \tau_{i,i} - \varphi_2 \tau_{i,i}$. The players' payoffs are as follows:

$$\text{Pharmacy 1's profit: } \Pi_{i,i}^P = R_0 D_{i,i} - \omega_{i,i} r_{i,i} + G(r_{i,i} - r_0) - \theta r_{i,i} \tau_{i,i}$$

$$\text{Recycler's profit: } \Pi_{i,i}^R = 2r_{i,i}(\omega_{i,i} + \rho(p + C_{dis} - c) - C_{dis} - s)$$

4.1.3. Plan 3

As Plan 3 combines Plans 1 and 2, participating pharmacies accept to make awareness-increasing efforts as well as offer discounts. In return, the NHS pays them a premium per each item collected beyond their initial return amount r_0 . Further, the NHS places special recycling bins at pharmacies (at the cost F) to assist the segregation process. Therefore, we assume that the recycler's segregation cost reduces from s to γs , where $0 < \gamma < 1$, because segregation should not be expected to be perfect, as we can see in the separation of household waste. We then have the following strategy profiles:

Strategy profile 1: $j, j = \{nCed, nCed\}$; *nCed* stands for “no customer-awareness efforts and discounts”. Hence none of the pharmacies participates in Plan 3, which means none of them offers any coupons or makes efforts to increase awareness. Thus, $r_{i,j} = r_0$. The players' payoffs are same as in strategy profile 1 of Plans 1 and 2, representing the status quo.

Strategy profile 2: $i, j = \{Ced, nCed\}$; *Ced* stands for “customer-awareness efforts and discounts”. Hence Pharmacy 1 participates in Plan 3 by increasing awareness and offering coupons to customers, whereas Pharmacy 2 does not. Accordingly, the return amount of Pharmacy 1 is $r_{i,j} = r_0 + a \frac{\tau_{i,j}}{\tau_{max}} + \alpha e_{i,j}$, and that of Pharmacy 2, $r_{j,i} = r_0 - b \frac{\tau_{i,j}}{\tau_{max}} + \beta e_{i,j}$. Further, participation of Pharmacy 1 in the plan increases the market demand of Pharmacy 1 and decreases that of Pharmacy 2. Thus, the demand of Pharmacy 1 is $D_{i,j} = D_0 + \varphi_1 \tau_{i,j} + \varepsilon_1 e_{i,j}$, and that of Pharmacy 2, $D_{j,i} = D_0 - \varphi_2 \tau_{i,j} - \varepsilon_2 e_{i,j}$. The players' payoffs are accordingly:

$$\text{Pharmacy 1's profit: } \Pi_{i,j}^P = R_0 D_{i,j} - \omega_{i,j} r_{i,j} + G(r_{i,j} - r_0) - \theta r_{i,j} \tau_{i,j} - \frac{1}{2} \lambda e_{i,j}^2$$

$$\text{Pharmacy 2's profit: } \Pi_{j,i}^P = R_0 D_{j,i} - \omega_0 r_{j,i}$$

$$\text{Recycler's profit: } \Pi_{i,j}^R = (r_{i,j} + r_{j,i})(\rho(p + C_{dis} - c) - \gamma s - C_{dis}) + \omega_{i,j} r_{i,j} + \omega_0 r_{j,i}$$

Strategy profile 3: $i, i = \{Ced, Ced\}$; hence both pharmacies participate in Plan 3. As a result, the return amount of each pharmacy is increasing in both, the amount of its customer-awareness effort and the amount of discount it is offering to customers for returning unwanted medication. At the same time, it

is increasing in the amount of its rival's effort and decreasing in the amount of the discount offered by the rival. Thus, each pharmacy's return amount is $r_{i,i} = r_0 + a \frac{\tau_{i,i}}{\tau_{max}} - b \frac{\tau_{i,i}}{\tau_{max}} + \alpha e_{i,i} + \beta e_{i,i}$. Further, by increasing customer awareness and offering discounts, each pharmacy is boosting its own demand and decreasing that of its rival. Thus, each pharmacy's market demand is $D_{i,i} = D_0 + \varphi_1 \tau_{i,i} + \varepsilon_1 e_{i,i} - \varphi_2 \tau_{i,i} - \varepsilon_2 e_{i,i}$. The players' payoffs are then as follows:

$$\text{Pharmacy 1's profit: } \Pi_{i,i}^P = R_0 D_{i,i} - \omega_{i,i} r_{i,i} + G(r_{i,i} - r_0) - \theta r_{i,i} \tau_{i,i} - \frac{1}{2} \lambda e_{i,i}^2$$

$$\text{Recycler's profit: } \Pi_{i,i}^R = (2 r_{i,i}) \left(\rho(p + C_{dis} - c) - \frac{\gamma^S}{2} - C_{dis} + \omega_{i,i} \right)$$

4.1.4. Plan 4:

In Plan 4, a coordinated decision-making structure is used to boost the performance of the entire RSC. To this end, we shall establish a performance benchmark which a hypothetical central decision-maker would achieve by maximising the system-wide profit.

This benchmark is featuring a globally optimal solution which is optimal for the RSC as a whole, yet this solution does not guarantee to benefit all parties. Therefore, a proper coordination mechanism is needed to re-distribute the gains between the parties and make them participate. To this end, we adopt a practical and easy-to-implement mechanism based on a profit-sharing contract (Hosseini-Motlagh et al., 2020b). Profit-sharing contracts offer several advantages to facilitate SC coordination. They incentivise collaboration among partners, aligning their goals and promoting mutual benefits (Leng and Parlar, 2009). By linking compensation to performance, these contracts encourage efficient resource allocation and risk-sharing and improve decision-making. Studies have shown that profit-sharing contracts can reduce costs, increase profitability, and enhance overall SC performance (Vosooghidizaji et al., 2020).

Strategy profile 1: $j, j = \{nCo, nCo\}$; *nCo* stands for “not Coordinated”. In this case, none of the pharmacies participate in Plan 4. We assume that the parties make their decisions as in strategy profile 3 of Plan 3, which hence represents the status quo that lacks coordination. Accordingly, $r_{j,j} = r_{CED,CED}$, $e_{j,j} = e_{CED,CED}$, $\tau_{j,j} = \tau_{CED,CED}$.

Strategy profile 2: $i, j = \{Co, nCo\}$; *Co* stands for “Coordinated”. Hence Pharmacy 1 coordinates with the recycler, while Pharmacy 2 opts out. According to strategy profile 3 of Plan 3, the return amount of Pharmacy 1 is $r_{i,j} = r_0 + a \frac{\tau_{i,j}}{\tau_{max}} - b \frac{\tau_{j,i}}{\tau_{max}} + \alpha e_{i,j} + \beta e_{j,i}$, and that of Pharmacy 2, $r_{j,i} = r_0 + a \frac{\tau_{j,i}}{\tau_{max}} - b \frac{\tau_{i,j}}{\tau_{max}} + \beta e_{i,j} + \alpha e_{j,i}$. Further, the demand of both pharmacies totals to $T_{i,j} = 2D_0 + \varepsilon_1 e_{i,j} + \varepsilon_1 e_{j,i} - \varepsilon_2 e_{j,i} - \varepsilon_2 e_{i,j} + \varphi_1 \tau_{i,j} + \varphi_1 \tau_{j,i} - \varphi_2 \tau_{j,i} - \varphi_2 \tau_{i,j}$. The performance benchmark is then obtained by solving:

$$\begin{aligned} \text{Max } \Pi_{i,j}^{SC}(\tau_{i,j}, e_{i,j}, \omega_{i,j}) = & R_0 T_{i,j} + G(r_{i,j} + r_{j,i} - 2r_0) - \frac{1}{2} \lambda e_{i,j}^2 - \frac{1}{2} \lambda e_{j,i}^2 - \theta r_{i,j} \tau_{i,j} - \theta r_{j,i} \tau_{j,i} + \\ & (r_{j,i} + r_{i,j}) \left(\rho(p + C_{dis} - c) - \frac{\gamma s}{2} - C_{dis} \right) \end{aligned}$$

An optimal solution determines globally optimal decisions of the parties that participate in coordination, which includes the customer-awareness effort of Pharmacy 1, the discount it offers to customers, and the recycler's collection fee charged to Pharmacy 2. In turn, Pharmacy 2 makes a decision by maximising its individual payoff:

$$\text{Pharmacy 2's profit: } \Pi_{j,i}^P(e_{j,i}, \tau_{j,i}) = R_0 D_{j,i} - \omega_{i,j} r_{j,i} + G(r_{j,i} - r_0) - \theta r_{j,i} \tau_{j,i} - \frac{1}{2} \lambda e_{j,i}^2,$$

where $D_{j,i} = D_0 + \varepsilon_1 e_{j,i} - \varepsilon_2 e_{i,j} + \varphi_1 \tau_{j,i} - \varphi_2 \tau_{i,j}$ is the demand of Pharmacy 2.

Using the solutions thus obtained, we implement a coordination mechanism between Pharmacy 1 and the recycler using a profit-sharing contract. Let $P_{i,j} = \Pi_{i,j}^{SC} - \Pi_{CED,CEd}^{SC}$ represent the gain from coordination, and Φ — the bargaining power of the pharmacy against the recycler ($0 \leq \Phi \leq 1$). Then, the payoffs of the participating players are as follows:

$$\text{Pharmacy 1's profit: } \Pi_{i,j}^P = \Pi_{CED,CEd}^P + \Phi P_{i,j}$$

$$\text{Recycler's profit: } \Pi_{i,j}^R = \Pi_{CED,CEd}^R + (1 - \Phi) P_{i,j}$$

Hence the profits of Pharmacy 1 and the recycler are equal to their profit in the absence of coordination plus their share of the gain derived from coordination.

Strategy profile 3: $i, i = \{Co, Co\}$; hence both pharmacies coordinate with the recycler. The demand of each pharmacy is $D_{i,i} = D_0 + \varepsilon_1 e_{i,i} - \varepsilon_2 e_{i,i} + \varphi_1 \tau_{i,i} - \varphi_2 \tau_{i,i}$, where $e_{i,i} = e_{i,i}$ and $\tau_{i,i} = \tau_{i,i}$. Further, the return amount of each pharmacy is $r_{i,i} = r_0 + (\alpha + \beta) e_{i,i} + (a - b) \frac{\tau_{i,i}}{\tau_{max}}$. The performance benchmark is then obtained by solving:

$$\begin{aligned} \text{Max } \Pi_{i,i}^{SC}(\tau_{i,i}, e_{i,i}) = & 2 \left(R_0 D_{i,i} + G(r_{i,i} - r_0) - \frac{1}{2} \lambda e_{i,i}^2 - \theta r_{i,i} \tau_{i,i} \right) + 2 r_{i,i} \left(\rho(p + C_{dis} - c) - \frac{\gamma s}{2} - \right. \\ & \left. C_{dis} \right) \end{aligned}$$

An optimal solution determines globally optimal decisions of both pharmacies. Similar to the previous strategy profile, we calculate the players' payoffs using the profit-sharing contract as the coordination mechanism, as follows:

$$\text{Pharmacy 1's profit: } \Pi_{i,i}^P = \Pi_{CED,CEd}^P + \frac{\Phi}{2} P_{i,i}$$

$$\text{Recycler's profit: } \Pi_{i,i}^R = \Pi_{CED,CEd}^R + (1 - \Phi) P_{i,i}$$

where $P_{i,i} = \Pi_{i,i}^{SC} - \Pi_{CED,CED}^{SC}$ is the coordination gain, and the payoff of Pharmacy 2 is equal to that of Pharmacy 1 because of the game symmetry. To determine the recycler's collection fee, we set $\Pi_{i,i}^P = \Pi_{CED,CED}^P + \frac{\Phi}{2} P_{i,i}$ equal to $\Pi_{i,i}^P = R_0 D_{i,i} - r_{i,i}(\omega_{i,i} + \theta \tau_{i,i}) + G(r_{i,i} - r_0) - \frac{1}{2} \lambda e_{i,i}^2$, and solve the equation for $\omega_{i,i}$.

So far, we have modelled the short-term behaviour of the pharmacies and the recycler, using one-shot, non-evolutionary game-theoretic analysis in all possible strategy profiles. Subsequently, the replicator dynamics is employed to investigate the long-term behaviour of the pharmacies. By iterating the one-shot game multiple times and accounting for dynamic settings, we can examine the pharmacies' evolutionary participation in the NHS plans over an extended period. We present this analysis below in greater detail.

4.2. The evolutionary stable strategy

We utilise EGT to assess the long-term behaviour of pharmacies and identify the prevailing evolutionary steady solution adopted by a majority of pharmacies within a population. To this end, we shall investigate the probability of the pharmacies' adopting Plans 1 to 4 according to Evolutionarily Stable Strategies (ESS). Let S_c and S_d be two possible strategies of a pharmacy, and $u(S_c, S_d)$ – its payoff when it belongs to the fraction of the population that employs strategy S_c rather than S_d . In a one-population evolutionary game, whenever only two pure strategies exist, ESS is defined as follows:

Definition (Barron, 2013): Strategy S^* is an ESS if and only if either of the following conditions holds for a sufficiently large fraction of the population adopting the strategy S^* :

$$u(S^*, S^*) > u(S, S^*) \quad \forall S \neq S^*$$

$$u(S^*, S^*) = u(S, S^*) \Rightarrow u(S^*, S) > u(S, S) \quad \forall S \neq S^*$$

where S can represent a mixed strategy. According to the above definition, S^* is an ESS if there exists no other strategy that can lead to a higher payoff. Therefore, as the evolutionary learning progresses, pharmacies will ultimately adopt the strategy that leads to a payoff that surpasses the average payoff across all strategies, highlighting the rationale behind defining the ESS. In Plan 1, each pharmacy can employ two pure strategies stated as follows:

- *CE*: participating in the NHS plan and making efforts to increase customer awareness.
- *nCE*: not participating in the plan and making no awareness-increasing efforts.

Also, let $\delta_1(t)$ be the fraction of pharmacies that participate in Plan 1, and $1 - \delta_1(t)$ be the fraction of those that do not. Table 1 shows the payoffs of two random pharmacies under different possible strategies.

Table 1. Payoff bi-matrix of pharmacies in Plan 1.

Pharmacy 1	Pharmacy 2	
	Participating in Plan 1 (δ_1)	Not Participating in Plan 1 ($1 - \delta_1$)
Participating in Plan 1 (δ_1)	$(\Pi_{CE,CE}^P, \Pi_{CE,CE}^P)$	$(\Pi_{CE,nCE}^P, \Pi_{nCE,CE}^P)$
Not Participating in Plan 1 ($1 - \delta_1$)	$(\Pi_{nCE,CE}^P, \Pi_{CE,nCE}^P)$	$(\Pi_{nCE,nCE}^P, \Pi_{nCE,nCE}^P)$

According to Table 1, the expected payoff of a pharmacy using strategies CE and nCE is equal to $E(CE) = \delta_1 \Pi_{CE,CE}^P + (1 - \delta_1) \Pi_{CE,nCE}^P$ and $E(nCE) = \delta_1 \Pi_{nCE,CE}^P + (1 - \delta_1) \Pi_{nCE,nCE}^P$, respectively. Accordingly, the average payoff of pharmacies is $E_{total} = \delta_1 E(CE) + (1 - \delta_1) E(nCE)$. As mentioned earlier regarding the ESS definition, pharmacies will adopt a strategy if it leads to a profit above the average payoff. In EGT, the *replicator dynamics equation* is used to determine which strategy will be chosen by a majority of the population at a specific time. In other words, this equation enables us to analyse the proportion of pharmacies likely to employ each strategy over time ($\delta_1(t)$). Therefore, the long-run behaviour of pharmacies can be investigated through the following dynamic equation:

$$\frac{d\delta_1}{dt} = \delta_1(t)(E(CE) - E_{total}) = \delta_1(t)(1 - \delta_1(t)) \left(\Pi_{CE,nCE}^P - \Pi_{nCE,nCE}^P + \delta_1(t)(\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P + \Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) \right)$$

The steady-state solution is a stationary solution of the replicator dynamics equation that remains unchanged over time. Therefore, equation $\frac{d\delta_1}{dt} = 0$ must be solved to obtain the ESS. The solutions and their relative conditions in a symmetric setting are accordingly (Barron, 2013):

$$\begin{cases} \delta_1^*(t) = 1 & \text{if } (\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) > 0, (\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P) < 0 \\ \delta_1^*(t) = \frac{\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P}{\Pi_{nCE,nCE}^P + \Pi_{CE,CE}^P - \Pi_{CE,nCE}^P - \Pi_{nCE,CE}^P} & \text{if } (\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) < 0, (\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P) < 0 \\ \delta_1^*(t) = 0 & \text{if } (\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) < 0, (\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P) > 0 \\ \delta_1^*(t) = 1, 0 & \text{if } (\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) > 0, (\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P) > 0 \end{cases}$$

The ESS can be identified based on the relation between the payoff functions. Note that when $(\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) > 0$ and $(\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P) < 0$, the ESS of the game is equal to (1,1), which means that both pharmacies are willing to participate in Plan 1 in the long term. That is, 100% of pharmacies in the population are willing to accept the NHS plan. Also, if $(\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) > 0$ and $(\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P) > 0$, the mixed Nash equilibrium is not an ESS and there are two ESS solutions, including (1,0) and (0,1). Moreover, an evolutionary trajectory (δ_1 is a function of time) followed by the population are described by the following equation (Barron, 2013):

$$\ln \left[\frac{A \left(\frac{1}{\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P} + \frac{1}{\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P} \right)}{\left(\frac{1}{\Pi_{nCE,nCE}^P - \Pi_{CE,nCE}^P} \right)_{\delta_1} \times \left(\frac{1}{\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P} \right)_{1-\delta_1}} \right] = t + C$$

where $A = \delta_1(\Pi_{CE,CE}^P - \Pi_{nCE,CE}^P) - (1 - \delta_1)(\Pi_{nCE,CE}^P - \Pi_{CE,nCE}^P)$, and $C > 0$.

This framework permits exploration of the evolutionary behaviours exhibited by pharmacies over time. The evolutionary game models are developed under all four plans, individually. As the equations and the solution procedures are similar to those presented previously, we illustrate the payoff bi-matrix for Plans 2, 3, and 4. Note that in Table 2, k indicates the number of the plan, i.e., $k \in \{2, 3, 4\}$.

Table 2. Payoff bi-matrix of pharmacies in Plans 2, 3, and 4.

Pharmacy 1	Pharmacy 2	
	Participating (δ_k)	Not Participating ($1-\delta_k$)
Participating (δ_k)	Plan 2: $(\Pi_{d,d}^P, \Pi_{d,d}^P)$	Plan 2: $(\Pi_{d,nd}^P, \Pi_{nd,d}^P)$
	Plan 3: $(\Pi_{CED,CED}^P, \Pi_{CED,CED}^P)$	Plan 3: $(\Pi_{CED,nCED}^P, \Pi_{nCED,CED}^P)$
	Plan 4: $(\Pi_{Co,Co}^P, \Pi_{Co,Co}^P)$	Plan 4: $(\Pi_{Co,nCo}^P, \Pi_{nCo,Co}^P)$
Not Participating ($1-\delta_k$)	Plan 2: $(\Pi_{nd,d}^P, \Pi_{nd,d}^P)$	Plan 2: $(\Pi_{nd,nd}^P, \Pi_{nd,nd}^P)$
	Plan 3: $(\Pi_{nCED,CED}^P, \Pi_{CED,nCED}^P)$	Plan 3: $(\Pi_{nCED,nCED}^P, \Pi_{nCED,nCED}^P)$
	Plan 4: $(\Pi_{nCo,Co}^P, \Pi_{Co,nCo}^P)$	Plan 4: $(\Pi_{nCo,nCo}^P, \Pi_{nCo,nCo}^P)$

4.2.1. NHS utility and optimum reward

To derive the optimal levels of the pharmacies' awareness-increasing efforts and coupon amounts, the recycler's waste collection fee, and the NHS premium, we analyse a three-level hierarchical Stackelberg game. In the game sequence, we assume that the NHS is the first-mover and has the full bargaining power (Hadi et al., 2020; Taleizadeh et al., 2022). The NHS problem is to choose a premium that would maximise the NHS' own utility ensuing from the evolutionary game between the recycler and the pharmacies that unfolds subsequently. Thus, the NHS moves once at the start of the game, unlike other parties who can adjust their strategies in the course of the subsequent evolutionary game. This reflects the assumption that the NHS lacks the dynamic adaptability and agility to change its decision-making process in response to the varying strategy profiles encountered within the evolutionary game framework (Janssen and van der Voort, 2020; Sun et al., 2019). We solve the NHS problem separately for each plan.

The utility of the NHS is the pharmacies' total return amount. To calculate the expected total return amount, we use the Simpson's Diversity Index as follows: In each plan, there are three possible scenarios for each pair of pharmacies: both of them participate, one of them participates, and none of them participates. If the equilibrium is pure with 0% of pharmacies participating, then the total return amount is equal to its initial state. In the equilibrium with 100% of pharmacies participating, we can apply the third strategy profile to all pharmacies and calculate the total return amount. Otherwise, if the equilibrium is mixed — with a split, for example, 70% to 30% — then we shall consider all three scenarios as actually occurring with the probabilities at which they occur when we pick two random pharmacies from the population and calculate the return amount in each scenario. Using these probabilities as weights, we thus calculate the expected return amount as the weighted average across the three scenarios. Note that these probabilities are related to the Simpson's Diversity Index (Simpson, 1949)— used in ecology to measure the probability of two random species being of the same type.

Thus, the utility of the NHS in Plan k ($k \in \{1, 2, 3, 4\}$) is as follows:

$$U_k^{NHS}(G) = V[2 \delta_k^2 r_{i,i} + (2 \delta_k(1 - \delta_k))(r_{i,j} + r_{j,i}) + 2(1 - \delta_k)^2 r_{j,j}]$$

where V is the environmental conservation index for each uncollected item. Furthermore, we assume that the NHS has a limited budget B for implementing any of the Plans 1 to 4. Therefore, the problem of the NHS is formulated as follows:

$$\text{Max } U_k^{NHS}(G)$$

s.t.

$$\delta_k^2 [2 G(r_{i,i} - r_0)] + (2 \delta_k(1 - \delta_k)) [G(r_{i,j} - r_0) + G(r_{j,i} - r_0)] \leq B$$

5. Model evaluation and results

In this section, the applicability of the developed models is analysed to provide a comparative evaluation of the proposed plans.

5.1. Numerical example

Here, numerical illustrations are used to assess the efficiency of the proposed plans in both the short-term and long-term frameworks. The values of the parameters are as follows: $r_0 = 50$, $\alpha = 9$, $\beta = 3$, $\varepsilon_1 = 3$, $\varepsilon_2 = 2$, $\varphi_1 = 4$, $\varphi_2 = 3$, $a = 800$, $b = 200$, $C_{dis} = \text{£}2/\text{unit}$, $\rho = 0.65$, $c = \text{£}2/\text{unit}$, $s = \text{£}5/\text{unit}$, $h = \text{£}50$, $\omega_0 = \text{£}30/\text{unit}$, $p = \text{£}11/\text{unit}$, $D = 800$, $B = \text{£}15000$, $F = \text{£}2$, $V = \text{£}1/\text{unit}$, $\tau_{max} = 100$, $\theta = 0.9$, $\gamma = 0.5$. Table 3 reports the results of the developed models under all four plans.

Table 3. Comparative results of the proposed evolutionary game models in Plans 1, 2, 3, and 4.

Variable	Strategy Profile	Plan 1	Plan 2	Plan 3	Plan 4
Proportion of pharmacies participating in the NHS plan	-	100%	77%	100%	100%
NHS premium paid to pharmacies	-	36	74	60	34
Pharmacy 1 return amount	1	50	50	50	171
	2	68	129	165	197
	3	73	135	171	203
Pharmacy 2 return amount	1	50	50	50	171
	2	55	22	38	117
	3	73	135	171	203
Pharmacy 1 level of awareness-increasing efforts	1	0	-	0	4.1
	2	1.9	-	3.1	7.4
	3	1.6	-	3.3	7.5
Pharmacy 2 level of awareness-increasing efforts	1	0	-	0	4.1
	2	0	-	0	2
	3	1.6	-	3.3	7.5

Discount offered by Pharmacy 1	1	-	0	0	6
	2	-	13.7	10.5	10
	3	-	18.7	13.2	9.1
Discount offered by Pharmacy 2	1	-	0	0	6
	2	-	0	0	5.5
	3	-	18.7	13.2	9.1
Pharmacy 1 payoff	1	10500	10500	10500	10900.8
	2	10512.5	11004	11375	11013.9
	3	10521.9	10523.4	11003.3	11024
Pharmacy 2 payoff	1	10500	10500	10500	10900.8
	2	10281.7	10706.2	10283	10621.5
	3	10521.9	10523.4	11003.3	11024

The values of ESS in Table 3 indicate that all of the pharmacies will eventually choose participation in Plans 1, 3, and 4 in the long term, and 77% of the pharmacies will participate in Plan 2. High rates of participation in Table 3 show that all plans are applicable and acceptable by pharmacies. In Plan 1, when Pharmacy 1 increases customer awareness, it results in an increase in the return volume for both pharmacies. However, only Pharmacy 1 benefits by receiving the NHS reward. As a result, Pharmacy 2 is compelled to participate in the plan to avoid losses. Consequently, the entire population adopts this plan, resulting in a slight increase in the pharmacies' payoff and return amount. If Pharmacy 1 adopts Plan 2 while its rival does not (Strategy Profile 2), both pharmacies benefit compared to the status quo. Pharmacy 1's discount lead to a decrease in the return volume and waste management costs for Pharmacy 2. Notably, Pharmacy 1 can generate more profit in this scenario compared to the situation where both pharmacies choose to participate (Strategy Profile 3). Thus, participating in Plan 2 is beneficial for each pharmacy regardless of their rival's participation. Over time, pharmacies learn from this and eventually, as rational decision-makers, choose to participate when they discover the higher benefits obtained by the other pharmacy in Plan 2. Plan 3 combines elements from both Plans 1 and 2. The level of awareness-increasing efforts by pharmacies is higher in Plan 3 (1.6) compared to Plan 1 (3.3), leading to increased awareness in society and a higher return amount (171 in Plan 3 vs. 73 in Plan 1, for each pharmacy). Moreover, the discounts offered to customers in Plan 3 (13.2) are lower compared to Plan 2 (18.7), yet the return volume is higher. Additionally, the pharmacies' payoff in Plan 3 surpasses that in Plans 1 and 2. This indicates that Plan 3 exhibits higher economic and environmental performance in comparison to Plans 1 and 2. Plan 3 effectively caters to both reward- and awareness-driven customers, making it more efficient in increasing the returns.

Plan 4 has a significantly higher return volume (203 for each pharmacy) and higher awareness-increasing efforts (7.5 for each pharmacy) than other plans, which is favourable as it results in higher awareness in the society and shows that that coordination is able to effectively boost the environmental performance of the system. In comparison to Plan 3, we observe that pharmacies can achieve this high

return volume by offering lower discounts (13.2 in Plan 3 vs. 9.1 in Plan 4, for each pharmacy). Note that in Plan 4, we assume that the recycler has complete dominance over the pharmacies and therefore gains almost all of the surplus profit gained through coordination ($\Phi \rightarrow 0$). Nonetheless, pharmacies prefer to coordinate with their rivals and the recycler, which is a remarkable outcome. The profit surplus is captured by the difference between the profit in the coordinated and uncoordinated models. Specifically, in Plan 4, the surplus profit is equal to $P_{Co,Co} = 2074.9$ in strategy profile 3, and to $P_{Co,nCo} = 1036.4$ in strategy profile 2, which shows that coordination is able to boost the economic performance of the system. Accordingly, the best SC performance is achieved in strategy profile 3 of Plan 4, as it aligns the parties' individual objectives with that of the whole system. In fact, when both pharmacies coordinate with the recycler, the profit of the system increases, and it leads to a win-win situation for all participants when shared properly.

Comparison of the three strategy profiles for Plan 4 shows that the adoption of coordination strategy by both representative pharmacies (strategy profile 3) benefits them both. However, when only one pharmacy (Pharmacy 1) opts for coordination (strategy profile 2), Pharmacy 2 incurs loss due to a decrease in the NHS premium and demand. This explains why a majority of pharmacies in the population would prefer participation in Plan 4. Based on Table 3, participating in Plan 4 can be beneficial for a pharmacy regardless of its rival's choices. However, owing to the long-term learnings of pharmacies in the population, most of them will eventually adopt coordination when becoming aware of the benefits that other pharmacies obtain under the coordination strategy. The economic and environmental performance of the SC are significantly increased as a result of adopting the coordination strategy, highlighting the long-term value of adopting coordination.

Figure 3 depicts the dynamic evolution process of participation in the respective plan, showcasing its trajectory from an initial point to equilibrium. By interpreting the trajectory of each plan's evolution in Figure 3, we gain insights into the expected timelines for the implementation of the plans and their convergence patterns. Notably, Plan 3 exhibits the shortest evolution trajectory path, followed by Plan 4. On the other hand, Plan 2 converges to equilibrium faster than Plan 1, but unlike other plans, it fails to ensure a 100% participation. These observations lead to the implication that proposing Plan 3 can effectively stimulate pharmacies' full participation, prompting them to undertake awareness-increasing efforts and provide customer discounts for returning items. Consequently, this plan facilitates attainment of environmental goals by the NHS within a shorter period. Furthermore, Plan 4 also eventually ensures full participation, but over a longer duration compared to Plan 3. This longer convergence time can be attributed to the additional time and arrangements required for coordinating with recycler while simultaneously exerting awareness efforts and offering discounts. Moreover, because the pharmacies lack bargaining power against the recycler, the increase in the pharmacies' payoff when participating in Plan 4 is relatively low (from 10900.8 to 11024). In contrast, in Plan 3, participation enhances the

pharmacies' payoff from 10500 to 11003.3. This sharp increase stimulates pharmacies to respond to Plan 3 more promptly, while Plan 4 necessitates more time to fully evolve.

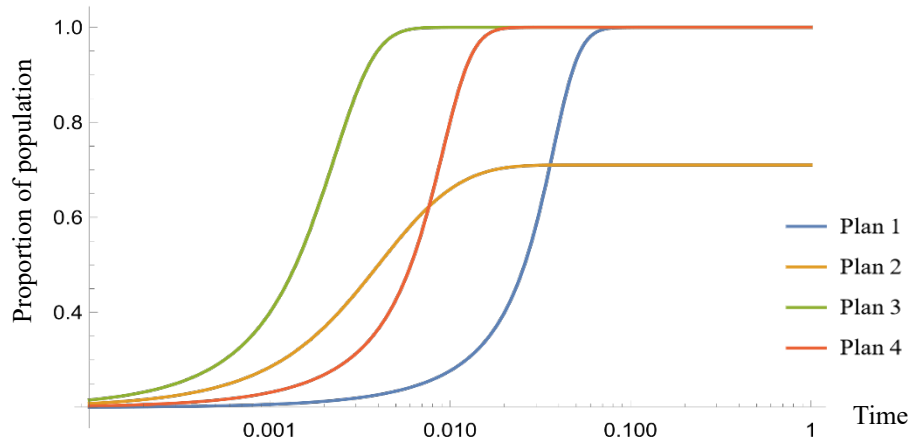


Figure 3. Evolution trajectory of each plan

Budget allocation is a crucial factor that significantly influences the evaluation of proposed plans. The amount of budget required for each plan directly impacts its feasibility and effectiveness. We provide Figure 4 to achieve a clear understanding of how the proposed plans perform with different budget levels, helping decision-makers make more informed choices. This allows us to see the potential outcomes and trade-offs associated with each plan under different budgetary conditions. Figure 4 evaluates the proposed plans within specific budget constraints, in terms of evolution trajectory and participation. As illustrated in Figure 4, all plans have a satisfactory performance in terms of evolutionary time and participation when the budget is high. Plan 2 outperforms Plan 1, especially when the budget is below 10,000. The equilibrium in Plan 1 is 0 when the budget is equal to 5,000, while under the same budget, the equilibrium in Plan 2 is 0.65 — which means that 65% of the pharmacies' population eventually choose Plan 2.

In low-budget scenarios, the limited effectiveness of Plan 1 can be attributed to insufficient funding for comprehensive awareness efforts. The lack of financial resources constrains the NHS ability to conduct extensive and impactful awareness efforts. Consequently, the reach and depth of the pharmacies' efforts are limited, resulting in lower levels of public engagement and awareness about the importance of returns. As a result, the desired behavioural changes necessary for increasing return rates may not be effectively generated. Plan 2, on the other hand, focuses on monetary rewards and shows relatively better performance than Plan 1 under low-budget conditions. We observe that the effect of monetary incentives on customers' return behaviour is higher and faster than the effect of awareness-increasing efforts. However, its budget-effectiveness may still be constrained by relying merely on the effect of discounts. Insufficient funding may restrict the attractiveness of the discounts offered. In such a case, discounts may not sufficiently motivate individuals to actively return items.

Plans 3 and 4 seem to be significantly more effective in terms of budget consumption, resource allocation, and expected results. Under the same amount of budget (i.e., 5,000) Plans 3 and 4 reach 100% participation in a relatively short time. The success of these plans in low-budget scenarios can be attributed to the synergistic effects resulting from the combination of awareness efforts and discounts. Integrating these strategies addresses the limitations of previous plans, creating a more comprehensive and persuasive approach. The awareness efforts broaden the knowledge and understanding among the public about the significance of returning unwanted medications. This awareness, in turn, enhances the perceived value of the discounts offered. The combination of these two approaches leads to significant increases in return rates and high efficiency of the plan, even with limited resources.

Moreover, a remarkable result shown in Figure 4 is that the coordination strategy (Plan 4) is consistently favoured by the population of pharmacies, even when the NHS does not offer any rewards ($B = 0$). This finding suggests that the inherent benefits of coordination, increased gain for the whole SC and guaranteed benefits for pharmacies, outweigh the absence of surplus paid by the NHS. This happens when the coordination gain is more than the pharmacies' investment cost in increasing returns. In such a case, coordination reduces reliance on NHS intervention in the long term. Nonetheless, without the NHS reward, Plan 4 takes longer to be chosen by pharmacies and leads only to a slight increase in the return volume.

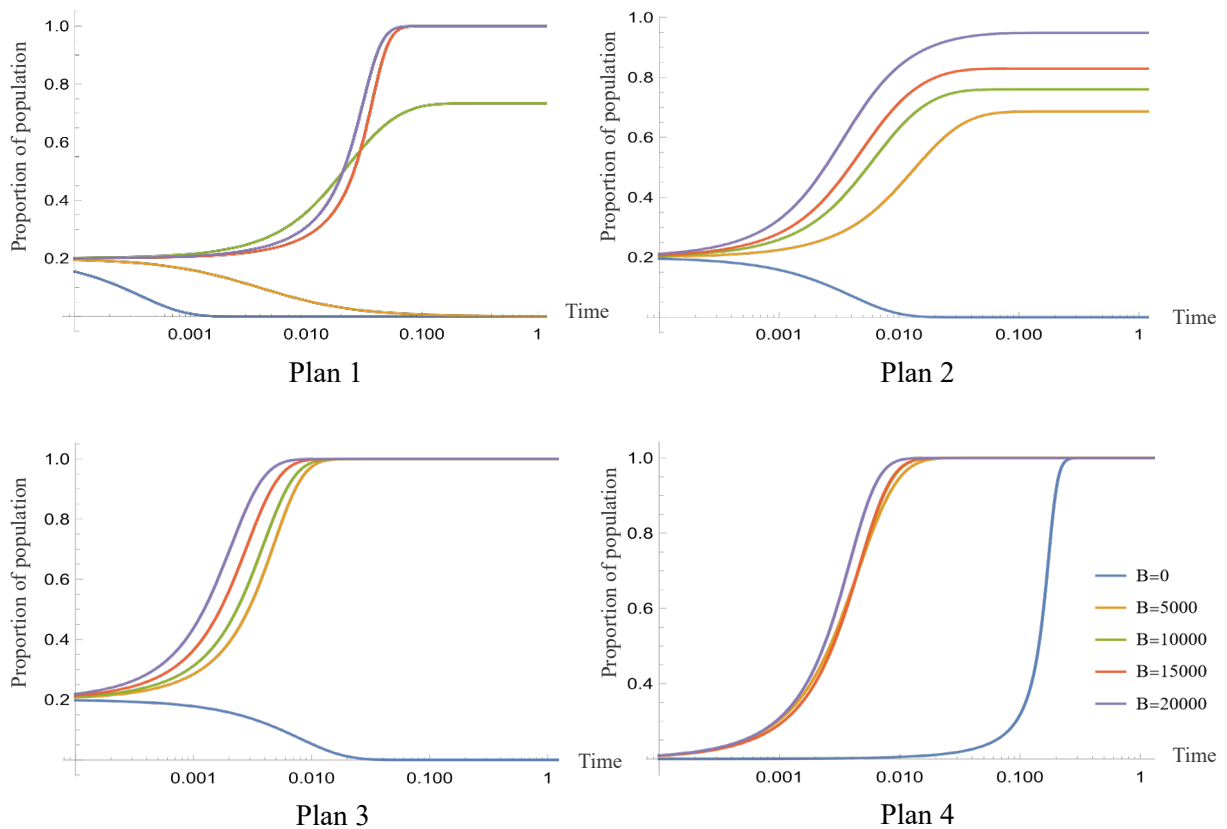


Figure 4. Evolution trajectories of all four plans under different levels of the NHS budget

5.2. Simulation analysis

In this section, a numerical analysis is conducted to validate the results and demonstrate the generalisability of the models to similar contextual problems. We generate 1100 random problem instances, assuming a fixed NHS budget ($B = £15000$) and ensuring that the parameter values satisfy the model assumptions.

All 1100 randomly generated samples are tested in Plans 1 to 4. An interesting issue that can be observed in these tests is that Plans 1 and 3 are chosen either by all pharmacies or partially, in each sample. This means completely ignoring these plans is never the ESS of the system (participation rate is never zero). Moreover, participation is non-zero for Plan 2 in 84% of samples and for Plan 4 in 90% of samples. Accordingly, one can conclude that in most cases the proposed plans are chosen by all or a part of the pharmacy population.

Table 4. Mean evolution time, participation, and return volume for the generated sample in Plans 1, 2, 3, and 4.

Plans	Mean Time	Mean return	Mean participation
Plan 1	0.59	0.41	0.85
Plan 2	0.48	0.50	0.74
Plan 3	0.22	0.61	0.85
Plan 4	0.35	0.87	0.79

Table 4 presents a comparative analysis of four different plans, each characterised by three key metrics: average evolution time (normalised across all instances), average return volume (normalised relative to the maximum possible return volume in each instance), and the average participation rate. Plan 1, with the longest mean time of 0.59 and lowest mean return volume of 0.41, appears to be the least efficient approach, although with the highest average participation rate. Plan 2 demonstrates an improvement over Plan 1 in both aspects, with a minor decrease in participation rate. Plan 3 stands out with the lowest mean time (0.22) while achieving the second-best mean return volume of 0.61 and the highest average participation rate, suggesting a swift and relatively effective process. In contrast, Plan 4 offers the best mean return volume of 0.87 within the second-best mean time of 0.35 and with a high participation rate, thus striking a different balance between speed and effectiveness. The table delineates clear distinctions between the plans in terms of time efficiency, adoption rate and return volume, highlighting the need for careful consideration of these metrics in alignment with specific organisational goals and constraints.

Further, we conduct a numerical analysis to identify the factors influencing the evolution and their impact on key performance indicators of Plans 1 to 4. To this end, we employ a tree-based method as a robust and user-friendly supervised machine-learning technique. Tree-based methods are known for their ability to offer high accuracy and interpretability and have therefore been widely used in a broad variety of study settings (Islam and Amin, 2020). They excel at capturing nonlinear relationships, a limitation often encountered with linear methods (Araz et al., 2019), and facilitate accurate prediction

and interpretation of continuous variables (Loh, 2014). Examples of tree-based methods in common use include classification and regression trees (CART) and random forests.

CART (Breiman et al., 1984) is a widely used method of supervised learning that accurately predicts a response variable based on input variables (Breiman, 2001). CART handles both regression (numerical response) and classification (categorical response) tasks, effectively accommodates missing data and produces interpretable models without distributional assumptions, handling any mixture of variables, and being robust to outliers and irrelevant variables (Kleijnen et al., 2005; Pishchulov et al., 2014). We used this method to derive Figures 5-9.

Figures 5-8 provide a schematic representation of the decision tree corresponding to each plan. As we are considering time, return volume, and participation rate as responses, we apply the multivariate regression technique (De'ath, 2002). Also, for a better presentation, all three responses are normalised between 0 and 1. Trees illustrate variations in the data, presenting a clear visualisation of how different predictor variables contribute to the observed patterns in the responses, identifying key values and interactions that significantly affect the results.

Figure 5 shows that λ and α play a critical role in explaining the outcomes of Plan 1. In other words, the cost of awareness-increasing efforts and sensitivity of customers' return to a pharmacy's awareness-increasing efforts predominantly determine the time, return, and participation in Plan 1. Other factors, such as competition intensity, do not hold the same significance as the two mentioned variables in the success of Plan 1. This is because when the customers' awareness increases, they may bring their unwanted medications to any of the pharmacies, which makes the competition less significant. Plan 1's mere dependence on awareness-increasing efforts makes the efficacy of this approach strongly correlated to the cost-effectiveness of these efforts and the subsequent degree of consumer responsiveness. When λ is more than 25, the return amount seems to be low. Since λ is randomly distributed between 1 and 100, we understand that the return amount in Plan 1 is likely to be low.

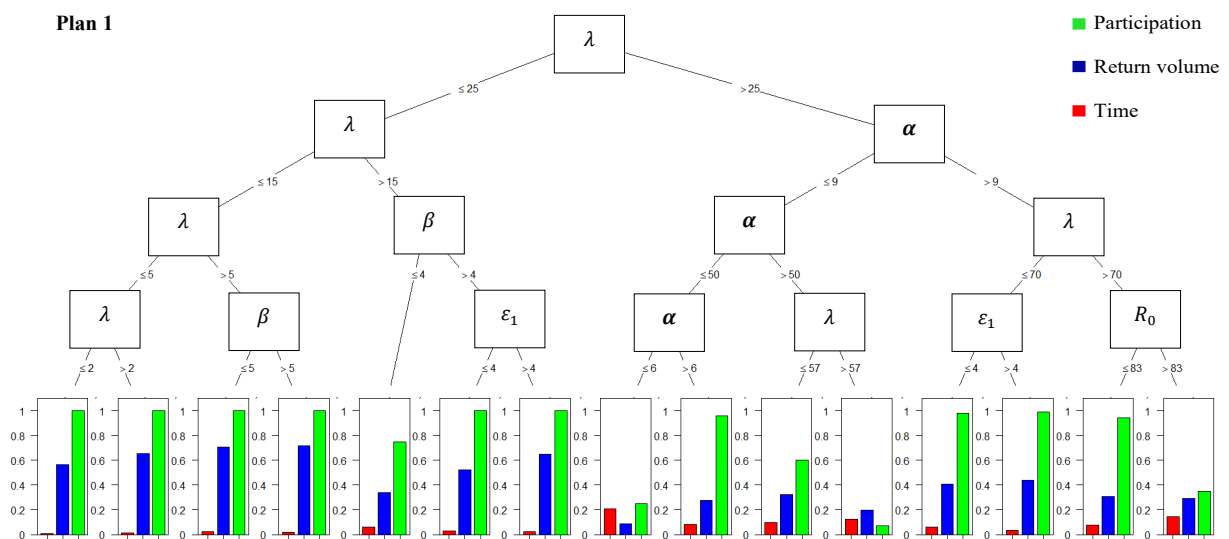


Figure 5. Multivariate regression tree of Plan 1 according to participation, return volume, and evolution time.

From Figure 6, we observe that in Plan 2, τ_{max} , a , and b have the chief role in explaining the outcomes. Thus, the maximum coupon value in customers' minds and the responsiveness of customers to the coupons determine the time, return, and participation in Plan 2. There are other factors, such as the initial return volume of pharmacies, that also play a part in explaining the outcomes in Plan 2. Accordingly, in Plan 2, the significant issues are how valuable customers find the coupons and how eager they are to acquire them. Thus, even slight changes in τ_{max} and a can generate completely different outcomes. When τ_{max} is not high enough, the return volume of Plan 2 is highly likely to be low unless the high responsiveness of customers can compensate for the high τ_{max} and keep the return volume at an acceptable level.

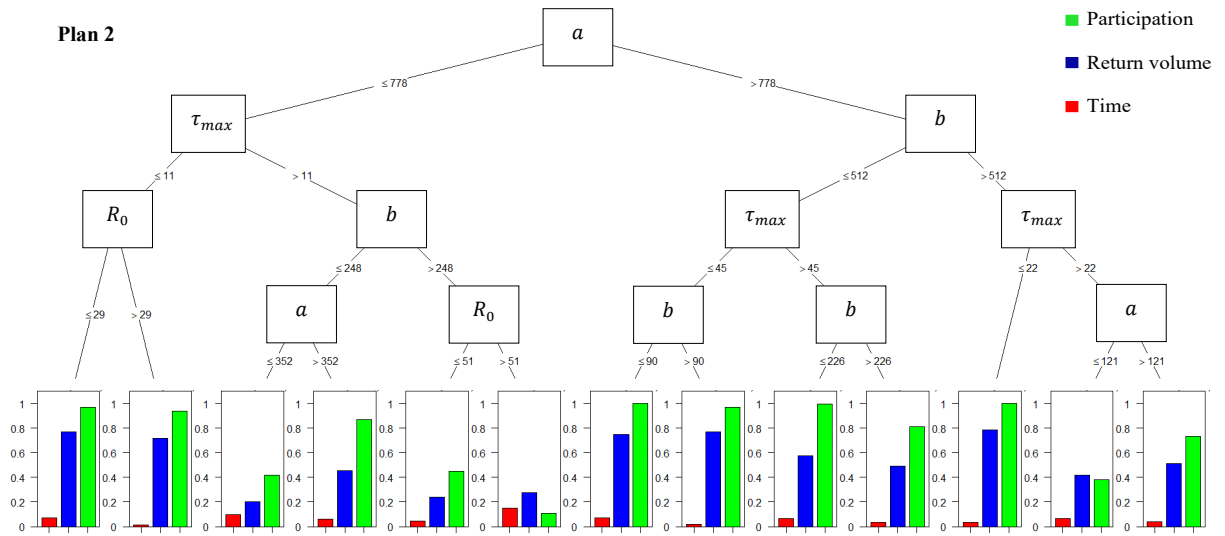


Figure 6. Multivariate regression tree of Plan 2 according to participation, return volume, and evolution time.

According to Figure 7, Plan 3 has a balanced approach between awareness-increasing efforts and offering coupons as the driving force, leading to improved return volumes compared to Plans 1 and 2. While τ_{max} and a has the lead, the cost of awareness-increasing efforts (λ) and the competition intensity and the pharmacies' unit revenue (R_0) play a part in explaining the time, return, and participation in Plan 3. Accordingly, apart from the maximum coupon value in customers' minds and the responsiveness of customers, the emphasis on understanding pharmacies' capabilities seems to significantly affect the outcomes of this plan. It is observed that the return volume in Plan 3 is kept at a good to moderate level in most branches (consistently higher than 0.4).

When the maximum coupon value in customers' minds (τ_{max}) is high, and the responsiveness of customers to the coupons (a) is lower than 880, it is highly likely that the return volume and participation rate in Plan 3 are low. This is because changing the initial state of the system is hard, and pharmacies are less motivated to make any attempts. If τ_{max} is low, the return volume and participation in this plan are high unless the customers' responsiveness to coupons (a) is lower than 304 or the

sensitivity of customers to the rival pharmacy's coupon value (b) is higher than 227. Moreover, we observe that although high values of awareness-increasing efforts cost ($\lambda > 44$) lead to a low participation rate, the return volume remains high due to Plan 3's balanced approach in addressing both reward- and awareness-driven customers.

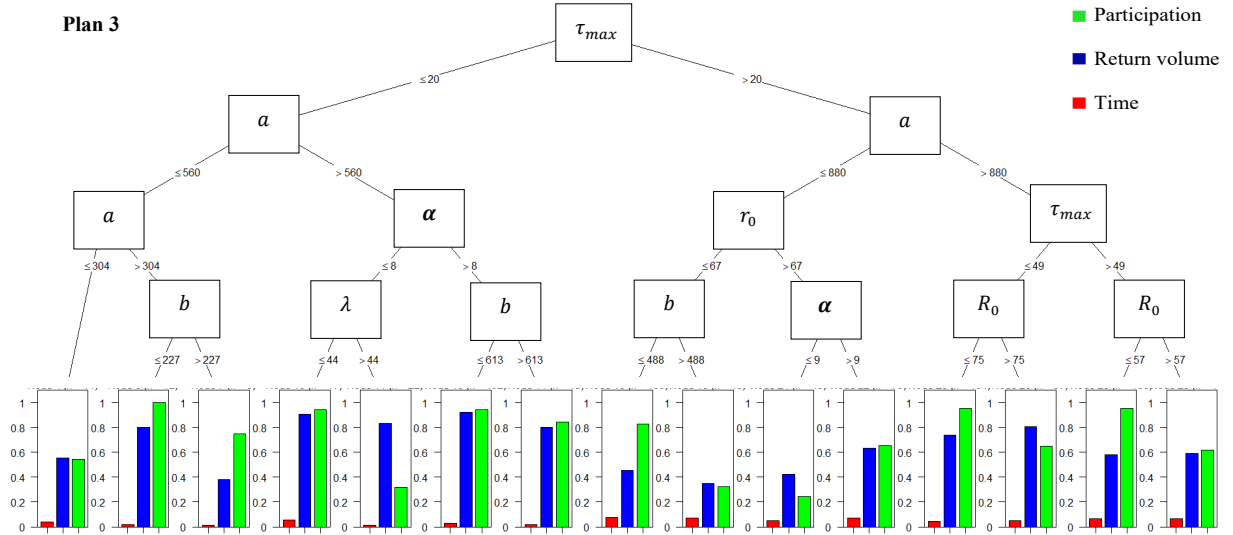


Figure 7. Multivariate regression tree of Plan 3 according to participation, return volume, and evolution time.

Plan 4 emphasises the coordination among PSC members. Based on Figure 8, high return volume and longer time frames compared to Plan 3 might be indicative of a focus on the long-term gains of Plan 4, prioritising efficiency at the expense of immediate pharmacies' engagement. Moreover, in low values of discount effects ($a \leq 575$), pharmacies' participation in this plan seems to be very low when (1) the recycler's revenue from selling the recycled products is low ($p \leq 16$), and (2) awareness-increasing efforts cost is high (λ). In such conditions, the potential gains from coordination might not justify the necessary investments, leading to reduced participation in the coordination strategy. We observe that when the discount effect is sufficiently high ($a > 575$), Plan 4 leads to consistently high return volumes.

Success of the plans seems to be mainly correlated to the cost of awareness-raising efforts, competition dynamics, the maximum coupon value in customers' minds, and responsiveness of customers. These interpretations underscore the complexity of the different plans, each shaped differently by the combinations of influencing factors. The differences in Plans 1-4 can be attributed to distinct methodologies adopted by pharmacies to facilitate the return of unwanted medications within the framework of each plan.

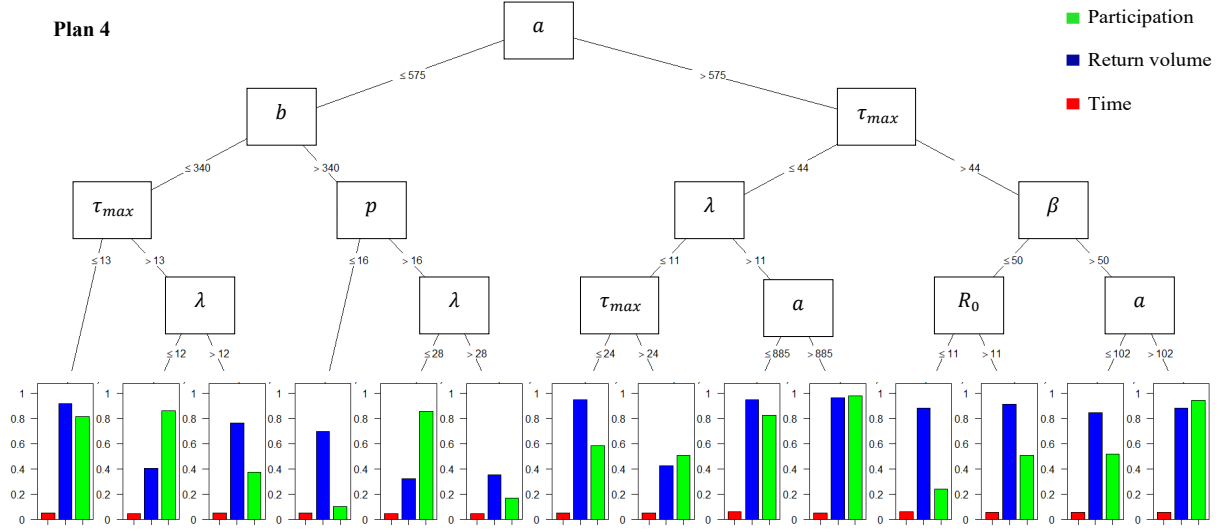


Figure 8. Multivariate regression tree of Plan 4 according to participation, return volume, and evolution time.

Figure 9 shows the frequency and conditions of each plan being the most favourable among pharmacies. According to Figure 9, if awareness-increasing efforts cost is low ($\lambda < 56$), Plan 3 is highly likely to be the most favourable by the population unless the effect of discounts on the return volume is not high ($a > 800$) and the market is competitive ($b > 354$). This is because coordination is useful in dealing with internal competition between supply-chain members. Also, when the customers are highly receptive to the discounts offered by the pharmacies, the benefits of coordination (i.e., increased return volume) outweigh its costs, rendering Plan 4 the most dominant plan.

If the cost of awareness-increasing efforts is high ($\lambda > 56$), Plan 4 is highly likely to be the most favourable by the population unless the unit revenue of pharmacies is low ($R_0 < 52$), and the effect of awareness-increasing efforts is higher than 7 ($\alpha > 7$). This is because when pharmacies' revenue is high enough, the cost of increased return volumes (due to coordination) is tolerable and worth the investment.

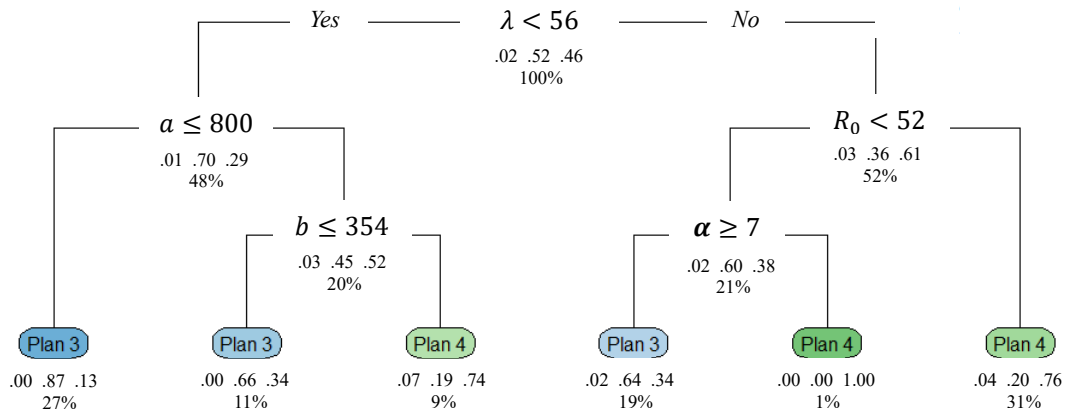


Figure 9. Classification tree for the highest participation rate of the pharmacies in Plans 1 to 4. *Note:* under each node, (1) the three decimals show the fraction of instances where 'Plan 1 or 2', 'Plan 3', and 'Plan 4' dominates other plans, respectively; (2) the percentage of instances that fall into each respective node is also depicted.

Trees facilitate the interpretation of complex relationships and enhance our ability to make informed decisions. The insights derived from Figures 5-9 guide the implementation of the respective plans, enabling optimisation towards desired goals, considering potential trade-offs and constraints. While decision trees are valued for their ability to provide an interpretable representation of models, they are not without limitations. In our specific application, the coefficient of determination (R^2) stands at 0.68, which may be due to the correlation between variables. The presence of a relatively high error term in the decision tree model motivates the need for a more robust approach. As a remedy, we utilised the Random Forest (RF) algorithm. RF is an ensemble method that combines multiple decision trees, improves generalisation, mitigates discontinuities, enhances stability, and captures complex relationships and interactions (Hastie et al., 2009; Liaw and Wiener, 2002). As we are considering time, return volume, and participation rate as responses, we apply the multivariate regression technique (De'ath, 2002). Adaptation of the RF model has led to a marked improvement in model performance, reducing the error term to 0.05. Such an enhancement in accuracy significantly augments our capacity to explain the variations in the data, underlining the utility of RF in providing a more accurate and effective modelling of the underlying relationships. RF offers a built-in feature of estimating variable importance, which allows us to assign degrees of importance to the parameters influencing return volume, participation rate, and evolution time. Notably, RF has demonstrated superior performance in generating such importance estimates (Niculescu-Mizil and Caruana, 2005). Table 5 represents the percentage of variable importance in explaining the return volume and evolution time across different plans.

Table 5. Results of the relative variable importance percentages in Plans 1, 2, 3, and 4:

Plan 1																
Response	Variable															
	r_0	α	β	ε_1	ε_2	C_{dis}	s	λ	p	R_0	c					
Time	11.6	16.7	10.6	6.1	6.7	6.1	6.3	19.6	7	5.5	4.5					
Return	13.4	12.1	10	6.4	7.2	8.2	7.2	19.4	5	5.7	5.9					
Participation	5.4	12.8	10.4	4.4	4.5	4.5	4.4	15.3	5.3	4.1	4.5					
Plan 2																
Response	Variable															
	r_0	a	b	φ_1	φ_2	C_{dis}	s	τ_{max}	p	R_0	c					
Time	11	17.1	11.6	8.8	7.9	7.1	7.4	16.7	5.3	3.1	6					
Return	12.7	11.1	10.8	12.1	7.9	8.4	6.4	15.4	6	4.5	3.5					
Participation	7	11.2	11	7.7	7	7.3	7.1	18.1	4.4	4.9	5					
Plan 3																
Response	Variable															
	r_0	α	β	a	b	ε_1	ε_2	φ_1	φ_2	C_{dis}	s	λ	τ_{max}	p	R_0	c
Time	7.5	6.9	9.4	8.3	7.8	4.5	5.1	4	5.1	7	5.1	6.1	7.4	4.5	5	6.7
Return	8.1	9.6	9.2	7.1	7.7	6.9	5.5	4.4	4.4	6.3	5.5	9.7	9.7	3.3	3.3	3.8
Participation	4.4	7.1	6.9	9.5	5.4	4.1	4.9	4.5	4.2	5.3	4	9.9	9.7	4.7	4.2	4.6
Plan 4																
Response	Variable															
	r_0	α	β	a	b	ε_1	ε_2	φ_1	φ_2	C_{dis}	s	λ	τ_{max}	p	R_0	c
Time	7.3	8.4	6.7	9	7.2	5	5.5	6	5.5	4.5	4.9	7.1	8.9	6.1	4.5	5.3

Return	7.4	8.1	6.5	9	7.7	4.6	5.2	5.5	4.6	5	6.6	7.5	8.8	2.9	4	5
Participation	4.6	7.4	5.5	10.6	5.8	4.4	4.2	4.2	4.5	5	4.6	10	9.5	4.1	5	4.4

By examining the relative importance of each variable, we can gain a deeper understanding of how they contribute to the estimation of return volume, participation rate, and evolution time. Variables with higher importance values indicate a stronger influence on the model performance, highlighting their significance in explaining the observed outcomes. Thus, higher variable importance values indicate a stronger association between the predictor variable and the response variable, suggesting that the variable has a greater influence on the model's predictions. This information can guide decision-makers in identifying key drivers and factors that significantly impact SC performance.

Table 5 provides the following insights and implications. The initial return amount, i.e., r_0 has the highest effect on outcomes of Plan 1 and Plan 2, while this effect is lower in Plan 3 and Plan 4. This shows that in Plans 1 and 2, the outcomes (i.e., time, return volume and participation) depend more on the status quo, which makes it more difficult to improve the situation. On the other hand, the participation rate, return volume, and time of Plan 1 highly depend on the cost of awareness-increasing efforts, i.e., λ , while this effect is much lower in Plans 3 and 4. This shows that if the pharmacies are able to reduce this cost by changing their means to increase awareness (e.g., using online promotions instead of paper pamphlets), they can have a greater impact on the outcomes in Plan 1 compared to Plans 3 and 4; and the same applies to the effect of τ_{max} in Plan 2, compared to Plans 3 and 4. However, if τ_{max} can be considered an environmental parameter, which is beyond the control of pharmacies. In this case, we can conclude that the outcomes in Plans 3 and 4 are more adaptable with respect to the high values of τ_{max} .

Furthermore, the importance of α (sensitivity of customers' return behaviour to a pharmacy's awareness-increasing efforts) and a (sensitivity of customers' return behaviour to a pharmacy's discounts) in Plans 1 and 2 are higher than those in Plans 3 and 4. This indicates that these variables have a stronger influence on the customers' return behaviour in Plans 1 and 2, while their impact is relatively lower in Plans 3 and 4. Thus, when these parameters are high, or the SC players are capable of increasing these parameters, the outcomes are better improved in Plans 1 and 2. However, if these parameters are low, for instance, due to cultural issues, and the SC members cannot change them, it is better to opt for Plans 3 and 4. This is because Plans 3 and 4 can hedge against low values of α and a , according to variable importance results.

The competition intensity in the return volume (β and b) has a stronger effect on the model outcomes in Plans 1 and 2 compared to Plans 3 and 4. It implies that in Plans 1 and 2, the level of competition among pharmacies plays a critical role in shaping the outcomes of the model. It cannot be easily stated that competition has a positive or negative relationship with model performance. However, generally, competition intensity is assumed to exacerbate the performance of the system (Adida and DeMiguel, 2011). Under such an assumption, one can conclude that Plans 3 and 4 can be of more advantage in

highly competitive environments, as they can decrease the negative effect of competition intensity on the system outcomes.

Overall, Plans 3 and 4 demonstrate a more balanced weighting of variable importance. In these plans, all variable importance measures are below 10%. This may indicate that under these plans, the PSC is more intricate and interconnected, with no single variable overshadowing the others in terms of influence. Such a distribution of variable importance suggests that the PSC is resilient to potential changes in one or two factors, as the impact is distributed across multiple variables. This diversified approach may reduce the risk associated with extreme fluctuations in a single factor, meaning that Plans 3 and 4 are better equipped to handle high costs, low initial return quantity, or unfavourable market conditions. Furthermore, it implies a more holistic strategy where all factors are considered and integrated, promoting a comprehensive understanding of the system. While this may pose challenges in pinpointing specific influential variables for immediate intervention, it also means that the system is less vulnerable to singular disruptions and can maintain stability even if one or several variables undergo changes.

On the other hand, Plans 1 and 2 are mostly explained by two dominant variables, which may make these plans more easily manageable and predictable. This is because when strategies are driven by a limited set of factors, the outcomes can be more directly correlated, allowing for quicker adjustments and refinements. Fewer variables mean fewer interactions to monitor, leading to a simplified decision-making process. Moreover, with fewer components to account for, it becomes feasible to allocate resources more efficiently and to anticipate potential challenges. This streamlined nature of Plans 1 and 2 may make them more appealing to those stakeholders who prefer clarity and a more direct cause-effect relationship in their strategic endeavours.

6. Conclusion and managerial implications

The central theme of this research is the reverse flow of unwanted medications, with a focus on the UK government's role, recycling of packaging, and increasing society's awareness of proper medication disposal. With a critical view of the current state of waste management practices in the UK's pharmaceutical sector, our study aims to investigate enduring ways to improve these practices and provide insights for policymakers. Traditional game theory models often focus on short-term interactions and immediate payoffs. In contrast, EGT allows us to examine how strategies and behaviours of various actors (i.e., pharmacies as collectors of unwanted medications, a recycler, and the NHS) evolve over the long term and understand the dynamics and outcomes of their interactions and their impact on the reverse PSC. Thus, this paper contributes to the literature by introducing an analytical model of the long-term behaviours of participants towards adopting four proposed incentive plans. The plans are designed such that they address reward- and awareness-driven customer segments and coordination among the supply-chain members. Using EGT, we explore how adopting each plan

eventually affects the PSC performance and compare the plans in terms of return volume, participation rate, budget spend and implementation time to recommend the most effective plan. Our analyses offer the following insights for the policymakers in the pharmaceutical sector dealing with medication waste.

Evolutionary stability of the plans in the long run: Analysis of the pharmacies' evolving behaviour shows that the proposed plans can have a majority of the pharmacies participating in the long term (see Figure 3). In other words, participation in the proposed plans will be the ESS for the population of pharmacies in most conditions. Even when the budget is low, or the market is competitive, the evolutionary trend of the system will be evolved towards taking part in the plans. This finding reveals the evolutionary stability of the proposed plans in the long term. Furthermore, the coordination strategy (Plan 4) may be favoured by the pharmacies even in the absence of a premium from the NHS. This is because the inherent benefits of coordination, such as increased profit for the entire SC and guaranteed profit for pharmacies, outweigh the absence of an NHS reward. This shows that pharmacies may benefit from taking part in coordination and increasing return volume even when the NHS budget is extremely scarce.

Efficiency of coordination strategy in mitigating the negative impacts of exogenous factors: The analysis reveals that implementing the coordination strategy for managing unwanted medications yields significant managerial benefits. Implementing the coordination strategy among the supply-chain members improves the environmental efficiency of the SC, even when customers are less attracted to discounts and have a low propensity to respond to awareness-increasing efforts. Additionally, the coordination strategy mitigates the negative impacts of increasing parameter values such as the cost of awareness-increasing efforts and the maximum coupon amount that satisfies customers, resulting in higher return volumes compared to the no-coordination strategy. Also, the positive effect of customer sensitivity to awareness-increasing efforts and discounts on return amount is further amplified under coordination. These findings emphasise the efficiency of the coordination strategy in improving performance and increasing return volumes in the management of unwanted medications.

Effectiveness of the proposed plans: All of the proposed plans are successful in increasing the return volume and tackling the issue of pharmaceutical waste to some extent. Specifically, the research results highlight the effectiveness of Plans 3 and 4 in low-budget scenarios (see Figure 4). The synergetic effects of combining awareness-increasing efforts and rewards in these plans address the limitations of Plans 1 and 2 and create a more comprehensive and persuasive approach. Integrating these strategies enhances public awareness and perception of the value of returning unwanted medications, resulting in significant increases in return rates and overall plan efficiency, even with limited resources. Notably, Plan 4 shows a higher return rate with respect to the budget compared to other plans, indicating that it is more budget-effective than others (see Figure 4). Moreover, the results demonstrate the economic viability of coordination, as captured by the surplus profit gained through coordination compared to the

uncoordinated scenario. Plan 4, with its coordination strategy, exhibits the highest income for the system and creates a win-win situation for all participants when the surplus profit is shared properly.

Time-efficiency of the proposed plans: Analysing the evolution trajectory under each plan provides insights into their expected timelines and convergence patterns (see Figures 3 and 4). Plan 3 exhibits the shortest evolution trajectory path, followed by Plan 4. Plan 2 converges to equilibrium faster than Plan 1. These observations suggest that proposing Plan 3 can effectively stimulate pharmacies' participation, facilitating the NHS in attaining environmental goals within a shorter period. Plan 4, while eventually reaching full equilibrium, requires more time due to the coordination involved. It is important to note that the bargaining power of pharmacies is significantly lower compared to the recycler, resulting in a relatively low increase in the pharmacies' payoff in Plan 4. However, the coordination strategy still stimulates pharmacies to respond promptly to the NHS plan.

Finally, we can rank the proposed plans based on the significant decision-making criteria (see Table 6). Plan 4 stands out as a strong all-around choice, ranking first in efficiency and return volume, and second in Time and participation rate, making it suitable for various scenarios that prioritise both efficiency and return volume. Plan 3 is the quickest and may be optimal when rapid execution and high participation rate are prioritised, with competitive ranks in other criteria. Plan 3's balanced approach addresses both reward- and awareness-driven customers. Educating customers combined with offering them discounts create a reinforcing cycle, leading to satisfying performance across all metrics (i.e., time, return volume, and participation rate). Plan 1, although tied first for participation rate, faces challenges in other areas, whereas Plan 2 consistently ranks third across all criteria, serving as a safe middle-ground option but lacking leadership in any particular area. The best choice among these plans will hinge on specific organisational priorities and constraints, such as whether the immediate goal is to maximise efficiency, return volume, execution speed, or participation. The insights from these rankings provide a tailored approach to create a customised strategy that meets specific needs. Careful consideration of these criteria can guide strategic choices aligned with pressing organisational needs and opportunities.

Table 6. Ranks Plans 1, 2, 3, and 4 based on the four decision-making criteria.

Plans	Return volume	Time	Participation rate	Efficiency
Plan 1	4	4	1	4
Plan 2	3	3	3	3
Plan 3	2	1	1	2
Plan 4	1	2	2	1

Further avenues for research in the context of the investigated SC can be explored as follows. First, the investigated SC consists of a recycler and a population of pharmacies, but one can also consider a population of recyclers to investigate the evolution of the two populations' strategies. Moreover, it would be interesting to consider populations of pharmacies, where each population corresponds to a specific area, and the government's budget needs to be divided between them. Furthermore,

investigating dynamic customer awareness using EGT and dynamic game approaches would capture the temporal evolution of customer awareness and its impact on SC dynamics. Also, this study considers that the information is visible to all SC members. However, in many cases, pharmacies have private information which is not shared with the recycler and the government. Hence, this model can be developed under asymmetric information (Vosooghizaji et al., 2020). In addition, risk-related analyses (Choi et al., 2019) in long-term SC coordination can also be conducted in the future.

References

- Abahussain, E. A. and Ball, D. E. (2007) 'Disposal of unwanted medicines from households in Kuwait', *Pharmacy World & Science*, 29(4), pp. 368-373.
- Abdallah, Q., Al-Haddad, M., Al-Khathami, O., Al-Kherish, O., Al-Marri, K., Al-Matani, M. and Al-Rashed, A. (2014) 'Knowledge, Attitude and Practice towards Discarding Unwanted Household Medicines among University Students in Western Region, KSA', *International journal of pharmacy*, 4(4), pp. 14-21.
- Adida, E., and DeMiguel, V. (2011). 'Supply Chain Competition with Multiple Manufacturers and Retailers'. *Operations Research*, 59(1), 156–172.
- Ahlaqqach, M., Benhra, J., Mouatassim, S. and Lamrani, S. (2020) 'Closed loop location routing supply chain network design in the end of life pharmaceutical products'. *Supply Chain Forum: An International Journal*, 21(2), pp. 1-14.
- Alderwick, H. and Dixon, J. (2019), 'The NHS long term plan'. *British Medical Journal Publishing Group*. doi:10.1136/bmj.l84.
- Alhamad, H., Patel, N. and Donyai, P. (2018) 'How do people conceptualise the reuse of medicines? An interview study', *International Journal of Pharmacy Practice*, 26(3), pp. 232-241.
- Alshemari, A., Breen, L., Quinn, G. and Sivarajah, U. (2020) 'Can we create a circular pharmaceutical supply chain (CPSC) to reduce medicines waste?', *Pharmacy*, 8(4), pp. 221.
- Araz, O. M., Olson, D., and Ramirez-Nafarrate, A. (2019). 'Predictive analytics for hospital admissions from the emergency department using triage information'. *International Journal of Production Economics*, 208, 199–207.
- Atasu, A., and Subramanian, R. (2012). 'Extended producer responsibility for e-waste: Individual or collective producer responsibility?', *Production and Operations Management*, 21(6), 1042–1059.
- Ayele, Y. and Mamu, M. (2018) 'Assessment of knowledge, attitude and practice towards disposal of unused and expired pharmaceuticals among community in Harar city, Eastern Ethiopia', *Journal of Pharmaceutical Policy and Practice*, 11(1), pp. 1-7.
- Babu, S. and Mohan, U. (2018) 'An integrated approach to evaluating sustainability in supply chains using evolutionary game theory', *Computers & Operations Research*, 89, pp. 269–283.
- Barron, E. N. (2013). *Game theory: An introduction*.
- Bound, J. P. and Voulvoulis, N. (2005) 'Household disposal of pharmaceuticals as a pathway for aquatic contamination in the United Kingdom', *Environmental Health Perspectives*, 113(12), pp. 1705-1711.
- Breen, L. and Xie, Y. (2009) 'Examining the role of the customer in facilitating reverse logistics systems in NHS community pharmacy in the UK', *14th Logistics Research Network (LRN) Conference*.
- Breiman, L. (2001). 'Statistical modeling: The two cultures'. *Statistical Science*, 16(3), 199–231.
- Breiman, L., Friedman, J. H., Olshen, R. A., and Stone, C. J. (1984). *Classification and regression trees (the wadsworth statistics/probability series)* chapman and hall, 1–358.
- Cachon, G. P. (2003). 'Supply chain coordination with contracts'. *Handbooks in Operations Research and Management Science*, 11, 227–339.
- Chen, W. and Hu, Z.-H. (2018) 'Using evolutionary game theory to study governments and manufacturers' behavioral strategies under various carbon taxes and subsidies', *Journal of Cleaner Production*, 201, pp. 123–141.

- Chen, Y., Ding, S., Zheng, H., Zhang, Y., and Yang, S. (2018) 'Exploring diffusion strategies for mHealth promotion using evolutionary game model', *Applied Mathematics and Computation*, 336, pp. 148–161.
- Cheng, H., and Ding, H. (2021). 'Dynamic game of corporate social responsibility in a supply chain with competition', *Journal of Cleaner Production*, 317, 128398.
- Choi, T.-M., Wen, X., Sun, X., and Chung, S.-H. (2019). 'The mean-variance approach for global supply chain risk analysis with air logistics in the blockchain technology era'. *Transportation Research Part E: Logistics and Transportation Review*, 127, 178–191.
- Chung, S.-s. and Brooks, B. W. (2019) 'Identifying household pharmaceutical waste characteristics and population behaviors in one of the most densely populated global cities', *Resources, Conservation and Recycling*, 140, pp. 267–277.
- da Silva Rocha, A. B., and Salomão, G. M. (2019). 'Environmental policy regulation and corporate compliance in evolutionary game models with well-mixed and structured populations'. *European Journal of Operational Research*, 279(2), 486–501.
- Dai, H., Han, J. and Lichtfouse, E. (2021) 'Smarter cures to combat COVID-19 and future pathogens: a review', *Environmental Chemistry Letters*, 19(4), pp. 2759–2771.
- De'ath, G. (2002). 'Multivariate Regression Trees: A New Technique for Modeling Species–Environment Relationships'. *Ecology*, 83(4), 1105–1117.
- de Campos, E. A. R., Tavana, M., Ten Caten, C. S., Bouzon, M. and de Paula, I. C. (2021) 'A grey-DEMATEL approach for analyzing factors critical to the implementation of reverse logistics in the pharmaceutical care process', *Environmental Science and Pollution Research*, 28(11), pp. 14156–14176.
- Ding, B. (2018) 'Pharma Industry 4.0: literature review and research opportunities in sustainable pharmaceutical supply chains', *Process Safety and Environmental Protection*.
- Dong, J., Jiang, L., Lu, W. and Guo, Q. (2021) 'Closed-loop supply chain models with product remanufacturing under random demand', *Optimization*, 70(1), pp. 27–53.
- Friedman, D. (1998) 'On economic applications of evolutionary game theory', *Journal of evolutionary economics*, 8(1), pp. 15–43.
- Govindan, K. and Popiuc, M. N. (2014) 'Reverse supply chain coordination by revenue sharing contract: A case for the personal computers industry', *European Journal of Operational Research*, 233(2), pp. 326–336.
- Hadi, T., Chaharsooghi, S. K., Sheikhmohammady, M., and Hafezalkotob, A. (2020). 'Pricing strategy for a green supply chain with hybrid production modes under government intervention'. *Journal of Cleaner Production*, 268, 121945.
- Han, J. (2022a) 'Barcoding drug information to recycle unwanted household pharmaceuticals: a review', *Environmental Chemistry Letters*, 20(5), pp. 1–15.
- Han, J. (2022b) 'Closing the Loop: An Integrative Framework for Managing Unwanted Pharmaceuticals During COVID-19 and Beyond', *Available at SSRN 4020765*.
- Hastie, T., Tibshirani, R., Friedman, J. H., and Friedman, J. H. (2009). 'The elements of statistical learning: Data mining, inference, and prediction', 2, pp. 1–758, *Springer*.
- Health, D. o. (2007) 'Environment and Sustainability Health Technical Memorandum 07-06: Disposal of Pharmaceutical Waste in Community Pharmacies'. Department of Health London.
- Health, D. o. (2013) 'Health Technical Memorandum 07–01: Safe Management of Healthcare Waste'. DH London.
- Heydari, J., Govindan, K., and Sadeghi, R. (2018). 'Reverse supply chain coordination under stochastic remanufacturing capacity'. *International Journal of Production Economics*, 202, 1–11.
- Hosseini-Motlagh, S.-M., Johari, M., and Zirakpourdehkordi, R. (2021). 'Grain production management to reduce global warming potential under financial constraints and time value of money using evolutionary game theory'. *International Journal of Production Research*, 17, 5108–5129.
- Hosseini-Motlagh, S.-M., Nami, N. and Farshadfar, Z. (2020a) 'Collection disruption management and channel coordination in a socially concerned closed-loop supply chain: a game theory approach', *Journal of Cleaner Production*, 276, pp. 124173.

- Hosseini-Motlagh, S.-M., Nematollahi, M., and Nami, N. (2020b). 'Drug recall management and channel coordination under stochastic product defect severity: A game-Theoretic analytical study'. *International Journal of Production Research*, 59(6), 1–27.
- Hua, M., Lai, I.K.W. and Tang, H. (2019) 'Analysis of advertising and a points-exchange incentive in a reverse supply chain for unwanted medications in households based on Game Theory', *International Journal of Production Economics*, 217, 259-268.
- Hua, M., Tang, H. and Lai, I.K.W. (2017) 'Game Theoretic Analysis of Pricing and Cooperative Advertising in a Reverse Supply Chain for Unwanted Medications in Households', *Sustainability*, 9(10), pp. 1902.
- Hua, M., Tang, H. and Wu, Z. (2016) 'Analysis of a pharmaceutical reverse supply chain based on unwanted medications categories in household', *IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, pp. 1493–1497.
- Johari, M. and Hosseini-Motlagh, S.-M. (2022) 'Evolutionary behaviors regarding pricing and payment-convenience strategies with uncertain risk', *European Journal of Operational Research*, 297(2), pp. 600–614.
- Johari, M., Hosseini-Motlagh, S.-M. and Rasti-Barzoki, M. (2019) 'An evolutionary game theoretic model for analyzing pricing strategy and socially concerned behavior of manufacturers', *Transportation Research Part E: Logistics and Transportation Review*, 128, pp. 506–525.
- Islam, S., and Amin, S. H. (2020). 'Prediction of probable backorder scenarios in the supply chain using Distributed Random Forest and Gradient Boosting Machine learning techniques'. *Journal of Big Data*, 7(1), 65.
- Janssen, M., and van der Voort, H. (2020). 'Agile and adaptive governance in crisis response: Lessons from the COVID-19 pandemic'. *International Journal of Information Management*, 55, 102180.
- Keivanpour, S., Ait-Kadi, D. and Mascle, C. (2017) 'Automobile manufacturers' strategic choice in applying green practices: joint application of evolutionary game theory and fuzzy rule-based approach', *International Journal of Production Research*, 55(5), pp. 1312-1335.
- Kheir, N., El Hajj, M., Wilbur, K., Kaissi, R. and Yousif, A. (2011) 'An exploratory study on medications in Qatar homes', *Drug, Healthcare and Patient Safety*, 3, pp. 99.
- Kleijnen, J. P., Sanchez, S. M., Lucas, T. W., and Cioppa, T. M. (2005). 'State-of-the-art review: A user's guide to the brave new world of designing simulation experiments'. *INFORMS Journal on Computing*, 17(3), 263–289.
- Krapp, M., and Kraus, J. B. (2019). 'Coordination contracts for reverse supply chains: A state-of-the-art review'. *Journal of Business Economics*, 89(7), 747–792.
- Law, A. V., Sakharkar, P., Zargarzadeh, A., Tai, B. W. B., Hess, K., Hata, M., Mireles, R., Ha, C. and Park, T. J. (2015) 'Taking stock of medication wastage: Unused medications in US households', *Research in Social and Administrative Pharmacy*, 11(4), pp. 571-578.
- Leng, M., and Parlar, M. (2009). 'Lead-time reduction in a two-level supply chain: Non-cooperative equilibria vs. Coordination with a profit-sharing contract'. *International Journal of Production Economics*, 118(2), 521–544.
- Liaw, A., and Wiener, M. (2002). 'Classification and regression by random forest'. *R News*, 2(3), 18–22.
- Liu, W., Wan, Z., Wan, Z. and Gong, B. (2020) 'Sustainable recycle network of heterogeneous pharmaceuticals with governmental subsidies and service-levels of third-party logistics by bi-level programming approach', *Journal of Cleaner Production*, 249, pp. 119324.
- Loh, W.-Y. (2014). 'Fifty years of classification and regression trees'. *International Statistical Review*, 82(3), 329–348.
- Luo, Y. and Wan, Z. (2022) 'An optimal system of recycling unwanted medicines by sustainable synergy of drugmakers, drugstores, customers and governments', *Journal of Cleaner Production*, 376, p. 134304.
- Mager, M., Traxler, I., Fischer, J., and Finger, D. C. (2022). 'Potential Analysis of the Plastics Value Chain for Enhanced Recycling Rates: A Case Study in Iceland'. *Recycling*, 7(5), Article 5.
- Marques, C. M., Moniz, S., de Sousa, J. P., Barbosa-Povoa, A. P. and Reklaitis, G. (2020) 'Decision-support challenges in the chemical-pharmaceutical industry: Findings and future research directions', *Computers & Chemical Engineering*, 134, pp. 106672.

- Moslemi, S., Sabegh, M. H. Z., Mirzazadeh, A., Ozturkoglu, Y. and Maass, E. (2017) 'A multi-objective model for multi-production and multi-echelon closed-loop pharmaceutical supply chain considering quality concepts: NSGAII approach', *International Journal of System Assurance Engineering and Management*, 8(2), pp. 1717-1733.
- Nematollahi, M., Hosseini-Motlagh, S.-M., Ignatius, J., Goh, M., and Nia, M. S. (2018) 'Coordinating a socially responsible pharmaceutical supply chain under periodic review replenishment policies', *Journal of Cleaner Production*, 172, pp. 2876-2891.
- Niculescu-Mizil, A., and Caruana, R. (2005). 'Predicting good probabilities with supervised learning'. *Proceedings of the 22nd International Conference on Machine Learning*, 625-632.
- Pishchulov, G., Richter, K., and Golesorkhi, S. (2023). 'Supply chain coordination under asymmetric information and partial vertical integration', *Annals of Operations Research*, 329(1), 1315-1356.
- Pishchulov, G., Tuselmann, H., and Sinkovics, R. R. (2014). 'Towards a consolidation of worldwide journal rankings—A classification using random forests and aggregate rating via data envelopment analysis'. Available at SSRN 2492472.
- Ranjbar, Z. and Mirzazadeh, A. (2019) 'The forward and reverse pharmaceutical supply chain network design considering tainted product delivery', *International Journal of Logistics Systems and Management*, 33(2), pp. 205-220.
- Rogowska, J., Zimmermann, A., Muszyńska, A., Ratajczyk, W. and Wolska, L. (2019) 'Pharmaceutical household waste practices: preliminary findings from a case study in Poland', *Environmental management*, 64(1), pp. 97-106.
- Sabouhi, F., Pishvae, M.S. and Jabalameli, M.S. (2018) 'Resilient supply chain design under operational and disruption risks considering quantity discount: A case study of pharmaceutical supply chain', *Computers & Industrial Engineering*, 126, pp. 657-672.
- Sadeghi, R., Taleizadeh, A. A., Chan, F. T. and Heydari, J. (2019) 'Coordinating and pricing decisions in two competitive reverse supply chains with different channel structures', *International Journal of Production Research*, 57(9), pp. 1-25.
- Savaskan, R. C., Bhattacharya, S. and Van Wassenhove, L. N. (2004) 'Closed-loop supply chain models with product remanufacturing', *Management Science*, 50(2), pp. 239-252.
- Sazvar, Z. , Zokaee, M., Tavakkoli-Moghaddam, R., Salari, S. A., and Nayeri, S. (2022) 'Designing a sustainable closed-loop pharmaceutical supply chain in a competitive market considering demand uncertainty, manufacturer's brand and waste management', *Annals of Operations Research*, 315(2), pp. 2057-2088..
- Sbihi, A. and Eglese, R. W. (2007) 'Combinatorial optimization and green logistics', *4OR*, 5(2), pp. 99-116.
- Simpson, E. H. (1949) 'Measurement of diversity', *nature*, 163(4148), 688-688.
- Smale, E. M., Egberts, T. C., Heerdink, E. R., van den Bemt, B. J., and Bekker, C. L. (2021). 'Waste-minimising measures to achieve sustainable supply and use of medication'. *Sustainable Chemistry and Pharmacy*, 20, 100400.
- Sun, H., Wan, Y., Zhang, L., and Zhou, Z. (2019) 'Evolutionary game of the green investment in a two-echelon supply chain under a government subsidy mechanism'. *Journal of Cleaner Production*, 235, 1315-1326.
- Taleizadeh, A. A., Ahmadzadeh, K., Sarker, B. R., and Ghavamifar, A. (2022). 'Designing an optimal sustainable supply chain system considering pricing decisions and resilience factors'. *Journal of Cleaner Production*, 332, 129895.
- Taleizadeh, A. A., Haghghi, F. and Niaki, S. T. A. (2019a) 'Modeling and solving a sustainable closed loop supply chain problem with pricing decisions and discounts on returned products', *Journal of cleaner production*, 207, pp. 163-181.
- Taleizadeh, A. A., Haji-Sami, E. and Noori-daryan, M. (2019b) 'A robust optimization model for coordinating pharmaceutical reverse supply chains under return strategies', *Annals of Operations Research*, pp. 1-22.
- Tat, R., and Heydari, J. (2021). 'Avoiding medicine wastes: Introducing a sustainable approach in the pharmaceutical supply chain'. *Journal of Cleaner Production*, 320, 128698.
- Tat, R., Heydari, J. and Rabbani, M. (2020) 'A mathematical model for pharmaceutical supply chain coordination: Reselling medicines in an alternative market', *Journal of Cleaner Production*, pp. 121897.

- Viegas, C. V., Bond, A., Vaz, C. R. and Bertolo, R. J. (2019) 'Reverse flows within the pharmaceutical supply chain: A classificatory review from the perspective of end-of-use and end-of-life medicines', *Journal of Cleaner Production*, pp. 117719.
- Vosooghidizaji, M., Taghipour, A., and Canel-Depitre, B. (2020). 'Supply chain coordination under information asymmetry: A review'. *International Journal of Production Research*, 58(6), 1805–1834.
- Wang, C., Wang, H. and Liu, Y. (2015) 'Separation of aluminum and plastic by metallurgy method for recycling waste pharmaceutical blisters', *Journal of Cleaner Production*, 102, pp. 378-383.
- Weraikat, D., Zanjani, M. K. and Lehoux, N. (2016a) 'Coordinating a green reverse supply chain in pharmaceutical sector by negotiation', *Computers & Industrial Engineering*, 93, pp. 67-77.
- Weraikat, D., Zanjani, M. K., and Lehoux, N. (2019). 'Improving sustainability in a two-level pharmaceutical supply chain through Vendor-Managed Inventory system'. *Operations Research for Health Care*, 21, 44–55.
- Weraikat, D., Zanjani, M. K. and Lehoux, N. (2016b) 'Two-echelon pharmaceutical reverse supply chain coordination with customers incentives', *International Journal of Production Economics*, 176, pp. 41-52.
- Xie, Y. and Breen, L. (2012) 'Greening community pharmaceutical supply chain in UK: a cross boundary approach', *Supply Chain Management: An International Journal*. 17(1), pp. 40-53.
- Xie, Y. and Breen, L. (2014) 'Who cares wins? A comparative analysis of household waste medicines and batteries reverse logistics systems: The case of the NHS (UK)', *Supply Chain Management: An International Journal*, 19(4), pp. 455-474.
- Xing, X.-H., Hu, Z.-H., and Luo, W.-P. (2023). 'Using evolutionary game theory to study governments and logistics companies' strategies for avoiding broken cold chains'. *Annals of Operations Research*, 329(1–2), 127–155.
- Yan, B., Wu, X.-h., Ye, B. and Zhang, Y.-w. (2017) 'Three-level supply chain coordination of fresh agricultural products in the Internet of Things', *Industrial Management & Data Systems*, 117(9), pp. 1842-1865.
- Yousef, S., Mumladze, T., Tatariants, M., Kriūkienė, R., Makarevicius, V., Bendikiene, R. and Denafas, G. (2018) 'Cleaner and profitable industrial technology for full recovery of metallic and non-metallic fraction of waste pharmaceutical blisters using switchable hydrophilicity solvents', *Journal of Cleaner Production*, 197, pp. 379-392.
- Yu, Z., Lin, Y., Wang, Y., and Goh, M. (2023). 'Closed-loop supply chain coalitional cooperation and coordination under differentiated carbon tax regulation'. *Journal of Cleaner Production*, 392, 136239.
- Zeng, A. Z. (2013) 'Coordination mechanisms for a three-stage reverse supply chain to increase profitable returns', *Naval Research Logistics (NRL)*, 60(1), pp. 31-45.

Appendix A: Model notations

General notations:

a	Sensitivity of customers' return volume to a pharmacy's coupon amount
b	Sensitivity of customers' return volume to the rival pharmacy's coupon amount
B	Total budget of the NHS
c	Unit recycling cost of the recycler
C_{dis}	Unit disposal cost of the recycler
D_0	The initial customer demand for medications faced by a pharmacy
F	The fixed cost of placing special recycling bins for returned medications
G	Premium paid by the NHS to pharmacies for collecting each item beyond the threshold

i, j	Strategies of Pharmacies 1 and 2 in a one-shot game, as elements of the following sets:
$\{CE, nCE\}$	in Plan 1 (increasing customer awareness, or not)
$\{d, nd\}$	in Plan 2 (offering discounts, or not)
$\{CEd, nCEd\}$	in Plan 3 (increasing customer awareness and offering discounts, or not)
$\{Co, nCo\}$	in Plan 4 (coordinated or uncoordinated mode)
p	Selling price of recycled packages
r_0	Initial return amount of each pharmacy
$r_{i,j}$	Return amount of the pharmacy using strategy i when the rival pharmacy uses strategy j
R_0	Pharmacies' revenue per unit
s	Unit cost of segregating recyclable items
V	Environmental conservation index for each uncollected item
α	Sensitivity of customers' return volume to a pharmacy's awareness-increasing efforts
β	Sensitivity of customers' return volume to awareness-increasing efforts of a rival pharmacy
ρ	Percentage of recyclable packages
ω_0	Waste recycler's initial collection fee
Π^P	Profit function of the pharmacy
Π^W	Profit function of the waste recycler
U^{NHS}	The utility function of the NHS

Plan 1 notations:

ε_1	Sensitivity of demand to a pharmacy's awareness-increasing efforts
ε_2	Sensitivity of demand to awareness-increasing efforts of a rival pharmacy
λ	Cost coefficient of awareness-increasing efforts

Plan 2 notations:

γ	Reduced segregation cost of recycler due to placing recycling bins ($0 < \gamma < 1$)
θ	Fraction of redeemed coupons ($0 < \theta \leq 1$)
τ_{max}	Maximum coupon value that attracts all customers to return medications
φ_1	Sensitivity of demand to the coupon amount offered by a pharmacy
φ_2	Sensitivity of demand to the coupon amount offered by a rival pharmacy

Plan 4 notations:

P	Profit surplus derived from members' collaboration
Φ	Bargaining power of the pharmacy against the recycler

Evolutionary game notations:

$\delta_k(t)$	The probability level of employing Plan k by the pharmacies ($k \in \{1,2,3,4\}$)

Decision variables:

$e_{i,j}$ The level of collection effort (increasing awareness) of the pharmacy using strategy i and when the rival pharmacy uses strategy j .

$\tau_{i,j}$ Coupon amount offered to customers for returning items by the pharmacy using strategy i when the rival pharmacy uses strategy j

$\omega_{i,j}$ Waste collection fee of the pharmacy using strategy i when the rival ph

Leisure and Narcissism: Understanding the Dual Effect of Entrepreneurial Leader Proactivity on Team Outcomes through Team Proactive Motivational Pathways

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Abstract

Proactivity may have a potential dark side that causes unfavorable consequences, especially when executed unwisely. Drawing on the integration of the wise proactivity concept, enrichment theory, and conservation of resources theory, this study aims to investigate why and when entrepreneurial leader proactivity is detrimental or beneficial for team outcomes and the dichotomy of its execution. This study addresses the dual mechanism of team proactive motivational states, which cover cognitive motivational pathways (reason-to-state), including team intrinsic and team extrinsic motivation, and affective motivational pathways (energized-to-state), involving team happiness and team stress. This study focuses on understanding two components of the wise proactivity concept, task-strategic and self-regulation aspects, that play essential roles in this relationship and examines its potential association with entrepreneurial leader dark traits, including narcissism. This study applies a quantitative, longitudinal analysis of 165 micro and small business companies across three-time data points. This study reveals that various leisure practices that leaders engage in are found to bring favorable consequences. The finding shows that when proactive leaders are actively involved in various leisure activities, such as virtual, intellectual, contemplation, and manual leisure, it can reduce the negative impact of their proactive personality on team extrinsic motivation. Furthermore, this study demonstrates that team autonomy has a substantial impact on moderating the relationship between leaders' proactivity and team stress. This study indicates that the joining effect of leaders' proactivity and team autonomy can reduce the stress experienced by team members. In addition, this study suggests that leaders' narcissism was found to negatively moderate the relationship between leaders' proactive personality and team organizational engagement through team intrinsic motivation and team happiness. This study contributes to the theoretical trajectory of wise proactivity by investigating the role of leaders' leisure and team autonomy in the likelihood of dual effects of leader proactivity on team well-being. This study helps to present strategic encouragement for organizations to be able to realize the concept of wise proactivity to maintain favorable outcomes. Ultimately, this study attempts to synthesize the realm of proactivity theory and leisure literature by emphasizing team-level study in depicting the double-edged sword of entrepreneurial leader proactivity.

Keywords: entrepreneurial leader proactivity, entrepreneurial narcissism, entrepreneurial leisure, team happiness, team stress, team autonomy, team engagement

Introduction

Entrepreneurship serves as the catalyst for a nation's economic expansion as it boosts economic activities throughout all aspects of people's economic lives (Kumar & Raj, 2019). Small and medium-sized enterprises (SMEs), which are usually run by entrepreneurs, contribute to approximately 60% of the workforce in the major countries worldwide (OECD, 2017). New small businesses are essential for economic stability, growth, and innovation in many regions, as they play a vital role in developing new job creation and fostering competition in emerging sectors (Morrison, Breen, & Ali, 2003; Ribeiro-Soriano, 2017). However, as the business environment is faced with frequent unpredictable uncertainty and ambiguity, most business startups begin to fail during the first three and a half years (Worku, 2016).

For years, entrepreneurship has been recognized as one of the most demanding jobs (Dhingra, 2020), requiring entrepreneurs to dedicate their entire capacity to managing and improving their business performance. Entrepreneurs grapple with a myriad of challenges on a daily basis, from developing and refining business ideas to securing investments, recruiting and managing employees, and adapting to changes in the business environment (Cardon & Kirk, 2015; Klyver, Honig, & Steffens, 2018; Lomberg, Thiel, & Steffens, 2019). Besides, challenges might be associated with insufficient resources, a lack of entrepreneurial skills, outdated technology (Amankwah-Amoh, 2016), limited access to capital from formal institutions (Meressa, 2020; Ndege, 2015), not having strategic assets and low competitiveness (Hyder & Lussier, 2016).

To sustain longer in this intense competition, organizations are required to embrace fast, agile, and innovative responses. All these challenging circumstances strived entrepreneurs to perform their businesses proactively (Kreiser, Marino, Kuratko, & Weaver, 2013). Recent evidence suggests that entrepreneurs are likely to represent a proactive personality (Hu et al., 2018), which leads to greater success when they possess such a personality (Kickul & Gundry, 2002; Rauch & Frese, 2007). Proactive orientation can lead entrepreneurs' businesses to better performance (Gallagher, Mazur, & Ashkanasy, 2015; Menguc, Auh, & Ozanne, 2010; Vecchiato, 2015). A proactive personality, characterized by exploring potential markets and proposing innovation, is an essential personality feature for entrepreneurs that embodies the ideas of personal agency that is central to entrepreneurship (McMullen, Brownell, & Adam, 2021; Rooks, Sserwanga, & Frese, 2016). Entrepreneurs' proactive personality has been widely acknowledged to play a crucial role in shaping entrepreneurial intention, entrepreneurial self-efficacy, entrepreneurial behavior, entrepreneurial learning, and organizational innovation

(Kiani, Ali, Biraglia, & Wang, 2023; Nogueira, 2019; Neneh, 2019; Paul & Srivastava, 2017; Kickul & Gundry, 2002).

Two streams of research indicate that proactivity plays a significant role in organizations. The first research stream suggests that being proactive can have a beneficial impact on improving one's career, team performance, and organizational innovativeness (Fuller & Marler, 2009; Seibert, Kraimer, & Crant, 2001). However, the argument of the second research stream argues that proactivity may have detrimental consequences for those who are undertaking it, as well as for others and organizations surrounding it, due to the experience of stress caused by feeling pressured or resource depletion (Pingel, Fay, & Urbach, 2019). It is important to note that prior research emphasized that individuals with extremely proactive behavior may have misdirected decisions that lead to negative rather than positive consequences for others (Bolino et al., 2010). Misguided proactive behavior might bring dark consequences and may potentially harm individuals who perform it, as well as others who surround it, which subsequently refers to unwise proactivity (Bateman & Crant, 1993; Bindl, & Parker, 2010; Bolino et al., 2010; Parker et al., 2019). Organizations are placing a higher importance on proactivity, which may lead the team to feel pressured to perform proactive action (Pingel et al., 2019). It is in line with prior studies, indicating that being proactive may harm individuals since it potentially leads to resource depletion, job strain (Hahn, Frese, Binnewies, & Schmitt, 2012; Strauss, Parker, & O'Shea, 2017), and withdrawal (Pingel et al., 2019).

Unfortunately, although prior studies have shown that being proactive can have personal consequences, less is known concerning the influence of leaders' proactivity on team outcomes. To help fill these important gaps in the literature, this study aims to investigate why and when proactivity is detrimental or beneficial and the dichotomy of its execution. Moreover, this study aims to answer the call to investigate the positive and negative affectivity at the same time within the team-level context (Wu & Wang, 2015). Integrating the proactive motivational concept (Parker, Bindl, & Strauss, 2010), social learning theory (Bandura, 1971), and conservation of resources theory (Hobfoll, 2001), this study suggests that leaders' proactivity can influence team proactive motivation within the dual mechanism processes, including the cognitive motivational route (reason-to-state) and affective motivational pathway (energized-to-state) (Peng, Li & Bindl, 2021; Van Den Heuvel et al., 2015) in both positive and negative pathways, which in turn may influence team well-being.

First, within the cognitive positive pathway, in relation to a reason-to-state (Parker et al., 2010), it encompasses self-determination and meaning, which pertains to the concept of

having an internalized reason-to take the initiative (Parker & Wu, 2014). Leadership has the capacity to influence followers' intrinsic motivation for proactive behavior, which conscientiously engages them in proactivity due to it being interesting, enjoyable, and challenging (Deci & Ryan, 2000). The tenet of social learning theory defines that individuals acquire a broad range of behaviors through careful observation and imitation of role models (Bandura, 1977). Proactive leaders are attractive to followers, and they tend to be highly motivated to adopt and emulate leaders' values, cognitive patterns, and behaviors (Zhang & Chui, 2022). Followers often imitate their leader's behaviors as their role models by observing the leader's behaviors and the resulting outcomes (Liu, Kwan, Fu, & Mao, 2013). A supportive work environment that encourages followers to explore new ways of working without fear of potential obstacles is likely to foster proactive behavior, given the uncertainties and risks associated with proactivity (Parker et al., 2010). In line with social learning theory, this study believes that leaders can inspire followers by embracing their ideas and involving people in decision-making to bring about positive changes in the organization. Therefore, followers are more likely to be motivated and hold a strong desire to conduct proactive action, which in turn may lead to increased well-being.

Second, within the cognitive negative pathway, in relation to the reason-to-state route (Parker et al., 2010), due to the pressure followers perceive for being proactive, they may exhibit proactive actions driven by external factors, such as the desire for financial rewards and social recognition, as well as avoiding undesirable consequences (Bateman & Crant, 1999; Crant, 2000). Moreover, since organizations increasingly value proactivity, followers may perceive external pressure to exhibit proactive behavior to evade criticism from supervisors (Pingel et al., 2019). However, engaging in proactive action for external motivators might create a sense of pressure among followers, resulting in a higher likelihood of feeling exhausted (Pingel et al., 2019). Besides, performing proactive behavior can be resource-intensive, which may result in their seeing a loss of resources (Bolino & Turnley, 2005).

Aligned with the conservation of resources theory (Hobfoll, 2001), individuals whose personal resources are depleted are more prone to experience burnout and, consequently, demonstrate diminished task performance. The fundamental principle underlying the conservation of resources theory is that individuals make deliberate attempts to maintain, protect, and improve their valuable resources, wherein any possible or actual depletion is perceived as a threat (Hobfoll, 1988). This theory emphasizes that well-being can be adversely affected by the threat of resource loss (Hobfoll, 2001). Consistent with this theory, this study suggests that followers are more prone to experiencing emotional exhaustion due to resource

loss if they perceive proactivity as an expected behavior from their leader or even organization. Thus, in this sense, followers' engagement in proactivity might be driven more by their extrinsic motivators, which can potentially lead to a decrease in well-being.

Given the affective pathways, leaders' proactivity can also have positive and negative impacts on team proactive motivation. Both positive and negative affectivity induced by leaders provide a complete and accurate depiction of affectivity in the leaders-followers relationship (Nifadkar, Tsui, & Ashford, 2012). As prior research pointed out, proactive action may have dual consequences on well-being, including increasing motivation and decreasing resources at the same time (Cangiano & Parker, 2016). First, within the affective positive pathway, in relation to energized-to-state (Parker et al., 2010), leaders can motivate followers to engage in proactive behavior by fostering positive emotions in the workplace (Parker & Wu, 2014). Positive affect is linked to proactive behavior since it invokes the feeling of energy (Shraga & Shirom, 2009), personal initiative (Den Hartog & Belschak, 2007) and taking charge (Fritz & Sonnentag, 2009), as well as enables self-efficacy and persistence (Tsai, Chen, & Liu, 2007).

Second, under the affective negative pathway, leaders' proactivity can exert a considerable amount of stress on their followers (Spain, Harms, & Wood, 2016). Consistently, prior evidence indicated that proactivity may harm others through the experience of stress and burnout (Bolino et al., 2010; Bolino, Turnley, & Anderson, 2017). Proactivity may hurt not only the one who performs it but also others and the organization surrounding it (Bolino et al., 2017). Individuals with limited personal resources are more likely to encounter stress and be vulnerable to more resource depletion (Hobfoll, 1989). Leaders who are engaged in proactivity may perceive an increased workload due to the resource-intent nature of proactivity. A high workload for leaders is linked to followers experiencing emotional exhaustion (Stein, Vincent-Hoper, & Gregersen, 2020). Specific affective states which are associated with a goal can drive proactive behaviour through the activation of a goal to relieve negative emotions (Wolsink, Den Hartog, Belschak, & Oosterwijk, 2019). Therefore, in this sense, when followers view their leaders' proactivity as pressure, it is more likely that leaders' proactivity leads to the hot side of proactivity, which is negative affectivity.

Although past studies have begun to acknowledge the drawbacks of proactivity, less is known on how entrepreneurial leaders' characteristics contribute to its negative impact. To help address these significant gaps in the literature, this study aims to investigate how the leaders' entrepreneurial dark personality tendencies, including narcissism and perfectionism, may moderate the relationship between leaders' proactivity and team members' cognitive and

affective proactive motivational stages in both positive and negative pathways. Recent evidence suggests that entrepreneurs may hold dark personalities. Entrepreneurs are often suggested to possess four temperament traits, including eagerness for effort, work hardiness, ambition, and perfectionism (Okoye, 2018). Besides, entrepreneurs are likely to show double-faced, positive, and negative personalities, which inclines to potentially harm their performance if they are unable to handle it (Miller, 2015). They further implied that the negative extremes of some personality traits, such as overconfidence, narcissism, deviance, and obsessiveness, can have severe consequences on personal, organizational, and societal. Leaders often fail due to constant factors, many of which are closely associated with dark personality traits, specifically, problems in interpersonal relationships (Van Velsor & Leslie, 1995), in which the domain may include interpersonal styles arrogance, perfectionism, and extreme cautious (Dotlich & Cairo, 2003). Narcissism, hubris, grandiosity, and entrepreneurial addiction have been indicated to be the dark side of entrepreneurial traits, which may have unfavorable impacts on society (Klotz & Neubaum, 2016; Spivack & McKelvie, 2018). Narcissism, perfectionism, and aggressiveness are linked to negative emotions, which might eventually impede performance (Bollaert et al., 2020; Gorgievski, Moriano, & Bakker, 2014; Miller, 2015; Yu, 2020).

Considering that entrepreneurs put such significant demand on their team members, especially during the hatching process of a new business venture (Klotz, Hmieleski, Bradley, & Busenitz, 2014), these dark attributes can interfere with follower motivational states since the occurrence of such an extremely activated negative affect that elicits negative consequences (Bohlmann, Rudolph, & Zacher, 2021; Cangiano, Parker, & Yeo, 2019). As followers have more chances to witness narcissistic leaders, they will increasingly encounter leaders' toxic behavior, like exploitative, and the more they perceive their leader as an ineffective leader (Nevicka, Vianen, de Hoogh, & Voorn, 2018). Since narcissistic leaders rarely remain receptive to their ideas or include them in decision-making, the team members feel disrespected and reduce their motivation to work (Hochwarter & Thompson, 2012; Liu et al., 2021; Wirtz & Rigotti, 2020; Volmer, Koch, & Goritz, 2016).

Even though previous research has acknowledged the downside of proactivity, there is limited understanding of how to effectively mitigate the potential negative impacts and ensure that leaders' proactivity stays beneficial. To help bridge these critical gaps in the literature, we aim to investigate the impact of entrepreneurial leader proactivity on team well-being from the perspective of the wise proactivity concept. Recent evidence suggests leaders can maintain proactivity's positive impact by wisely conducting proactive behavior (Parker & Liao, 2016).

Being proactive in a wise way has been indicated as essential to manage the desirable outcomes of proactive behavior (Liu et al., 2019; Parker, Wang, & Liao, 2019). Wise proactivity addresses the importance of understanding the context of task-strategic, social-relational, and self-regulation aspects while performing proactive behavior (Parker et al., 2019).

The wise proactivity concept emphasizes that person-environment fit and effective internal self-regulation are essential to realizing wise proactivity (Parker et al., 2019). Self-regulatory mechanisms tend to be strengthened when an individual owns high personal resources, such as a positive self-view, which contributes to the effectiveness of proactive behavior (Parker et al., 2019). Although followers are crucial in managing their own fatigue, leaders might be able to identify and regulate job strain and burnout among followers by conducting self-regulation, like leisure as recovery (Bakker & de' Vries, 2021; Kaluza et al., 2020). It is consistent with enrichment theory, suggesting that resources from one role can be transferred to another role, hence improving the quality of life in the latter role (Greenhaus & Powell, 2006). Therefore, leaders' engagement in leisure activities may help them replenish their psychological resources, allowing them to effectively handle the demanding responsibilities of their role in the workplace.

Furthermore, from an organizational standpoint, it is important for an organization to modify their systems, structures, and processes to encourage greater levels of proactivity by enhancing job autonomy (Parker et al., 2019). Giving followers autonomy may foster trust and can lead to a more open and psychologically safe environment, which encourages proactive behavior (Chiaburu, Smith, Wang, & Zimmerman, 2014; Gao, Janssen, & Shi, 2011; Huang, Iun, Liu, & Gong, 2010). Similar to team-level leadership, leaders can influence followers through direct actions (e.g., a leader's behavior affecting follower motivation) or indirect actions (such as granting more autonomy, leading to increased proactivity) (Parker & Wu, 2014). Autonomy is a crucial job resource that influences employees' personal growth and development while facilitating the attainment of work goals (Bakker & de' Vries, 2021). Thus, giving team members autonomy can provide them with significant resources, which encourages the team members to be more proactive.

By integrating the wise proactivity concept, enrichment theory and conservation resources theory, this study proposes several key objectives. First, this study aims to explore the role of entrepreneurial leaders' dark traits, including narcissism, in moderating the influence of leaders' proactivity on team organizational engagement via team proactive motivational states. This study proposes dual pathways of team proactive motivational states that encompass cognitive (team intrinsic and extrinsic motivation) and affective motivational

(team happiness, team stress, and team negativity affect). This study proposes that the joint impact of leaders' proactive personality and leaders' narcissism are likely to strengthen the potential negative impact of leaders' proactivity on team organizational engagement.

Second, this study also examines the role of leaders' leisure and team autonomy in the relationship between leaders' proactivity and team organizational engagement via cognitive (team intrinsic and extrinsic motivation) and affective motivational (team happiness, team stress, and team negativity affect) pathways. This study suggests that engaging in leisure activities and the existence of team autonomy can benefit leaders and team members to experience more positive emotions, which in turn may contribute to effectively managing the consequences of leader proactivity on the team's organizational engagement. Moreover, to build a bridge between leader and team members, we apply a crossover model that demonstrates how leaders' proactivity may affect team organizational engagement. The crossover model suggests that an individual's experiences and conditions (such as stress and strain) can indirectly affect others in the same work setting through the individual's behavioral adjustments in response to these experiences (Bakker, Westman, & Emmerik, 2009; Westman, 2001). This perspective redirects attention away from the transfer of psychological conditions from leaders to followers and emphasizes the responsibility of leaders' work environment factors for the well-being of team members (ten Brummelhuis, Haar, & Roche, 2014; Huang, Wang, Wu, & You., 2016; Köppe, Kammerhoff, & Schutz, 2018; Li, Wang, Yang, & Liu, 2016; Stein, Vincent-Hoeper, & Gregersen, 2020).

Emerging studies have called into question the universally positive effects of a proactive personality (Crant, Hu, & Jiang, 2016). It has also been shown to have negative impacts on how proactive individuals are perceived by others and their own well-being (Hirschfeld et al., 2011; Wihler et al., 2017; Zacher et al., 2019). Unfortunately, the potential adverse consequences of proactive individuals that may affect others' well-being remain unequivocal. By integrating insights from the wise proactivity concept, enrichment theory, and conservation of resources theory, this study sheds new light on the following ways. First, this study answers the calls to investigate the idea of proactivity from a different lens (Cai, Parker, Chen, & Lam, 2019). This study not only explores the favorable impact of proactivity but also delves into the dark side of leaders' proactivity. To understand that this is an issue that may have more far-reaching implications for team members, we examine the likelihood of dual effects of leader proactivity on team engagement through the team's proactive motivational states.

Second, this study contributes to the existing body of literature on proactivity by emphasizing the importance of two distinct proactive motivational states which include cognitive and affective motivational pathways. By adopting the proactive motivational concept (Parker et al., 2010), this study highlights these two pathways to examine the positive and negative aspects of leader proactivity. The cognitive motivational pathways encompass two diverse components, such as team intrinsic and extrinsic motivation. Meanwhile, affective motivational pathways constitute team happiness and team stress. Third, this study explores the dark side of leaders' proactivity by investigating the role of entrepreneurial dark traits in determining its effect on team outcomes through team proactive motivational states. This study extends the conservation of resources theory (Hobfoll, 2001) and proactive motivational concept (Parker et al., 2010) by demonstrating the joining effect of leaders' proactivity and leaders' narcissism in undermining the positive impact of leaders' proactivity on team organizational engagement via team cognitive and affective motivational pathways.

Ultimately, this study integrates the proactive literature with the notion of leisure practice and theory. By extending enrichment theory, this study responds to the need to explore ways for individuals to detach from work and how it affects well-being and performance (Fritz et al., 2010). This study enriches the theoretical paradigm toward an ample trajectory of wise proactivity by examining the impact of entrepreneurial leisure as an act of self-regulation and team autonomy, representing task and strategic aspects, which may help leaders realize the wise proactivity concept and potentially mitigate the negative effects of leaders' proactive personalities on team outcomes through cognitive and affective motivational mechanisms. This study emphasizes team-level research design by exploring how proactivity may bring unfavorable consequences and how leaders might mitigate such adverse situations.

Literature Review and Hypotheses

Proactive Motivational States Concept

The proactive motivation concept defines that individuals' proactivity is shaped by a motivational state, which drives them to pursue goals proactively (Parker et al., 2010). This concept highlights that motivational states can establish how individuals envision the future. In addition, this theory suggests that motivational states consist of three essential aspects, including can-do, reason-to, and energized-to state. Can-do state refers to the extent to which an individual's perception of self-efficacy (Can I do it?), control appraisal (Is it feasible to do?), and perceived cost (Is it risky to do?) to do proactive action. Moreover, reason-to-state indicates the rationale that underlies someone to be proactive, including intrinsic motivation (to what

extent the proactive action is intrinsically interesting), integrated motivation (to what extent the proactive action is central to one's values or identity) and identified motivation (to what extent the proactive action is important for oneself or others). Lastly, energized to-state defines that individual-activated positive affect (e.g., enthusiastic, inspired, proud) may determine someone to behave proactively.

Leaders play a significant role in followers' experience, being part of, and shaping the social environment of their followers (Inceoglu et al., 2018). It is aligned with social learning theory, individuals learn diverse behaviors by attentively observing and imitating role models (Bandura & Walters, 1977). Followers tend to emulate the actions of their leader as a role model by observing the leaders' behaviors and the outcomes of these behaviors as they learn about the cause-and-effect relationships between these behaviors and consequences (Bommer, Miles, & Grover, 2003; Ehrhart & Naumann, 2004; Liu, Kwan, Fu, & Mao, 2013; Mayer et al., 2009; Resick, Hargis, Shao, & Dust, 2013). Leaders who demonstrate proactivity establish challenging objectives by envisioning a desirable future, taking charge to enhance job efficiency, and providing subordinate knowledge and assistance (Crossley, Cooper, & Wernsing, 2013). Considering that proactive leaders are enticing to followers, followers are highly motivated to acquire and emulate such leaders' values, cognitive patterns, and behaviors (Zhang & Cui, 2022). This study proposes that leaders' proactive personalities may influence team members' motivational states toward proactivity. Consequently, leaders who exhibit a high level of proactivity are likely to cultivate followers who likewise show strong proactivity.

In the team context, a positive climate and favorable interpersonal interaction play a substantial role in predicting team proactive motivation (Cai et al., 2019). Moreover, they suggested that the road to proactivity at the team level resembles the individual level. In other words, at both the team and individual levels, the functions of various proactive motivational states are similar, which entail can do (role breadth self-efficacy/ RBSE, psychological safety), the reason to (identification, affective commitment, flexible role orientation, felt responsibility for a change), and energized to motivational states (affective well-being, positive and negative mood) (Chen & Kanfer, 2006; Choi, 2007). However, despite the importance of motivational states in envisaging proactive behavior, proactivity scholars have mainly focused on identifying cognitive-motivational states (can do and reason to states) or the so-called cold side (Mitchell & Daniels, 2003; Parker et al., 2010), particularly from the lens of favorable consequences of proactivity. To help provide a broader understanding, this study focuses on investigating the dual pathways in the relationship between leaders' proactive personality, team engagement, and proactive performance. This study focuses on exploring two different

mechanisms within proactive motivational states, including cognitive motivational pathways (reason to states), such as team intrinsic motivation and team extrinsic motivation, and affective motivational pathways (energized to state), such as team happiness and team stress.

Cognitive Motivational Pathways

Intrinsic motivation has been recognized as one of the most important aspects of the proactive motivational states concept defined by Parker et al. (2010). Intrinsic motivation describes to what extent the proactive action is intrinsically interesting for individuals who perform it. This is consistent with previous research suggesting that intrinsic motivation creates a stronger effect on behavior (Ryan & Deci, 2001). Leaders can impact followers' intrinsic motivation for proactivity as it is interesting, enjoyable, and challenging (Deci & Ryan, 2000; Parker et al., 2010). It is in line with Zhang & Bartol (2010), suggesting that there is a strong correlation between intrinsic motivation and proactivity. Individuals who are motivated autonomously tend to experience enjoyment as their actions are driven by strong personal desires (Deci & Ryan, 2008; Grant, 2008). They tend to actively seek information and approach problems innovatively (Baldé, Ferreira, & Maynard, 2018). Consistent with these findings, Parker et al. (2006) emphasized that one of the most critical contextual factors for proactivity to arise, especially through the reason-to-motivational pathway, is a supportive work environment. Proactive action is more likely to be fostered in a supportive work environment that encourages followers to explore new ways of working without fear of potential obstacles, considering the uncertainties and risks that are inherent in proactivity (Parker et al., 2010).

Individual intrinsic motivation refers to a person's perceptions, experiences, and beliefs towards their job, which can mutually influence and reinforce one another within a team (Deci & Ryan, 1985; Wang, Kim, & Lee, 2016). In other words, an individual develops intrinsic motivation at the team level through continuous interaction, coordination, and collaboration shared among team members (Morgeson & Hofmann, 1999). Prior research showed that intrinsic motivation is mainly affected by one's needs. Team intrinsic motivation embodies how team members experience pleasure and satisfaction inherent in the task and enjoy performing a team task (Wang et al., 2016). They further described that team intrinsic motivation is fundamentally consistent with collective engagement since both constructs highlight the internal motives of team members to accomplish the job in which the positive effect results from such motives. It is aligned with previous findings, demonstrating that team intrinsic motivation has a positive influence on team affective commitment through the

experience of pleasure innate in the job itself (De Jong, Wilkin, & Rubino, 2019; Kuvaas & Dysvik, 2009; Ohana, 2016).

On the other hand, extrinsic motivation defines to what extent one participates in the action for instrumental reasons, such as accepting rewards and approval, avoiding punishment, elevating an individual's self-esteem, or accomplishing personal goals (Gagné et al., 2015). Extrinsic motivation is characterized by external regulation, such as reward and punishment, that pushes individuals to promote action and thus leads them to feel pressured and depleted (Pingel et al., 2019). Deci and Ryan (2000) explain four components of extrinsic motivation in the self-determination theory. First, external regulation is to engage in activity to get rewards or avoid punishments imposed by others. Second, introjected regulation describes the control of behavior in the face of internal pressures involving ego, shame, and guilt, subsequently known as controlled motivation. Third, identified regulation refers to conducting action since one recognizes its value and takes it as one's own, in which the form of internalization is volitional as it represents the instrumental value. Lastly, integrated regulation defines one performing an activity as they find it meaningful. Van den Broeck et al. (2021) emphasized that both identified and integrated regulations remain considered extrinsic motivation since they aim to achieve such distinct outcomes from the activity itself, although they are frequently regarded as autonomous motivation types because their volitional nature is similar to intrinsic motivation.

When leaders exert excessive pressure on followers to be proactive, followers may engage in proactive action motivated solely by external motivator factors, such as financial incentives, social acceptance, or the desire to evade adverse consequences, such as criticism or punishment. (Bateman & crant, 1999; Crant, 2000; Pingel et al., 2019). However, scholars argued that one needs to develop an autonomous motivation to behave proactively, given that proactivity requires numerous recourses to perform (Parker et al., 2010). It is consistent with previous research, suggesting that the negative outcomes of proactivity can be more obvious, particularly when there is a high level of controlled or extrinsic motivation (Strauss et al. (2017). Performing proactivity can be resource-intensive, which may result in their seeing a loss of resources (Bolino & Turnley, 2005). Consequently, when individuals take proactive action due to external pressure, they are more prone to feeling depleted and experiencing emotional exhaustion (Pingel et al., 2019).

Affective Motivational Pathways

Happiness encompasses the emotions of joy, the sense of fulfilment and achievement, the actualization of one's potential, and goal attainment (Delle Fave et al., 2011). Individuals' core effects are typically viewed as a combination of two primary dimensions that involve pleasure (whether an affect is positive or negative in its affective valence) and arousal (whether an effect is highly activated or minimally activated) (Russell, 2003). Prior research suggested that proactive actions are prompted by high-activated positive affect (e.g., inspired and feeling enthusiastic) rather than low-activated positive affect (e.g., content and feeling calm), considering that highly activated positive affect has greater energizing potential to enable approach-oriented behaviors like proactivity (Warr et al., 2014). People are more inclined to seek out and set proactive goals when they are experiencing positive affect, and they are also more likely to keep an open mind and be adaptable while they pursue these goals (Parker & Wang, 2015). Positive affect encourages the pursuit of more difficult goals and thus motivates them to conduct taking charge behavior (Fritz & Sonnentag, 2009; Ilies & Judge, 2005). Affective experiences that occur within teams are the direct outcome of individual-level affective elements held by team members and determine the team's emotional composition (Collins et al., 2016; Collins et al., 2013; Kelly & Barsade, 2001). Positive emotional responses from individual team members towards the leader are likely to be transferred onto the team as a whole (Kabins et al., 2016). Positive affect enhances cognitive and behavioral resources (Aspinwall, 1998; Aspinwall & Taylor, 1997; Hobfoll, 1989) for teams to establish future-oriented and change-driven objectives, improve coordination throughout teams, and consistently participate in actions to get the desired outcomes (Wu & Wang, 2015).

Leaders can be a significant source of affective response through their actions and behaviors, which can evoke a wide spectrum of emotional responses (Dasborough, 2006; Humphrey, Kellert, Sleeth, & Hartman, 2008). It is in line with previous research, indicating that leaders can influence followers' well-being in various ways, from increasing happiness to inducing stress (Donaldson-Feilder, Munir, & Lewis, 2013). In other words, leaders' behavior provokes followers' affective reactions, thereby influencing their future attitudes and actions (Johnson, 2008). When leaders demonstrate proactivity with enthusiasm and can transmit positive vigor to their followers, then followers may experience the same enjoyment and fulfilment that comes with being proactive. It is consistent with past studies, suggesting that leaders can motivate followers to be proactive by promoting positive emotion in the workplace (Parker & Wu, 2014). This positive emotion is subsequently associated with proactive behavior since it generates a sense of energy (Shraga & Shirom, 2009).

On the contrary, when leaders become anxious or weary while being proactive and even pass on the pressure to their followers, it can create tension in the workplace. Such pressure may eventually lead followers to feel stressed while they strive to be proactive. It is in line with previous research indicating that being proactive can have detrimental effects on others, including stress and burnout, because it demands significant resources (Bolino et al., 2010; Bolino et al., 2017), and those with less personal resources are more prone to experience stress and become more depleted of resources (Hobfoll, 1989). In the team context, prior research indicated that team stress is more likely to occur when there are many sources of stressors or tension inside the team's working environment (Liu & Li, 2018). Due to the interdependent nature of teamwork and shared duties, team members tend to have the same work objectives, collaborative methods, and cognitive appraisals of their working environment (Drach-Zahavy & Freund, 2007; Pearsall, Ellis, & Stein, 2009), and, therefore, may experience fear, pressure, and feel puzzled collectively (Akgün, Byrne, Lynn, & Keskin, 2007; Leach, Wall, Rogelberg, & Jackson, 2005). Collective role stress, which has many of the same mechanisms as individual role stress, can lead to cognitive and motivational blockages that undermine the entire team's performance (Savelsbergh, Gevers, Van der Heijden, & Poell, 2012).

The Role of Entrepreneurial Dark Trait

Entrepreneurs are encouraged to proactively devote all their capacity to manage and enhance their business performance. Most entrepreneurs are equipped with proactive personalities (Hu et al., 2018). Entrepreneurs are more likely to have solid proactivity by demonstrating personal initiative, innovation, and problem-solving behavior (Mensmann & Frese, 2019). Entrepreneurs highly value independence, liberty, job satisfaction, and financial gain (Alstete, 2008). Amid uncertain circumstances, entrepreneurs may have the capacity and capability to envision or create a favorable future solely based on available information (Wood, Bakker, & Fisher, 2021). Although the progressive features of entrepreneurs have been strongly accepted, scholars argue that entrepreneurs may also hold dark personalities that inhibit their performance. There is growing evidence that dark traits are becoming more common in younger generations (Harms, White, & Fezzey, 2024). Due to the growing uncertainties in the modern economy; thus, for nascent entrepreneurs, dark personality traits are likely to influence their behavior and performance (Bălan et al., 2019). It is in line with Cai et al. (2019), indicating that although leaders' behavior and personality have been found to have a positive impact on employees' proactive behavior, some leaders have been shown to have a dark side, as evidence argued that negative behaviors are more likely to discourage proactive behavior.

Although prior studies have begun to discuss the dark traits of entrepreneurs, the investigation into entrepreneurial leaders has not yet identified the likelihood of leaders' dark traits that could impede proactive leaders from achieving a favorable influence on their teams. To our knowledge, recent studies have focused on how entrepreneurial traits and behaviors may determine their own well-being (Lerman, Munyon, & Williams, 2021; Nikolaev, Boudreaux, & Wood, 2020). However, considering that entrepreneurs put such significant demand on their team members, especially during the hatching process of a new business venture (Klotz et al., 2014), these dark attributes can interfere with team motivational states since the occurrence of such an extremely activated negative affect that elicits adverse consequences (Bohlmann, Rudolph, & Zacher, 2021; Cangiano, Parker, & Yeo, 2019). Therefore, in this study, we focus on exploring the joint impact of leaders' proactive personality and their propensity for dark personalities in affecting team outcomes, including their well-being and performance.

According to Resick et al. (2009), entrepreneurs might be more likely to be driven by narcissism as they strive to attain self-fulfillment by gaining praise, power, and authority. As a personality trait, narcissists are typically self-centered and consistently seek attention and admiration from others (Twenge et al., 2008). It reflects entitlement, superiority, self-love, and a magnified yet fragile perception of self-importance (Raskin & Terry, 1988). A person's inflated sense of self, notions of entitlement, extreme arrogance, and psychological need for the prolonged attention of others are the hallmarks of the narcissistic personality trait (Gerstner, Konig, Enders, & Hambrick, 2013). Narcissism has been recognized as the impending negative extreme of entrepreneurial personality, which triggers detrimental effects on themselves and the organization (Miller, 2015), as they tend to have less human values yet high desires to control others (Boddy, 2015). Narcissists may be drawn to entrepreneurship not out of a need for independence but rather because they perceive it to be an environment where their unyielding ambition and passion for success can manifest through social influence strategies (Brownell et al., 2021).

Narcissism played a role in how employee decided to take charge and demonstrated power to accentuate their capability (Klimchak *et al.*, 2016; Sanecka, 2021). However, scholars indicated that it is not only the extreme tendency of a bright personality to endure such positive outcomes, but also dark characteristics aligned conceivably hold the power to elicit advantages for the organization (Smith *et al.*, 2018). In other words, despite the perks of acquiring a dark personality, the dark traits remain to hold the tendency to be impulsive, aggressive, heartless, and self-adulation (Baloch *et al.*, 2017; Baka, 2018). Moreover, past studies have also found

that narcissistic leaders' lack of support may adversely impact their team's work engagement and well-being. Since narcissistic leaders rarely remain receptive to their ideas or include them in decision-making, the team members feel disrespected and reduce their motivation to work (Hochwarter & Thompson, 2012; Liu et al., 2021; Wirtz & Rigotti, 2020; Volmer et al., 2016). The extreme level of negative traits may potentially bring detrimental effects to the organization rather than advantages (Miller, 2015). Thus, given the potential unexpected consequences of the entrepreneurial dark side, this study posits that the joining effect of leaders' narcissism and proactive personality may influence the positive and negative impact of leaders' proactivity on team engagement through both team cognitive (team intrinsic and extrinsic motivation) and affective (team happiness and team stress) motivational pathways distinctively. Therefore, this study builds the following hypotheses:

- H1a: Narcissism moderates the relationship between entrepreneurial leader proactivity and i) team intrinsic motivation (such that this relationship is weaker when narcissism is high rather than when it is low), and ii) team extrinsic motivation (such that the relationship is stronger when narcissism is high rather when it is low).
- H1b: Narcissism moderates the relationship between entrepreneurial leader proactivity and team organizational engagement through i) team intrinsic motivation (such that the relationship is weaker when narcissism is high rather than when it is low), and ii) team extrinsic motivation (such that the relationship is stronger when narcissism is high rather when it is low).
- H2a: Narcissism moderates the relationship between entrepreneurial leader proactivity and i) team happiness (such that this relationship is weaker when narcissism is high rather than when it is low), and ii) team stress (such that the relationship is stronger when narcissism is high rather when it is low).
- H2b: Narcissism moderates the relationship between entrepreneurial leader proactivity and team organizational engagement through i) team happiness (such that this relationship is weaker when narcissism is high rather than when it is low), and ii) team stress (such that the relationship is stronger when narcissism is high rather when it is low).

The Role of Entrepreneurial Leisure

A prior study indicated that exhaustion has been recognized as a major issue for entrepreneurs since it impairs cognitive performance, opportunity identification, appraisal,

decision-making, and tenacity (Murnieks et al., 2020). While engaging in proactive behavior, individuals are likely to encounter resource depletion and mental fatigue, as proactivity enforced them of a myriad of resources, including cognitive, time, and energy (Strauss et al., 2017; Lin & Johnson, 2015; Frese & Fay, 2001). Interestingly, prior research also found the positive and significant impact of proactive personality and leisure crafting (Hadi, Bakker, & Hausser, 2021). Proactive individuals are more adaptable to adjusting to novel and unfavorable circumstances by actively incorporating factors that promote physical and mental well-being (Hadi et al., 2021). Thus, these individuals recognize novel obstacles that provide significant experiences and fulfil fundamental psychological requirements during leisure (Petrou et al., 2017).

Furthermore, scholars pointed out that engaging in leisure crafting allows individuals to mentally disconnect from work-related concerns and enhance their proactive vitality management (Ni et al., 2022). Participating in personal life activities that bring joy enables individuals to acquire resources that ultimately improve their positive emotions and performance, and this type of activity is called pleasurable recovery activity (Daniel & Zhan, 2023; Sonnentag, Arbeus, Mahn, & Fritz, 2014). These autonomous pursuits activities fulfil the dual functions of feeling happiness and pleasure, as well as recuperating from stress (Sonnentag & Zijlstra, 2006). Likewise, prior research indicated that engaging in leisure activities has been shown to improve mood by reducing negative emotions, increasing positive emotions, and alleviating stress (Iwasaki & Manell, 2000). Participating in off-job leisure, such as physical post-work social activities, or spending time with friends, was found to reduce fatigue and improve well-being (Sonnentag, 2001; Sonnentag & Natter, 2004; Sonnentag & Zijlstra, 2006; van Hoof et al., 2011).

Leisure activities, including entertainment, art, recreation, social, and workplace leisure have been demonstrated to impact job performance through their effects on physical health and happiness (Wang, Kim, Jiang, & Tang, 2022). This implies that leisure is a significant domain for generating resources since individuals usually have the freedom to choose whether to engage time in leisure activities, which allows them a great deal of autonomy and options that promote the development of resources (Kelly, Strauss, Arnold, & Stride, 2020). It is consistent with enrichment theory indicates that resources obtained from one role can be transferred to another role, so enhancing the overall quality of life in that subsequent role because of the positive affect that was passed from role A to role B, which in turn led to a high level of performance (Greenhaus & Powell, 2006). However, although the negative effects of resource loss are greater than those of resource gain, individuals are motivated to obtain new resources

and accumulate resources that will prepare them for future obstacles (Halbesleben et al., 2014; Strauss & Parker, 2018). Resources that are likely to improve well-being and performance in other areas of individuals' roles may originate from non-work experiences, including leisure or recreational activities (Greenhaus & Powell, 2006).

Leisure has been identified as a new coping mechanism that can help individuals deal with stress and enhance well-being (Iwasaki & Mannel, 2000). In this study, the idea of leisure is defined as the time remaining after work and our no-work responsibilities, referred to as free time, and how we utilize that time (Stebbins, 2017). The classification of leisure activities has been primarily developed by Ragheb (1980) and covers six different types, including mass media, cultural events, sports activities, outdoor activities, social activities, and hobbies activities. However, in the last few years, scholars have identified the importance of including contemplation as a crucial element of leisure activities. According to Gim (2009), contemplation is the spirit of leisure, which may engender a quality leisure experience. It is in line with Andrade et al. (2018) pointed out leisure practice can be distinct for each person. They further suggested that leisure practices can be divided into eight groups, including artistic (e.g., musical show, going to the movies), manual (e.g., gardening, cooking), physical/sport (e.g., hiking, cycling), intellectual (e.g., attending courses, reading), social (e.g., going out with friends, visiting family), touristic (e.g., travelling, tours), virtual (e.g., social network, video games), and contemplation/rest (e.g., turning-off from tasks, others). Similarly, recent evidence suggested types of off-job activities that may help individuals to improve their well-being or to recover from stress.

Drawing on the wise proactivity concept and enrichment theory, this study attempts to investigate the role of entrepreneurial leisure in attenuating the undesirable outcomes of proactive behavior. The wise proactivity concept emphasizes that person-environment fit and effective internal self-regulation are essential to realize wise proactivity (Parker et al., 2019). As Bohlmann et al. (2021) suggested, individuals with higher emotion regulation skills were found to encounter positive well-being outcomes. Individuals who engage in leisure activities and have a positive attitude toward leisure are less stressed and more optimistic (Trenberth, 2005). Individuals may renew their loss of resources through recovery experience characterized by off-job activities (Meijman & Mulder, 1998; Sonnentag & Fritz, 2007). Individuals with strong resources can help handle psychological strain issues (Hobfoll, 1989), which is essential for proactive action that requires multiple resources to perform.

Departed from this notion, this study suggests that leaders' participation in leisure activities might help them in self-regulation and cultivating positive self-view. This

engagement replenishes their depleted resources following proactive actions, thereby strengthening the relationship between leaders' proactivity, team happiness, and team proactive performance. Despite the extensive discussion on resource recovery, prior studies have given little attention to how entrepreneurs may renovate their loss and/ or depleted personal resources to be able to conduct their proactive behavior wisely. This study proposes that entrepreneur leaders who actively engage in leisure practices might have more ability to regulate themselves, which enables them to conduct wise proactivity and thus alleviate the negative impact of entrepreneurial proactive leaders on team organizational engagement through cognitive (team intrinsic and extrinsic motivation) and affective motivational pathways (team happiness and team stress). This study adopts the leisure practice classification developed by Andrade et al. (2018), as it was found to be appropriate to investigate adult involvement in recent leisure activities. Thus, we build the following hypotheses:

- H3a: Leisure moderates the relationship between entrepreneurial leader proactivity and i) team intrinsic motivation (such that this relationship is stronger when entrepreneurial leisure is high rather than when it is low), and ii) team extrinsic motivation (such that the relationship is weaker when entrepreneurial leisure is high rather than when it is low).
- H3b: Leisure moderates the relationship between entrepreneurial leader proactivity and team organizational engagement through i) team intrinsic motivation (such that this relationship is stronger when entrepreneurial leisure is high rather than when it is low), and ii) team extrinsic motivation (such that the relationship is weaker when entrepreneurial leisure is high rather than when it is low).
- H4a: Leisure moderates the relationship between entrepreneurial leader proactivity and i) team happiness (such that this relationship is stronger when entrepreneurial leisure is high rather than when it is low), and ii) team stress (such that this relationship is weaker when entrepreneurial leisure is high rather than when it is low).
- H4b: Leisure moderates the relationship between entrepreneurial leader proactivity and team organizational engagement through i) team happiness (such that this relationship is stronger when entrepreneurial leisure is high rather than when it is low), and ii) team stress (such that this relationship is weaker when entrepreneurial leisure is high rather than when it is low).

The Role of Team Autonomy

Prior studies argue that when employees have autonomy or high-quality relationships with their supervisors, emotional and physical demands, as well as workload, do not instigate significant burnout (Bakker, Demerouti, & Euwema, 2005). Employees may have benefited from autonomy since they could choose when to respond to the demands. The need to adapt to greater responsibilities can provide employees with the freedom to choose how to approach tasks, enhancing their job control and ultimately leading to more fulfilling jobs (Stephan et al., 2024). Employees in groups with higher levels of autonomy can do their jobs with the ability to choose and desire (Van den Broeck et al., 2016).

Autonomy means that one is allowed to implement discretion over their work, such as deciding what, when, and how to finish tasks (Parker & Wall, 1998; Wu et al., 2018). Previous findings demonstrated that increased autonomy at work encourages proactive behavior by boosting self-efficacy or other motivational orientations (Grant, 2007; Parker et al., 2006). Moreover, job autonomy has been acknowledged as one of the most reliable predictors of proactivity, where it is potential that the same favorable effects of autonomy exist at the team level (Erkutlu, 2012). The effect of a proactive personality on behavior would be stronger in a more autonomous team since these team members have a greater ability to regulate their behavior based on their own proclivity (Lv et al., 2018). Enhancing team autonomy or assigning responsibilities can be an effective approach to improve individual task design, leading to improved psychological well-being of team members (Van Mierlo et al., 2007).

Similarly, previous research implied that when job autonomy is high, individuals have the liberty to use the information gained through proactivity, and there is more opportunity for their character and behavior to influence outcomes (Kim, Hon, & Crant, 2009; Parker, 2007). Team autonomy has been acknowledged as a significant determinant of organizational performance and commitment (Von Bonsdorff, Janhonen, Zhou, & Vanhala, 2015). Vice versa, work motivation, innovativeness, and well-being may be decreased if job design restricts autonomy (Lantz, Hansen, & Antoni, 2015). When proactive employees perform within a restrictive work environment that limits their autonomy in determining the time and manner of their tasks, their proactivity is more likely to result in conflicts with their colleagues (Giebels, Reuver, Rispens, & Ufkes, 2016). Consistent with the wise proactivity concept, this study indicates that team autonomy belongs to task and strategic context as it is considered a situational strength to behave in a wise proactive manner and thus elevate the likelihood of its positive impact on team well-being and proactive performance.

Building upon this notion, this study proposes that team autonomy may exert unique roles in determining the relationship between entrepreneurial leader proactivity on team organizational engagement via cognitive (team intrinsic and extrinsic motivation) and affective motivational pathways (team happiness, team stress, and team negative affect). Team members who perceive higher team autonomy may find it even more favorable to achieve better well-being. Accordingly, we propose the following hypotheses, as below:

H5a: Team autonomy moderates the relationship between entrepreneurial leader proactivity and i) team intrinsic motivation (such that this relationship is stronger when team autonomy is high rather than when it is low), and ii) team extrinsic motivation (such that the relationship is weaker when team autonomy is high rather than when it is low).

H5b: Team autonomy moderates the relationship between entrepreneurial leader proactivity and team organizational engagement through i) team intrinsic motivation (such that this relationship is stronger when team autonomy is high rather than when it is low), and ii) team extrinsic motivation (such that the relationship is weaker when team autonomy is high rather than when it is low).

H6a: Team autonomy moderates the relationship between entrepreneurial leader proactivity and i) team happiness (such that this relationship is stronger when team autonomy is high rather than when it is low), and ii) team stress (such that this relationship is weaker when team autonomy is high rather than when it is low).

H6b: Team autonomy moderates the relationship between entrepreneurial leader proactivity and team organizational engagement through i) team happiness (such that this relationship is stronger when team autonomy is high rather than when it is low), and ii) team stress (such that the relationship is weaker when team autonomy is high rather than when it is low).

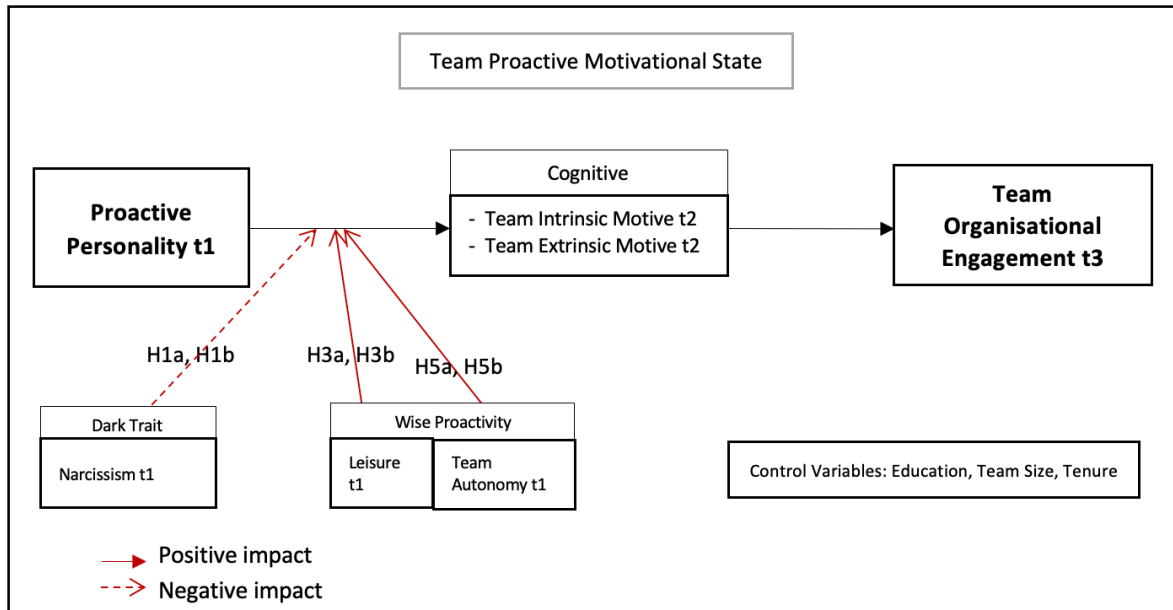


FIGURE 1 Research Model 1

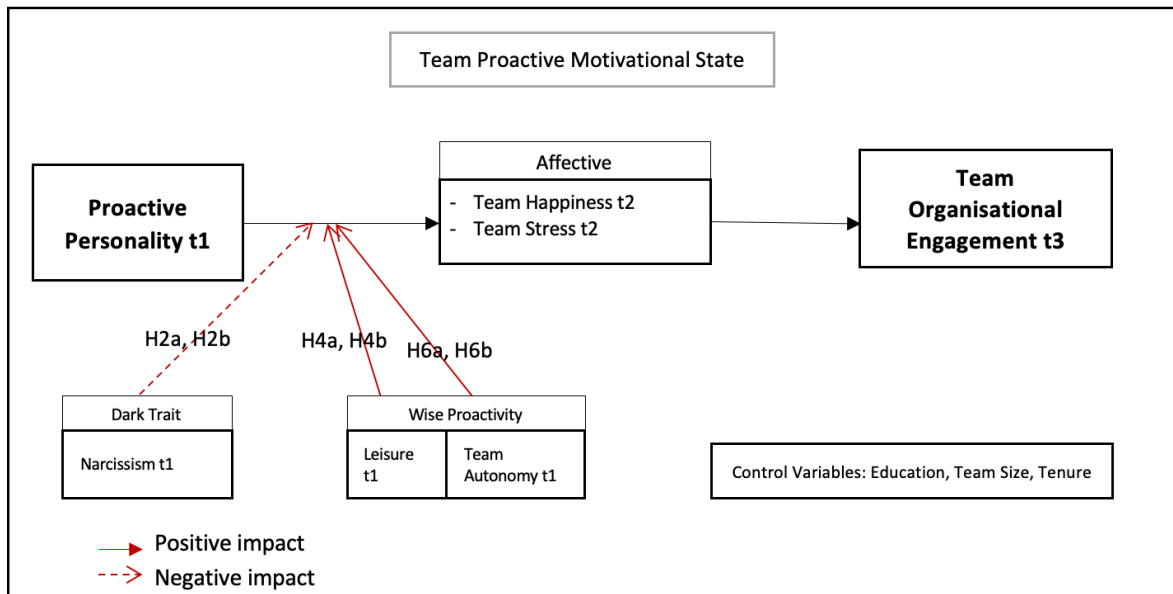


FIGURE 2 Research Model 2

Method

This study applies a quantitative approach and conducts a longitudinal study to analyze all hypotheses built. Data were collected from CEOs and team members from 165 micro and small business companies in Indonesia, with 691 respondents in total. The subject research of this study focuses on young businesses that have been developed not more than ten years (Haltiwanger, Jarmin, & Miranda, 2013). It is aligned with prior research, suggesting that

businesses that have been in operation for 10 years or less can be classified as new ventures (Covin & Slevin, 1990; Ostgaard & Birley, 1996). The respondents cover nascent entrepreneurs from diverse businesses, such as food and beverage, fashion, and cosmetics, as well as service and tech-based organizations. This study divides the participants into two groups, which include those who are identified as entrepreneurial leaders, commonly referred to as the founder of the business or the CEO and those who are part of the core team and report directly to the entrepreneurial leader. During the participants' recruitment process, entrepreneurial leaders are required to nominate team members who work in close collaboration with them and report to them directly. However, participation is voluntary. This procedure builds upon a previous study, where managers were initially approached and requested to nominate employees who directly reported to them to participate in completing the relevant questionnaire (Barling, Weber, & Kelloway, 1996).

At three time points with at least one-month intervals, both respondents, CEO, and core team members are required to fill out the questionnaire through Qualtrics, respectively. The procedure is aligned with Podsakoff, MacKenzie, and Podsakoff (2012), suggesting that to avoid a common method bias problem, obtaining data at different intervals and different sources is desirable. Team members were asked to answer the questionnaire that included measures for team intrinsic motivation adopted from Tierney et al. (1999), with sample items such as "Our team enjoy coming up with new ideas for products." Team extrinsic motivation is based on Gagné et al. (2015), with sample items such as "Because I risk losing my job if I don't put enough effort in it. Team happiness is measured using a scale developed by Underwood and Froming (1980) that has been aggregated at the team level (Liu et al., 2020). Item sample includes "Our team members usually feel as though we are bubbling over with joy in our team". Team stress is measured using the scale from Parker and DeCotiis (1983). This scale has been adjusted to the team level by Mao, Chang, Gong, and Xie (2021), and respondents will be asked items, including "In our team, we have felt fidgety or nervous as a result of our tasks". Team autonomy is based on the scale from Breugh (1985). Item sample includes "The team is free to decide how to go about getting work done". Team organizational engagement is measured using the scale from Barrick, Thurgood, Smith, and Courtright (2015) items such as "I find nearly everyone devotes a lot of effort and energy to our work".

Besides, the leaders were asked to report proactive personality, narcissism, and leisure practices. We used the proactive personality scale from Seibert et al. (1999), item sample, "I am constantly on the lookout for new ways to improve my life," to measure entrepreneurial leader proactivity, Jones and Paulhus's scale (2014) to measure narcissism, with a sample of

the item, “I react annoyed if another person steals the show from me.” Leader leisure activities measurements are based on the Leisure Practice Scale by Andrade et al. (2018). Besides, team size, education, and tenure among team members are controlled in the analysis. Structural Equation Modelling using MPLUS is applied to examine the hypotheses built in this study.

Results

Model 1: *Cognitive Motivational Pathway*

Leaders’ Narcissism and Leisure in the Relationship between Leaders’ Proactive Personality and Team Organizational Engagement through Team Intrinsic and Team Extrinsic Motivation Pathways

We assessed discriminant validity by conducting a Confirmatory Factor Analysis (CFA) of three constructs rated by team members, including team intrinsic motivation, team extrinsic motivation, and team organizational engagement, as well as four constructs rated by leaders, such as proactive personality, entrepreneurial leisure, and narcissism. The results showed that the proposed model fitted the data well (CFI: 0.92, TLI: 0.91, RMSEA: 0.05). In addition, we calculated intra-class correlation (ICC), and the results provided evidence supporting the process of data aggregation at the team level.

Moreover, we conducted an Exploratory Factor Analysis (EFA) to see whether the leisure practice items can be grouped into factors. Based on the analysis, the result indicated that leisure items can be grouped into two factors. The first factor includes manual, intellectual, virtual, and contemplation, and the second factor includes social and touristic. Figure 3 depicts that among leaders ($n = 165$), the most popular leisure activities are virtual (where 66.7% of leaders are highly involved), social (65.5%), and intellectual (57.6%). Furthermore, leaders have also been highly involved in other leisure activities such as contemplation (47.9%), touristic (44.2%), and manual (26.7%).

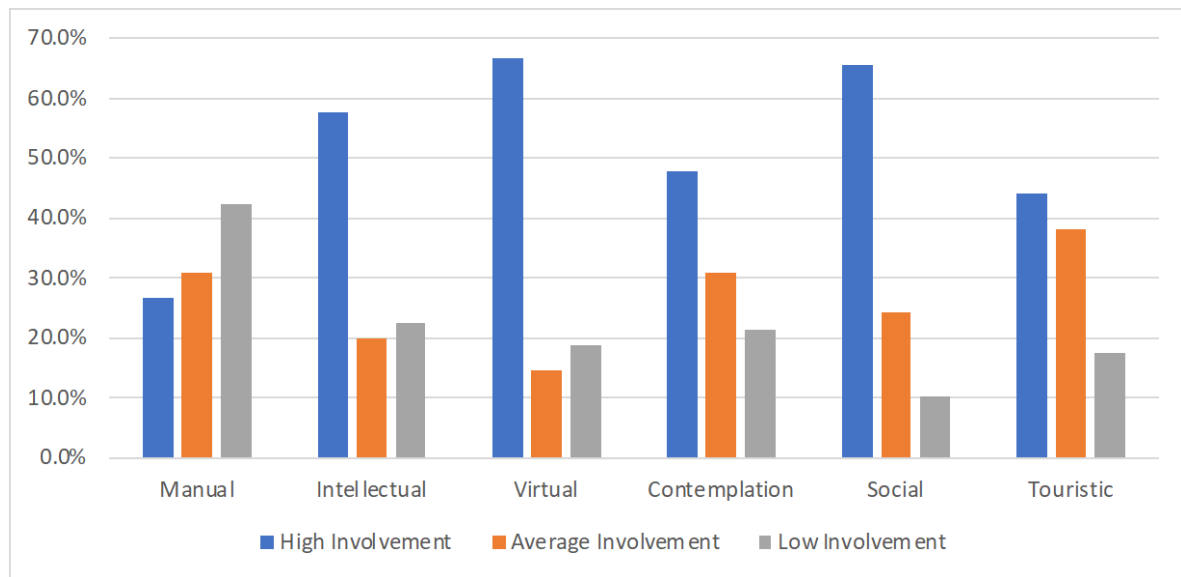


FIGURE 3 Leaders' Entrepreneurial Leisure

Table 1 presents the estimated results of the model. The interactive effect of leaders' proactive personality and leaders' narcissism on team intrinsic motivation was negative and significant ($b = -0.16, p < 0.05$). Thus, Hypothesis 1a.i. was supported. The indirect moderated mediation of leaders' proactive personality, leaders' narcissism, and team intrinsic motivation on team organizational engagement was negative and significant ($b = -0.10, p < 0.05$). Thus, Hypothesis 1b.i. was accepted. The interactive effect of leaders' proactive personality and leaders' narcissism on team intrinsic motivation and their indirect moderated mediation was not significant. Thus, Hypothesis 1a.ii. and Hypothesis 1b.ii. were not accepted.

TABLE 1

Unstandardized coefficients from moderated mediation Model 1

	Predicting Team Organizational Engagement t3		
	Estimate	S.E.	z
Education	0.230**	0.113	2.046
Team Size	0.053	0.059	0.897
Tenure	-0.052	0.069	-0.748
Proactive Personality t1 (PP)	0.099	0.066	1.501
Team Intrinsic Motivation t2 (TIM2)	0.617***	0.105	5.869
Team Extrinsic Motivation t2 (TEM2)	0.036	0.065	0.549

	Predicting Team Intrinsic Motivation t2			Predicting Team Extrinsic Motivation t2		
	Estimate	S.E.	z	Estimate	S.E.	z
Proactive Personality t1 (PP)	-0.066	0.067	-0.987	0.137	0.090	1.511
Education	0.033	0.110	0.298	-0.279	0.151	-1.815
Team Size	0.019	0.058	0.325	-0.066	0.079	-0.836
Tenure	-0.001	0.069	0.011	0.089	0.095	0.933
Narcissism t1	0.085	0.055	1.533	-0.015	0.076	-0.200
PP*Narcissism t1	-0.160**	0.078	-2.059	0.074	0.110	0.671
Leisure A t1	-0.068	0.047	-1.456	0.018	0.068	0.258
PP*Leisure A t1	-0.093	0.078	-1.202	-0.228**	0.111	-2.046
Leisure B t1	0.022	0.039	0.569	0.017	0.057	0.297
PP*Leisure B t1	-0.014	0.053	-0.271	0.041	0.076	0.538
Team Autonomy t1	0.314***	0.066	4.761	0.081	0.090	0.898
PP*Team Autonomy t1	-0.036	0.101	-0.361	0.071	0.146	0.482

Index of Moderated Mediation Predicting Team Organizational Engagement t3			
	Estimate	S.E.	z
PP*Narcissism t1 – TIM2	-0.099**	0.050	-1.990
PP*Leisure A t1 – TEM2	-0.008	0.015	-0.534
PP*Leisure A t1 – TIM2	-0.058	0.049	-1.197
PP*Narcissism t1 – TEM2	0.002	0.006	0.404
PP*Leisure B t1 – TIM2	-0.009	0.033	-0.270
PP*Leisure B t1 – TEM2	0.002	0.004	0.413
PP*Team Autonomy t1 – TIM2	-0.023	0.063	-0.361
PP*Team Autonomy t1 – TEM2	0.002	0.007	0.348

Note: Estimates are unstandardized, resulting from an overall analysis including proactive personality, team intrinsic motivation, team extrinsic motivation, team organizational engagement, moderators (leaders' narcissism, leaders' leisure activity, team autonomy), and control variables (team size, education, and tenure) in one model. The moderator variables were mean-centred.

Leisure A: manual, intellectual, virtual, contemplation; Leisure B: Social and touristic

p<0.05. *p<0.01.

Simple slope tests indicated that leaders' proactive personality mediated by team intrinsic motivation was negatively related to team organizational engagement at higher levels

of leaders' narcissism ($b = -0.19, p < 0.05$) but was not significantly related at lower levels of leaders' narcissism ($b = 0.09, n.s.$) (see Figure 4).

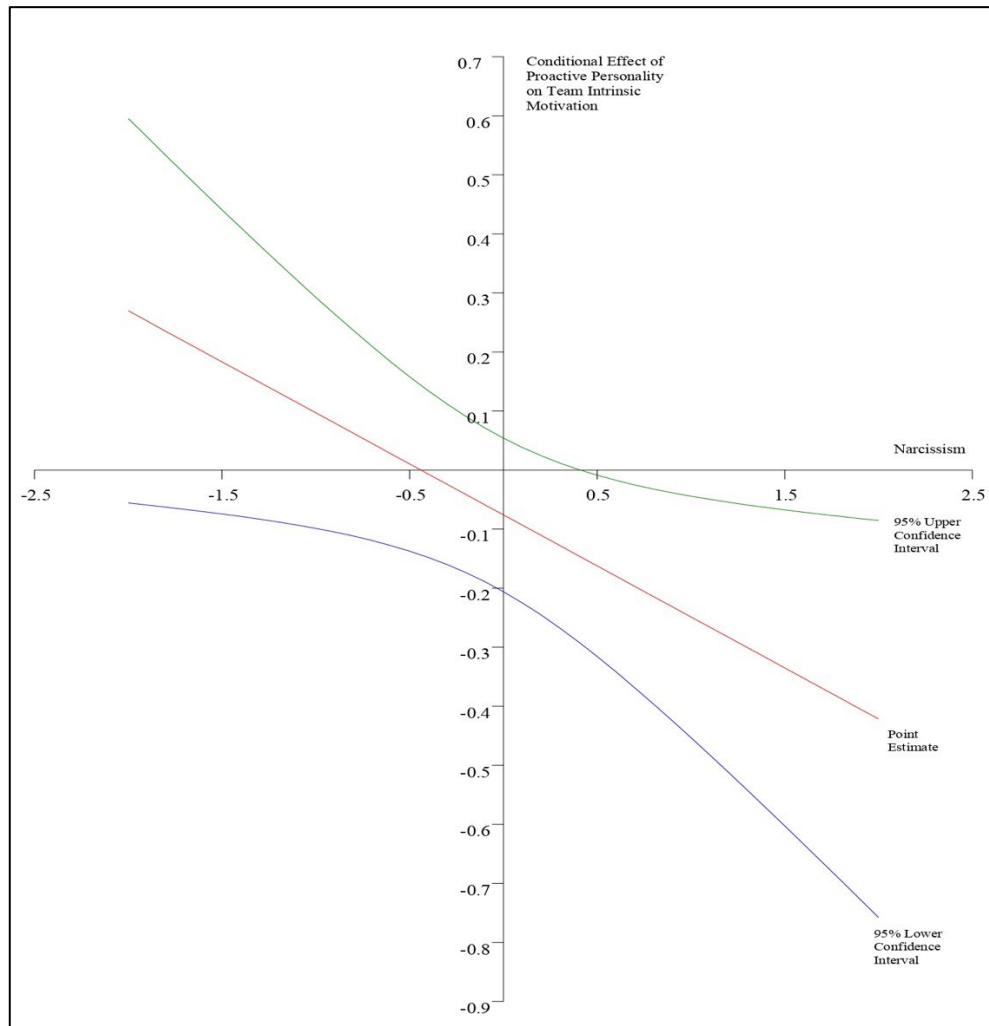


FIGURE 4 Graph of the conditional effect of proactive personality on team intrinsic motivation moderated by leaders' narcissism.

The interactive effect of leaders' proactive personality and entrepreneurial leisure (manual, intellectual, virtual, contemplation) on team extrinsic motivation was negative and significant ($b = -0.23, p < 0.05$). Thus, Hypothesis 3a.ii. was supported. Simple slope tests indicated that leaders' proactive personality was positively related to team extrinsic motivation at lower levels of entrepreneurial leisure ($b = 0.37, p < 0.05$) but was not significantly related at higher levels of entrepreneurial leisure ($b = -0.08, n.s.$) (see Figure 5).

The indirect moderated mediation of leaders' proactive personality, entrepreneurial leisure, and team extrinsic motivation on team organizational engagement was insignificant. Therefore, Hypothesis 3b.ii was not supported.

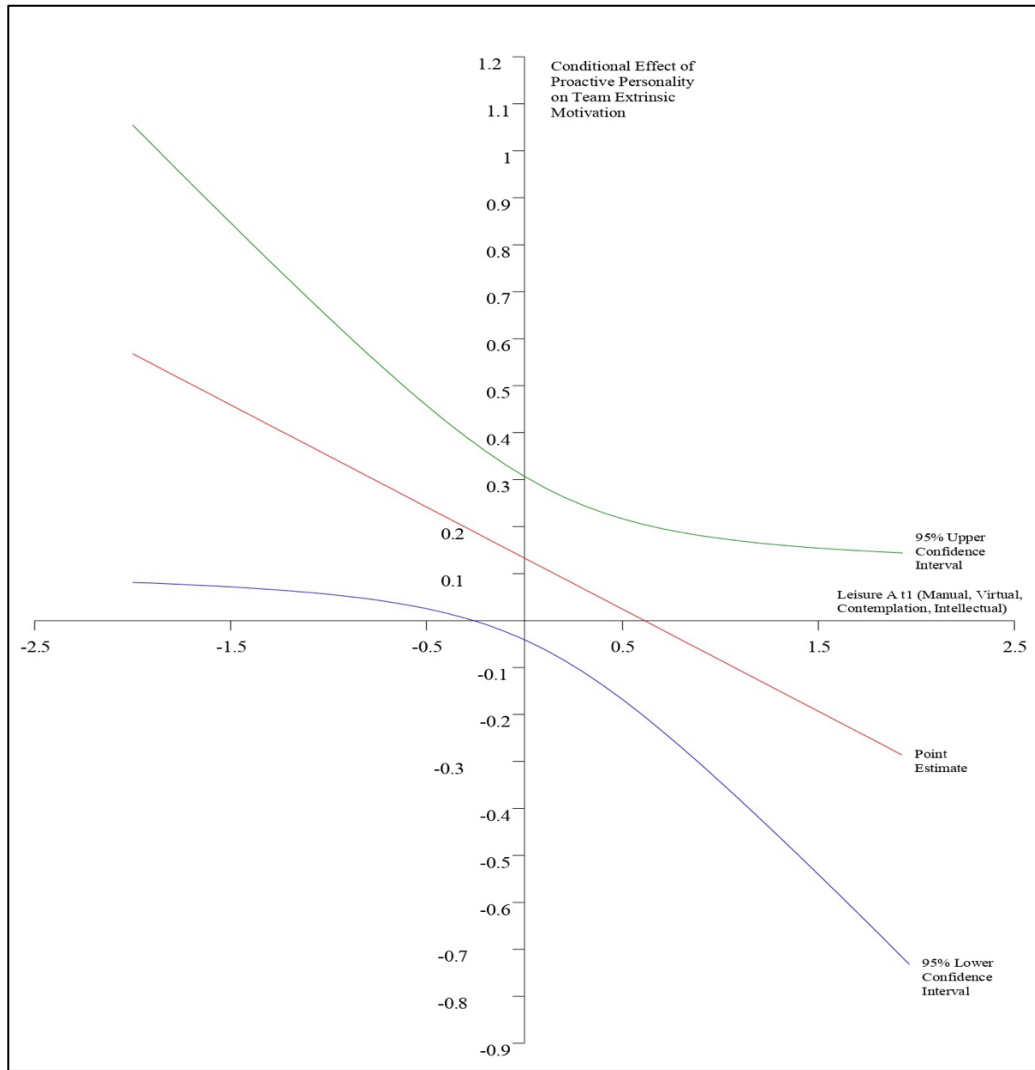


FIGURE 5 Graph of the conditional effect of proactive personality on team extrinsic motivation moderated by leaders' leisure (manual, intellectual, virtual, contemplation)

As can also be seen in Table 1, the interactive effect of leaders' proactive personality and team autonomy on team intrinsic and extrinsic motivation and their indirect moderated mediation was not significant. Thus, Hypothesis 5a and Hypothesis 5b were not accepted.

Model 2: *Affective Motivational Pathway*

Narcissism and Team Autonomy in the Relationship between Leaders' Proactive Personality and Team Organizational Engagement through Team Happiness and Team Stress

The CFA results showed that the proposed Model 2 fitted the data well (CFI: 0.96, TLI: 0.95, RMSEA: 0.04). Table 2 presents the estimated results of the model. The interactive effect of leaders' proactive personality and leaders' narcissism on team happiness was negative and significant ($b = -0.12$, $p < 0.05$). Thus, Hypothesis 2a.i. was supported. The indirect moderated mediation of leaders' proactive personality, leaders' narcissism, and team happiness on team organizational engagement was negative and significant ($b = -0.10$, $p < 0.05$). Thus, Hypothesis 2b.i. was accepted. The interactive effect of leaders' proactive personality and leaders' narcissism on team stress and their indirect moderated mediation was not significant. Thus, Hypothesis 2a.ii. and Hypothesis 2a.ii. were not accepted.

TABLE 2
Unstandardized coefficients from moderated mediation Model 2

	Predicting Team Organizational Engagement t3					
	Estimate	S.E.	z			
Education	0.240**	0.113	2.113			
Team Size	0.061	0.059	1.036			
Tenure	-0.095	0.070	-1.369			
Proactive Personality t1 (PP)	0.070	0.066	1.073			
Team Happiness t2 (THAP2)	0.518***	0.087	5.922			
Team Stress t2 (TSTR2)	0.029	0.073	0.400			

	Predicting Team Happiness t2			Predicting Team Stress t2		
	Estimate	S.E.	z	Estimate	S.E.	z
Proactive Personality t1 (PP)	-0.036	0.067	-0.543	0.033	0.085	0.391
Education	0.032	0.113	0.288	0.102	0.143	0.713
Team Size	-0.044	0.061	-0.734	-0.039	0.077	-0.507
Tenure	0.130	0.071	1.832	0.005	0.090	-0.059
Narcissism t1	0.123**	0.056	2.218	-0.024	0.072	-0.333
PP*Narcissism t1	-0.192**	0.078	-2.453	0.048	0.104	0.464
Team Autonomy t1	0.281***	0.068	4.148	0.078	0.085	0.921

PP*Team Autonomy t1	-0.036	0.101	-0.361	-0.352**	0.138	-2.543
Leisure A t1	-0.087	0.083	-1.045	0.023	0.064	0.355
PP*Leisure A t1	0.087	0.083	1.045	-0.173	0.107	-1.607
Leisure B t1	-0.034	0.043	-0.805	-0.014	0.054	-0.268
PP*Leisure B t1	-0.012	0.057	-0.207	0.004	0.072	0.054

Index of Moderated Mediation Predicting Team Organizational Engagement t3			
	Estimate	S.E.	z
PP*Narcissism t1 – THAP2	-0.099**	0.043	-2.303
PP*Team Autonomy t1 – TSTR2	-0.010	0.026	-0.396
PP*Narcissism t1 – TSTR2	0.001	0.005	0.298
PP*Team Autonomy t1 – THAP2	-0.030	0.057	-0.532
PP*Leisure A t1 – THAP2	0.045	0.044	1.029
PP*Leisure B t1 – THAP2	-0.006	0.030	-0.207
PP*Leisure A t1 – TSTR2	-0.005	0.013	-0.383
PP*Leisure B t1 – TSTR2	0.000	0.002	0.054

Note: Estimates are unstandardized, resulting from an overall analysis including proactive personality, team intrinsic motivation, team extrinsic motivation, team organizational engagement, moderators (leaders' narcissism, leaders' leisure activity, team autonomy), and control variables (team size, education, and tenure) in one model. The moderator variables were mean-centred.

Leisure A: manual, intellectual, virtual, contemplation; Leisure B: Social and touristic

p<0.05. *p<0.01.

Simple slope tests indicated that leaders' proactive personality mediated by team happiness was negatively related to team organizational engagement at higher levels of leaders' narcissism ($b = -0.23$, $p < 0.05$) but was not significantly related at lower levels of leaders' narcissism ($b = 0.16$, *n.s.*) (see Figure 6).

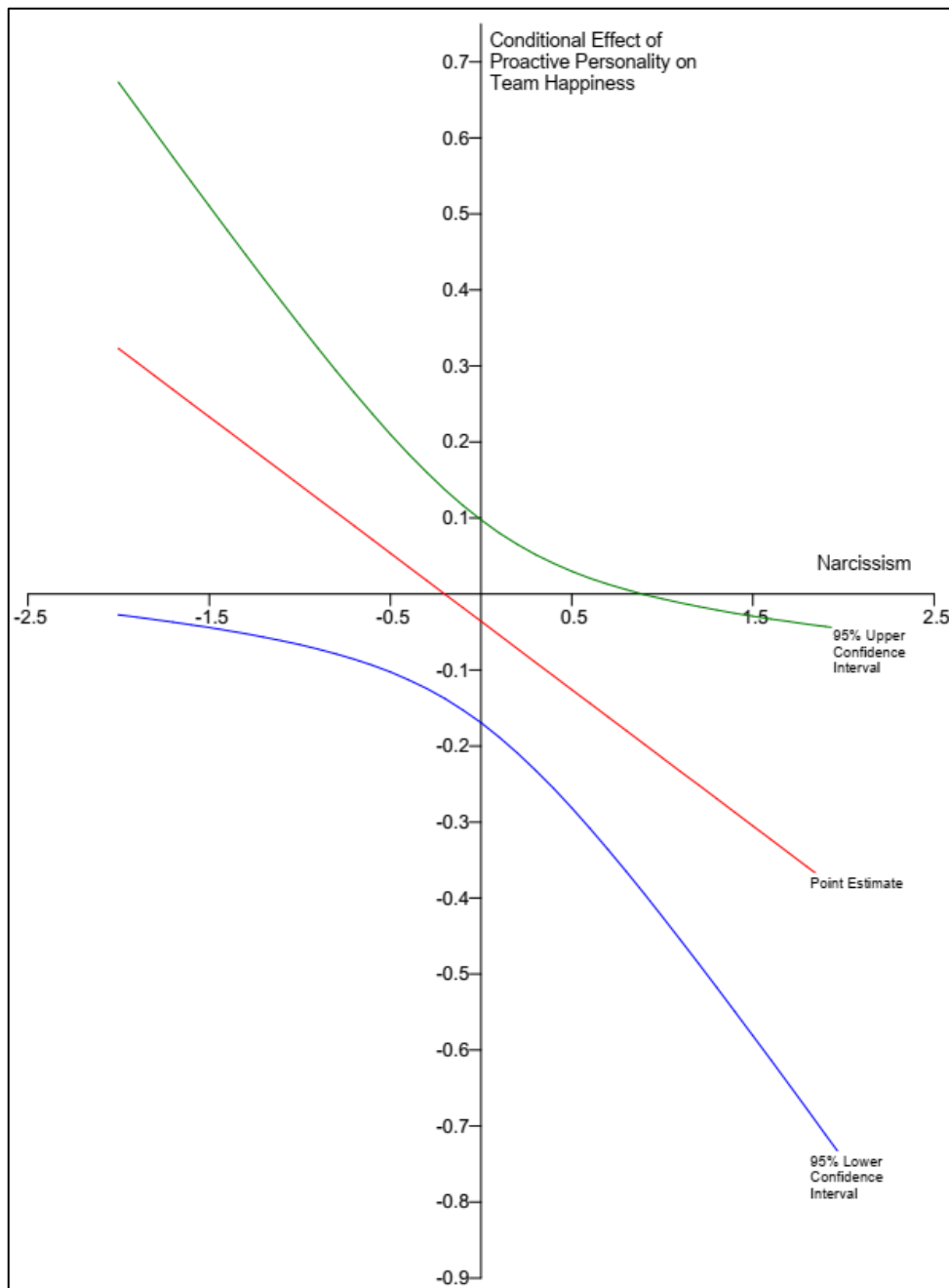


FIGURE 6 Graph of the conditional effect of proactive personality on team happiness moderated by leaders' narcissism

The interactive effect of leaders' proactive personality and team autonomy on team extrinsic motivation was negative and significant ($b = -0.35$, $p < 0.05$). Thus, Hypothesis 6a.ii. was supported. Simple slope tests indicated that leaders' proactive personality was positively related to team extrinsic motivation at lower levels of team autonomy ($b = 0.39$, $p < 0.05$) but was not significantly related at higher levels of team autonomy ($b = -0.32$, *n.s.*) (see Figure 7).

The indirect moderated mediation of leaders' proactive personality, team autonomy, and team extrinsic motivation on team organizational engagement was insignificant. Therefore, Hypothesis 6b.ii. was not supported. The interactive effect of leaders' proactive personality and team autonomy on team happiness and their indirect moderated mediation was not significant. Thus, Hypothesis 6a.i. and Hypothesis 6a.i. were not accepted.

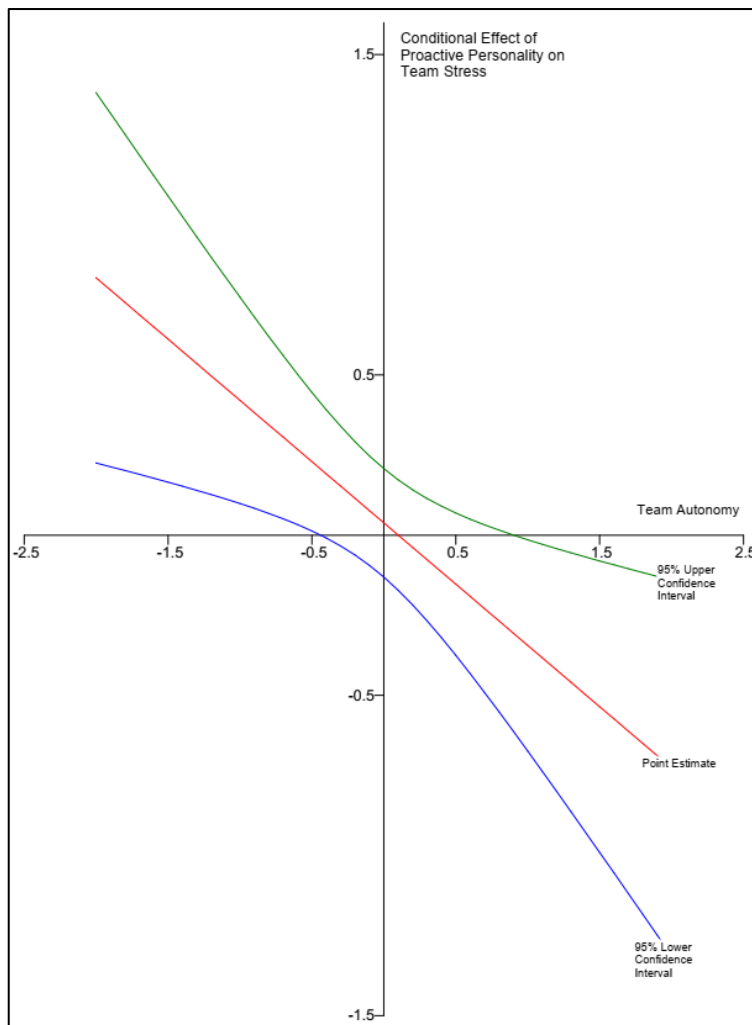


FIGURE 7 Graph of the conditional effect of proactive personality on team stress moderated by team autonomy.

As can also be seen in Table 2, the interactive effect of leaders' proactive personality and leaders' leisure on team happiness and team stress and their indirect moderated mediation was not significant. Thus, Hypothesis 4a and 4b were not accepted.

Discussion

Model 1: *Cognitive Motivational Pathway*

Leaders' Narcissism and Leisure in the Relationship between Leaders' Proactive Personality and Team Organizational Engagement through Team Intrinsic and Team Extrinsic Motivation Pathways

Prior research primarily focused on examining the dark side of proactive behavior by looking into its impact on the individuals who perform it. Building upon the integration of the wise proactivity concept, conservation of resources theory, and enrichment theory, the main purpose of this study was to investigate why and when entrepreneurial leader proactivity is detrimental or beneficial for team outcomes and the dichotomy of its execution. In this study, we focus on examining the role of leaders' dark traits, including narcissism, that can trigger the negative effects of leaders' proactivity on team outcomes. On the other hand, this study also investigates how leaders' leisure and team autonomy, as part of wise proactivity components, can stimulate the positive impact of leaders' proactive personality on team outcomes through the cognitive (team intrinsic and extrinsic motivation) and affective team proactive motivational pathways (team happiness and team stress).

In the first model, this study focuses on examining the circumstances in which leaders' proactivity may have positive and negative impacts on team outcomes through the cognitive motivational pathways (team intrinsic and extrinsic motivation). The findings demonstrate that being a proactive leader can have negative effects on team members' motivation and well-being, especially when the leaders show a high level of narcissistic personality. This study indicates that proactive leaders tend to reduce team intrinsic motivation when the leaders also have a high level of narcissism, which eventually decreases team organizational engagement. It is supported by prior research, suggesting that leaders' narcissism may have potentially adverse on followers' work engagement (Wirtz & Rigotti, 2020), and followers under the supervision of narcissistic leaders are likely to have diminished well-being due to lack of support (Volmer, Koch, & Goritz, 2016). Moreover, followers who perceive their leaders as narcissistic often hold the belief that leaders are unreceptive to their suggestions and hardly include them in decision-making, which subsequently reduces followers' motivation to work and thus reduces their job performance due to feeling disrespected by the leaders (Hochwarter & Thompson, 2012; Liu et al., 2021). As Liao et al. (2019) pointed out, when followers perceive a leader's narcissism, they are likely to question their openness to leadership and might believe that the leader will disregard their suggestions, which can lead to a strained

relationship between the leaders and followers. The negative attributes and actions demonstrated by narcissistic leaders exert a more substantial impact when their followers are exposed to a greater opportunity to observe such behavior (Nevicka et al., 2018).

Proactive leaders set thought-provoking goals by imagining a desirable future, taking the initiative to improve job efficiency, and offering their subordinates guidance and support (Crossley et al., 2013). Given that proactive leaders are attractive to followers, followers are strongly encouraged to adopt and imitate the ideals, cognitive patterns, and behaviors of these leaders (Zhang & Chui, 2022). An effective leader recognizes the criticality of followers in achieving organizations' objectives and understands the value of motivating them to succeed in the pursuit of these objectives (Asrar-ul-Haq & Anjum, 2020). However, prior research indicates that engaging in proactivity can lead to resource depletion and emotional exhaustion, as it requires individuals to expand various resources (Strauss et al., 2017; Lin & Johnson, 2015). When people engage in proactivity solely to get rewards and avoid punishment or extrinsic motivation, they may feel pressure to perform such actions and be more likely to be drained (Pingel et al., 2019; Strauss et al., 2017).

On the other hand, when their activities are driven by strong personal desires or intrinsic motivation, they feel happier (Deci & Ryan, 2008). In this study, we found that proactive leaders may stimulate their team members to have proactive motivational states. However, such proactive motivational pathways experienced by team members can be determined by the leader's dark trait, which is narcissism. This study suggests that leaders' narcissism was found to be powerful in weakening the influence of leaders' proactive personalities on team intrinsic motivation and team organizational engagement. In other words, proactive leaders with low levels of narcissism are more likely to improve team intrinsic motivation to conduct proactive behavior, which eventually enhances team organizational engagement. The findings are consistent with prior research, suggesting that leaders' narcissism leads to an overall decrease in followers' psychological contracts (Malik & Khan, 2013). When followers perceive their leaders to embellish their achievements and have a narcissistic personality, they are unlikely to feel satisfied (Asrar-ul-Haq & Anjum, 2020).

Furthermore, this study indicates that when proactive leaders are actively involved in various leisure activities, it can reduce the negative impact of their proactive personality on team extrinsic motivation. The existing research on stress and leisure has primarily concentrated on how engaging in leisure activities helps manage and alleviate the negative effects of stressful life events (Folkman & Moskowitz, 2000). Leisure is suggested to be a constructive strategy used by individuals to provoke positive emotion (Denovan & Macaskill,

2017). Consistent with the broaden and build theory, participating in leisure activities frequently enhances positive emotions and stimulates the accumulation of psychological resources, which in turn has a favorable impact on emotional well-being through the broaden and build process (Chen et al., 2022). Previous research also shows that leaders' psychological detachment from work during leisure time is positively associated with well-being and negatively associated with strain symptoms (Sonnentag & Schiffner, 2019). Aligned with the concept of wise proactivity, individuals can maintain proactive behavior to produce desirable outcomes by focusing on self-regulation. The examination shows that engaging in leisure practices is an effective internal way of regulating self that enables leaders to mitigate the negative effects of proactivity. In other words, this study confirms that leisure practices enlarge the likelihood for leaders to achieve wise proactivity, since leisure facilitates leaders to regulate themselves.

The findings align with prior research, suggesting that leisure practices can be categorized into several items of activities (Andrade et al., 2018). In this study, the significant part falls into four different items such as manual activities, like gardening, cooking, painting, or doing crafts or carpentry; intellectual activities, which include attending courses, reading books, listening or composing songs, and watching documentaries; virtual activities, like playing video games, social networking, or surfing the internet; and contemplation or rest, which might include turning-off from tasks by relaxing and reflecting, appreciating the nature, and the beautiful landscape. Within manual leisure activities, prior research has indicated how this type of leisure may help individuals improve their well-being. Gardening was not regarded as a mere leisure pursuit; instead, it was considered indispensable for individuals' physical and psychological well-being (Scott, Masser, & Pachana, 2015). Similarly, individuals who place significant value on the social components of cooking and do not feel pressured in their daily routines are more prone to perceive cooking as a leisure activity that elicits enjoyment rather than an obligatory task (Daniels, Glorieux, Minnen, & Tienoven, 2012). Besides, engaging in craft as a purposeful leisure activity has beneficial impacts on the well-being of craft makers by promoting a sense of self-actualization, empowerment, and enjoyment (Pöllänen, 2015).

In this study, manual leisure pursuits become the least preferred activities for CEOs to fill the day during the day off. However, manual leisure was found to have a significant impact in mitigating the undesirable effect of leaders' proactive personalities on team extrinsic motivation. In addition, intellectual endeavors have been identified as one of the most popular leisure practices. Aligned with the notion of serious leisure, certain activities that come within the realm of intellectual pursuits motivate individuals to gain more extensive knowledge.

Serious leisure participation can be characterized by six specific traits, including perseverance, personal effort in developing skills and knowledge, a desire to establish a career, obtaining long-lasting self-actualization or feelings of accomplishment, strong identification with the chosen activity, and self-immersion with other participants (Stebbins, 2007).

Intellectual pursuits generate novel insights for effectively handling diverse life circumstances, and thus, these advantages have the potential to enhance individuals' capabilities and foster their overall state of well-being (Lee & Hwang, 2018). This leisure activity brings personal satisfaction, enriches one's sense of self, and serves as a means of self-expression (Roberson, 2005). Individuals who pursue learning activities as a form of leisure can either engage in this practice casually or approach them with a high level of commitment. These leisure experiences provided a chance for both interpersonal and intrapersonal outcomes, as well as personal well-being (Dattilo, Ewert, & Dattilo, 2012).

Furthermore, this study demonstrates that virtual leisure items hold an important role in alleviating the adverse impact of leaders' proactive personalities. Prior research indicated that individuals use their leisure time to utilize digital social media to facilitate the formation of interaction patterns; it enables individuals to retrain existing relationships, establish new connections, and expand their social networks (Francisco, Lopez-Sintas, & Garcia-Alvarez 2016). Likewise, gaming incorporates several features, such as chats, video chats, instant messaging, and email, which enhance its social aspect as it borrows components from social networks, extending the sociability of gaming beyond its inherent social dimension (Keenan & Shiri, 2009; Schroeder, 2010).

Moreover, the findings suggest contemplation and/or rest as a form of leisure also enable leaders to mitigate the negative influence of being proactive. Contemplation or rest can encompass the act of appreciating nature and its scenic beauty, as well as disengaging from tasks by spending time in relaxation and reflection. Past studies suggested that having direct contact with nature offers several psychological and physiological advantages. These include enhanced pain tolerance and relief from stress through relaxation (Kaplan, 1992; Ulrich et al., 1991). Engaging in contemplative leisure might catalyze reflecting individual travel or walking as a means of self-discovery (Zovko & Dillon, 2023).

To summarize, this study indicates that the narcissistic tendencies of leaders significantly diminish the influence of their proactive personality on intrinsic motivation and team organizational engagement. Leaders who are proactive and have high levels of narcissism are more likely to undermine the team's internal drive to engage in proactive behavior, which, in turn, reduces the team's engagement in the organization. On the other hand, this study

suggests that engaging in virtual, intellectual, contemplation, and manual leisure might effectively mitigate the dark side of being a proactive leader, particularly related to team extrinsic motivation. The relationship between leaders and their non-work hours activities is linked to stress experienced by team members (Sonnentag & Schiffner, 2019). It is crucial for leaders to recognize how their failure to disconnect from work during non-work hours can affect their subordinates, and thus, leaders may respond by seeking greater psychological detachment from work, such as by engaging in leisure activities (Hahn, Binnewies & Haun, 2012).

Model 2: *Affective Motivational Pathway*

Narcissism and Team Autonomy in the Relationship between Leaders' Proactive Personality and Team Organizational Engagement through Team Happiness and Team Stress

In the second model, this study focuses on examining the circumstances in which leaders' proactivity may have positive and negative influences on team outcomes through team affective motivational pathways, including team happiness and team stress. This study reveals that leader narcissism has a negative and moderating effect on the relationship between leaders' proactive personality and team organizational engagement through team happiness. The findings indicate that the level of team happiness is found to decrease when leaders exhibit high levels of proactive personality and narcissism, which in turn negatively affects team engagement. It is consistent with prior research, suggesting that narcissistic leaders increase followers' stress, which in turn affects individual well-being and the workplace environment (Asrar-ul-Haq & Anjum, 2020).

Employees working under a narcissist who is compelled to support the egocentric objectives of the leaders are unlikely to express happiness and may experience physical and mental exhaustion due to the excessive demands placed upon them without sufficient reciprocation (Blair, Hoffman, & Helland, 2008; Ellen, Kiewitz, & Garcia, 2019; Hochwarter & Thompson, 2012). Besides, past studies defined narcissism as a personality trait characterized by a grandiose sense of the self, accompanied by self-promoting strategies and a lack of concern for others (Gerstner et al., 2013; Twenge et al., 2008). They further suggested that the paradox of narcissism resides in its simultaneous disregard for others and craving for their approval, and thus, it can adversely impact social relationships (Klotz & Neubaum, 2016). Leaders exhibiting a pronounced narcissistic personality trait are inclined to strictly protect

their own interests, manipulate subordinates into displaying loyalty to them, and prioritize the approval of leaders over the well-being of followers (Rosenthal & Pittinsky, 2006).

In addition, the findings align with prior studies, indicating that narcissism among leaders negatively impacts followers' job satisfaction and psychological well-being (Hochwarter & Thompson, 2012). Given its origins in personality and emotion theories, narcissism is intricately linked to self-regulation aspects, including emotions and well-being (Sudha & Shahnawaz, 2020). Although past research suggested that narcissist leaders typically exhibited a greater sense of well-being since they have inflated a sense of self-confidence, self-esteem, and emotional skills (Lobbestael, de Bruin, Kok, & Voncken, 2016; Sandage, Jankowski, Bissonette, & Paine, 2017; Sedikides et al., 2004), these self-centered leaders do not inherently promote their followers' well-being. Narcissists display a number of unethical behaviors in the workplace, which most likely result in decreased job satisfaction and have a negative impact on the culture of the organization (Blair, Helland, & Walton, 2017). When leaders are high in narcissism, it leads their followers to feel less supported and less engaged as a result (Fehn & Schutz, 2021). Accordingly, the act of narcissistic supervision has a detrimental impact on the well-being of subordinates and frequently becomes an unavoidable source of stress (Godkin & Allcorn, 2011; Padilla et al., 2007; McFarlin & Sweeney, 2000).

In addition, this study demonstrates that team autonomy has a substantial impact on moderating the relationship between leaders' proactive personality and team stress. This study indicates that team members experience lower levels of perceived stress when their leaders exhibit a high level of proactive personality and when the organization allows a significant amount of autonomy to the team. As a result, team autonomy as one of the components of wise proactivity, specifically in terms of task and strategic actions, can be identified as a crucial element in mitigating the adverse impact of leaders' proactive personality on team stress. It is in line with prior studies indicating that team members reported that there is a positive correlation between higher team autonomy and increased active learning behavior, as well as a decrease in emotional exhaustion (Van Mierlo et al., 2007).

A higher level of autonomy could reduce the impact of negative job demands on emotional exhaustion and health problems (De Jonge, Janssen, & Van Breukelen, 1996). Moreover, these findings are consistent with past research, suggesting that team autonomy may play a significant role in enhancing work motivation (Janz, Colquitt, & Noe, 1997), reducing psychological fatigue and job strain (Van Mierlo, Rutte, Kompier, & seinen, 2001; Leach, Wall, Rogelberg, & Jackson, 2005). The investigation enriches prior studies that suggested that team autonomy moderated the positive relationship between proactive personality and work

engagement, which results in a significant and positive relationship only in more autonomous teams (Bao et al., 2021). In addition, scholars have argued that the subsequent rise in team autonomy promotes the psychological well-being of team members (Van Mierlo et al., 2007), reduce psychological fatigue (Van Mierlo et al., 2001) and job strain (Leach et al., 2005).

To sum up, based on these findings, it can be concluded that it is not only entrepreneurial leisure engagement, particularly in virtual, intellectual, contemplating, and manual activities, can facilitate the decrease of the undesirable impact of leaders' proactive personality on team extrinsic motivation, but also a high level of team autonomy is more likely to help reduce the negative consequences on team stress. Ultimately, the interaction effect of leaders' proactive personality and narcissism were consistently found to intensify the unfavorable consequences of leader proactivity on team outcomes, such as decreased team intrinsic motivation and team happiness, which eventually affect team organizational engagement.

Theoretical and Practical Implication

While past studies mainly recognized the favorable impact of proactive personality for organizations, this study focuses on understanding how leaders' dark traits might lead to undesired consequences of leaders' proactive personalities. The investigation of the dual effect of leaders' proactive personality on team outcomes provides several theoretical implications. First, this study answers the call to examine both the bright and dark sides of leaders' proactivity on the team's well-being. This study enriches the proactive motivational states concept by examining the positive and negative side of leaders' proactivity through two distinct pathways, including cognitive and affective motivational pathways. This study contributes to the conservation of resource theory by exploring how leaders' proactivity may also influence the hot side of proactivity experienced by team members, such as the decrease in team happiness and the increase in team stress. In addition, this study extends the trajectory of proactivity and dark traits literature by revealing the role of leaders' narcissism in weakening the positive consequences of leaders' proactivity on team organizational engagement through team intrinsic motivation and team happiness.

Furthermore, this study deepened the wise proactivity concept by focusing on the role of entrepreneurial leisure as an act of self-regulation in eliminating the undesirable effects of leaders' proactive personalities on team extrinsic motivation. This study extends the enrichment theory by emphasizing the importance of leaders' engagement in leisure activities in improving their workplace situations. In addition, this study enhances the wise proactivity

concept by examining the significance of team autonomy as a task and strategic aspect in alleviating the negative impact of leaders' proactivity on team stress. Besides, the findings provide the dual impact of proactivity within the framework of leader and team-level effects. This study extends prior research by revealing that the impact of leaders' proactive personality can also affect team-level motivation and well-being both in positive and negative ways. Finally, this study practically implies that organizations need to provide strategic encouragement for both leaders and team members. This study encourages entrepreneurial leaders to conduct wise proactive approaches consistently by focusing on self-regulation through leisure participation and eliminating leaders' potentially dark traits, like narcissism. This study promotes organizations to provide autonomy in the workplace, as it fosters personal growth and development while also supporting the achievement of objectives at work.

Limitation and Future Research

Despite the theoretical and practical contribution, this study focuses on understanding the dual effect of leaders' proactivity on team well-being. Future research may enrich the understanding by investigating this dual impact on team or organizational performance. In addition, further studies could provide an avenue to explore specific types of leisure that enable leaders to mitigate the adverse impact of being proactive and improve team proactive performance. This research conducted a longitudinal study and collected the data at three-time points. Future research may apply a diary study to provide more intensive knowledge of how individuals engage in different leisure activities on a daily basis. This study focused on examining the impact of leaders' proactive personalities on team well-being. Future research may embark on comparative studies by looking into the double-edged swords of leaders' proactive behavior and its impact on the leader itself, the team, and the organization. Thus, the comparison analysis of each category might portray a more profound understanding of each group's level of well-being. This study adopted a general measurement of leisure practices to obtain a set of specific leisure types that leaders frequently engage in. Future research may utilize the leisure motivation scale to grasp the idea of individuals' rationale behind their chosen leisure practice.

References

- Abdel Hadi, S., Bakker, A. B., & Häusser, J. A. (2021). The role of leisure crafting for emotional exhaustion in telework during the COVID-19 pandemic. *Anxiety, Stress, & Coping*, 34(5), 530-544.
- Adhia, H., Nagendra, H., & Mahadevan, B. (2010) 'Impact of yoga way of life on organizational

- performance'. *International Journal of Yoga*, 3(2), 55-66.
- Akgün, A. E., Byrne, J. C., Lynn, G. S., & Keskin, H. (2007). Team stressors, management support, and project and process outcomes in new product development projects. *Technovation*, 27(10), 628-639.
- Alstete, J. W. (2008). Aspects of entrepreneurial success. *Journal of small business and enterprise development*, 15(3), 584-594.
- Amankwah-Amoah, J. (2016). An integrative process model of organisational failure. *Journal of Business Research*, 69(9), 3388-3397.
- Andrade, R. D., Schwartz, G. M., Tavares, G. H., Pelegri, A., Teixeira, C. S., & Felden, É. P. G. (2018). Construct validity and internal consistency in the Leisure Practices Scale (EPL) for adults. *Ciência & Saúde Coletiva*, 23, 519-528.
- Aspinwall, L. G. (1998). Rethinking the role of positive affect in self-regulation. *Motivation and emotion*, 22, 1-32.
- Aspinwall, L. G., & Taylor, S. E. (1997). A stitch in time: self-regulation and proactive coping. *Psychological bulletin*, 121(3), 417.
- Asrar-ul-Haq, M., & Anjum, T. (2020). Impact of narcissistic leadership on employee work outcomes in banking sector of Pakistan. *Future Business Journal*, 6, 1-9.
- Baka, Ł. (2018). When do the 'dark personalities' become less counterproductive? The moderating role of job control and social support. *International Journal of Occupational Safety and Ergonomics*, 24(4), 557-569.
- Bakker, A. B., Demerouti, E., & Euwema, M. C. (2005). Job resources buffer the impact of job demands on burnout. *Journal of occupational health psychology*, 10(2), 170.
- Bakker, A. B., & de Vries, J. D. (2021). Job Demands–Resources theory and self-regulation: New explanations and remedies for job burnout. *Anxiety, Stress, & Coping*, 34(1), 1-21.
- Bakker, A. B., Westman, M., & van Emmerik, I. H. (2009). Advancements in crossover theory. *Journal of managerial psychology*, 24(3), 206-219.
- Bălan, M., Marin, S., Mitan, A., Pinzaru, F., Vătămănescu, E. M., & Zbucnea, A. (2019). Leaders in focus: generational differences from a personality-centric perspective. *Management & Marketing. Challenges for the Knowledge Society*, 14(4), 372-385.
- Baldé, M., Ferreira, A. I., & Maynard, T. (2018). SECI driven creativity: the role of team trust and intrinsic motivation. *Journal of Knowledge Management*.
- Baloch, M. A., Meng, F., Xu, Z., Cepeda-Carrion, I., Danish, & Bari, M. W. (2017) 'Dark Triad, Perceptions of Organizational Politics and Counterproductive Work Behaviors: The Moderating Effect of Political Skills.' *Frontiers in Psychology*, 8, 1972.
- Bandura, A. (1971) Social Learning Theory. Morristown, N.J.: General Learning Press.
- Bandura, A. *Social learning theory*. Englewood Cliffs, N.J.: Prentice-Hall, 1977.
- Bandura, A., & Walters, R. H. (1977). *Social learning theory* (Vol. 1). Prentice Hall: Englewood cliffs.
- Barber, L. K., Taylor, S. G., Burton, J. P., & Bailey, S. F. (2017). A self-regulatory perspective of work-to-home undermining spillover/crossover: Examining the roles of sleep and exercise. *Journal of Applied Psychology*, 102(5), 753.
- Barling, J., Weber, T., & Kelloway, E. K. (1996). Effects of transformational leadership training on attitudinal and financial outcomes: A field experiment. *Journal of applied psychology*, 81(6), 827.
- Barnes, C. M., Lucianetti, L., Bhawe, D. P., & Christian, M. S. (2015). "You wouldn't like me when I'm sleepy": Leaders' sleep, daily abusive supervision, and work unit engagement. *Academy of Management Journal*, 58(5), 1419-1437.
- Barrick, M. R., Thurgood, G. R., Smith, T. A., & Courtright, S. H. (2015). Collective organizational engagement: Linking motivational antecedents, strategic implementation, and firm performance. *Academy of Management Journal*, 58(1), 111-135.
- Bateman, T. S., & Crant, J. M. (1993). The proactive component of organizational behavior: A measure and correlates. *Journal of organizational behavior*, 14(2), 103-118.
- Bidee, J., Vantilborgh, T., Pepermans, R., Willems, J., Jegers, M., & Hofmans, J. (2017). Daily motivation of volunteers in healthcare organizations: relating team inclusion and intrinsic motivation using self-determination theory. *European Journal of Work and Organizational Psychology*, 26(3), 325-336.

- Blair, C. A., Helland, K., & Walton, B. (2017). Leaders behaving badly: The relationship between narcissism and unethical leadership. *Leadership & Organization Development Journal*, 38(2), 333-346.
- Blair, C. A., Hoffman, B. J., & Helland, K. R. (2008). Narcissism in organizations: A multisource appraisal reflects different perspectives. *Human Performance*, 21(3), 254-276.
- Boddy, C. R. (2015). Organisational psychopaths: A ten year update. *Management Decision*, 53(10), 2407-2432.
- Bohlmann, C., Rudolph, C. W., & Zacher, H. (2021). Effects of proactive behavior on within-day changes in occupational well-being: the role of organizational tenure and emotion regulation skills. *Occupational Health Science*, 5(3), 277-306.
- Bollaert, H., Leboeuf, G., & Schwienbacher, A. (2020). The narcissism of crowdfunding entrepreneurs. *Small Business Economics*, 55(1), 57-76.
- Bolino, M. C., & Turnley, W. H. (2005). The personal costs of citizenship behavior: the relationship between individual initiative and role overload, job stress, and work-family conflict. *Journal of applied psychology*, 90(4), 740.
- Bolino, M., Valcea, S., & Harvey, J. (2010) 'Employee, manage thyself: The potentially negative implications of expecting employees to behave proactively'. *Journal of Occupational and Organizational Psychology*, 83(2), 325-345.
- Bolino, M. C., Turnley, W. H., & Anderson, H. J. (2017) 'The dark side of proactive behavior: When being proactive may hurt oneself, others, or the organization,' in Parker, S.K. and Bindl, U.K. (ed.) *Proactivity at work* (pp. 517-547). Routledge.
- Bommer, W. H., Miles, E. W., & Grover, S. L. (2003). Does one good turn deserve another? Coworker influences on employee citizenship. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 24(2), 181-196.
- Breaugh, J. A. (1985). The measurement of work autonomy. *Human relations*, 38(6), 551-570.
- Brownell, K. M., McMullen, J. S., & O'Boyle Jr, E. H. (2021). Fatal attraction: A systematic review and research agenda of the dark triad in entrepreneurship. *Journal of Business Venturing*, 36(3), 106106.
- Brunner, D., Abramovitch, A., & Etherton, J. (2017). A yoga program for cognitive enhancement. *PloS one*, 12(8), e0182366.
- Cai, Z., Parker, S. K., Chen, Z., & Lam, W. (2019). 'How does the social context fuel the proactive fire? A multilevel review and theoretical synthesis'. *Journal of Organizational Behavior*, 40(2), 209-230.
- Cangiano, F., & Parker, S. K. (2016) 'Proactivity for Mental Health and Well-Being'. in Clarke, S., Probst, T.M., Guldenmund, F., Passmore, J. (ed.) *The Wiley Blackwell Handbook of the Psychology of Occupational Safety and Workplace Health* (pp. 228-250).
- Cangiano, F., Parker, S. K., & Yeo, G. B. (2019). Does daily proactivity affect well-being? The moderating role of punitive supervision. *Journal of Organizational Behavior*, 40(1), 59-72.
- Cardon, M. S., & Kirk, C. P. (2015). Entrepreneurial passion as mediator of the self-efficacy to persistence relationship. *Entrepreneurship theory and practice*, 39(5), 1027-1050.
- Chen, S. T., Hyun, J., Graefe, A. R., Mowen, A. J., Almeida, D. M., & Sliwinski, M. J. (2022). The influence of leisure engagement on daily emotional well-being. *Leisure Sciences*, 44(7), 995-1012.
- Chen, G., & Kanfer, R. (2006). Toward a systems theory of motivated behavior in work teams. *Research in organizational behavior*, 27, 223-267.
- Chiaburu, D. S., Smith, T. A., Wang, J., & Zimmerman, R. D. (2014). Relative importance of leader influences for subordinates' proactive behaviors, prosocial behaviors, and task performance. *Journal of Personnel Psychology*.
- Choi, J. N. (2007). Change-oriented organizational citizenship behavior: effects of work environment characteristics and intervening psychological processes. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 28(4), 467-484.

- Collins, A. L., Lawrence, S. A., Troth, A. C., & Jordan, P. J. (2013). Group affective tone: A review and future research directions. *Journal of Organizational Behavior*, 34(S1), S43-S62.
- Collins, A. L., Jordan, P. J., Lawrence, S. A., & Troth, A. C. (2016). Positive affective tone and team performance: The moderating role of collective emotional skills. *Cognition and Emotion*, 30(1), 167-182.
- Covin, J. G., & Slevin, D. P. (1990). New venture strategic posture, structure, and performance: An industry life cycle analysis. *Journal of business venturing*, 5(2), 123-135.
- Crant, J. M., Hu, J., & Jiang, K. (2016). Proactive personality: A twenty-year review. *Proactivity at work*, 211-243.
- Crossley, C. D., Cooper, C. D., & Wernsing, T. S. (2013). Making things happen through challenging goals: Leader proactivity, trust, and business-unit performance. *Journal of Applied Psychology*, 98(3), 540.
- Daniel, V. L., & Zhan, Y. (2023). Wearing different hats enriches "outside the box" thinking: Examining the relationship between personal life activity breadth and creativity at work. *Journal of Applied Psychology*.
- Daniels, S., Glorieux, I., Minnen, J., & van Tienoven, T. P. (2012). More than preparing a meal? Concerning the meanings of home cooking. *Appetite*, 58(3), 1050-1056.
- Dasborough, M. T. (2006). Cognitive asymmetry in employee emotional reactions to leadership behaviors. *The Leadership Quarterly*, 17(2), 163-178.
- Dattilo, A. E. L., Ewert, A., & Dattilo, J. (2012). Learning as Leisure: Motivation and Outcome in Adult Free Time Learning. *Journal of Park & Recreation Administration*, 30(1).
- De Jong, J. P., Wilkin, C. L., & Rubino, C. (2019). The association between perceived personal power, team commitment, and intrinsic motivation for permanent and temporary workers. *Economic and Industrial Democracy*, 40(2), 257-279.
- Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of research in personality*, 19(2), 109-134.
- Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological inquiry*, 11(4), 227-268.
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian psychology/Psychologie canadienne*, 49(3), 182.
- Delle Fave, A., Brdar, I., Freire, T., Vella-Brodrick, D., & Wissing, M. P. (2011). The eudaimonic and hedonic components of happiness: Qualitative and quantitative findings. *Social indicators research*, 100, 185-207.
- Den Hartog, D. N., & Belschak, F. D. (2007). Personal initiative, commitment and affect at work. *Journal of occupational and organizational psychology*, 80(4), 601-622.
- Denovan, A., & Macaskill, A. (2017). Stress and subjective well-being among first year UK undergraduate students. *Journal of Happiness Studies*, 18, 505-525.
- Dhingra, P. (2020). Why entrepreneurship is so hard. *Harvard Business Review*.
- Donaldson-Feilder, E., Munir, F., & Lewis, R. (2013). Leadership and employee well-being. *The Wiley-Blackwell handbook of the psychology of leadership, change, and organizational development*, 155-173.
- Dotlich, D. L., & Cairo, P. C. (2003). *Why CEOs fail: The 11 behaviors that can derail your climb to the top-and how to manage them* (Vol. 48). John Wiley & Sons.
- Drach-Zahavy, A., & Freund, A. (2007). Team effectiveness under stress: A structural contingency approach. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 28(4), 423-450.
- Ellen, B. P., Kiewitz, C., Garcia, P. R. J. M., & Hochwarter, W. A. (2019). Dealing with the full-of-self-boss: Interactive effects of supervisor narcissism and subordinate resource management ability on work outcomes. *Journal of Business Ethics*, 157, 847-864.
- Ehrhart, M. G., & Naumann, S. E. (2004). Organizational citizenship behavior in work groups: a group norms approach. *Journal of applied psychology*, 89(6), 960.

- Erkutlu, H. (2012). The impact of organizational culture on the relationship between shared leadership and team proactivity. *Team Performance Management: An International Journal*, 18(1/2), 102-119.
- Fehn, T., & Schütz, A. (2021). What you get is what you see: Other-rated but not self-rated leaders' narcissistic rivalry affects followers negatively. *Journal of Business Ethics*, 174(3), 549-566.
- Fredrickson, B. L. (1998). What good are positive emotions?. *Review of general psychology*, 2(3), 300-319.
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American psychologist*, 56(3), 218.
- Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & emotion*, 19(3), 313-332.
- Frese, M., & Fay, D. (2001). 4. Personal initiative: An active performance concept for work in the 21st century. *Research in organizational behavior*, 23, 133-187.
- Fritz, C., & Sonnentag, S. (2009). Antecedents of day-level proactive behavior: A look at job stressors and positive affect during the workday. *Journal of management*, 35(1), 94-111.
- Fritz, C., Yankelevich, M., Zarubin, A., & Barger, P. (2010). Happy, healthy, and productive: the role of detachment from work during nonwork time. *Journal of Applied Psychology*, 95(5), 977.
- Folkman, S., & Moskowitz, J. T. (2000). Stress, positive emotion, and coping. *Current Directions in Psychological Science*, 9, 115-118.
- Fuller Jr, B., & Marler, L. E. (2009). Change driven by nature: A meta-analytic review of the proactive personality literature. *Journal of vocational behavior*, 75(3), 329-345.
- Gagné, M., Forest, J., Vansteenkiste, M., Crevier-Braud, L., Van den Broeck, A., Aspel, A. K., ... & Westbye, C. (2015). The Multidimensional Work Motivation Scale: Validation evidence in seven languages and nine countries. *European Journal of Work and Organizational Psychology*, 24(2), 178-196.
- Gallagher, E. C., Mazur, A. K., & Ashkanasy, N. M. (2015). Rallying the troops or beating the horses? How project-related demands can lead to either high-performance or abusive supervision. *Project Management Journal*, 46(3), 10-24.
- Gao, L., Janssen, O., & Shi, K. (2011). Leader trust and employee voice: The moderating role of empowering leader behaviors. *The Leadership Quarterly*, 22(4), 787-798.
- Gerstner, W. C., König, A., Enders, A., & Hambrick, D. C. (2013). CEO narcissism, audience engagement, and organizational adoption of technological discontinuities. *Administrative science quarterly*, 58(2), 257-291.
- Giebels, E., de Reuver, R. S., Rispens, S., & Ufkes, E. G. (2016) 'The Critical Roles of Task Conflict and Job Autonomy in the Relationship Between Proactive Personalities and Innovative Employee Behavior'. *Journal of Applied Behavioral Science*, 52(3), 320-341.
- Gim, J. (2009). Toward a quality leisure experience: The practice of mindfulness. *World Leisure Journal*, 51(2), 105-109.
- Godkin, L., & Allcorn, S. (2011). Organizational resistance to destructive narcissistic behavior. *Journal of Business Ethics*, 104(4), 559-570.
- Gorgievski, M. J., Moriano, J. A., & Bakker, A. B. (2014). Relating work engagement and workaholism to entrepreneurial performance. *Journal of Managerial Psychology*.
- Grant, A. M. (2007). Relational job design and the motivation to make a prosocial difference. *Academy of management review*, 32(2), 393-417.
- Grant, A. M. (2008). Does intrinsic motivation fuel the prosocial fire? Motivational synergy in predicting persistence, performance, and productivity. *Journal of applied psychology*, 93(1), 48.
- Greenhaus, J. H., & Powell, G. N. (2006). When work and family are allies: A theory of work-family enrichment. *Academy of management review*, 31(1), 72-92.
- Griffin, M. A., Parker, S. K., & Mason, C. M. (2010). Leader vision and the development of adaptive and proactive performance: A longitudinal study. *Journal of applied psychology*, 95(1), 174.
- Hahn, V. C., Frese, M., Binnewies, C., & Schmitt, A. (2012). Happy and proactive? The role of hedonic and eudaimonic well-being in business owners' personal initiative. *Entrepreneurship theory and practice*, 36(1), 97-114.
- Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2013). Who creates jobs? Small versus large versus

- young. *Review of Economics and Statistics*, 95(2), 347-361.
- Harms, P. D., White, J. V., & Fezzey, T. N. (2024). Dark clouds on the horizon: Dark personality traits and the frontiers of the entrepreneurial economy. *Journal of Business Research*, 171, 114364.
- Heintzman, P. (2010). Leisure studies and spirituality: A Christian critique. *Movement and Being: The Journal of the Christian Society for Kinesiology, Leisure and Sports Studies*, 1(1), 2.
- Hirschfeld, R. R., Thomas, C. H., & Bernerth, J. B. (2011). Consequences of autonomous and team-oriented forms of dispositional proactivity for demonstrating advancement potential. *Journal of Vocational Behavior*, 78(2), 237-247.
- Hobfoll, S. E. (1988). The conservation of resources: A new stress model. *The ecology of stress*, 24-57.
- Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *American psychologist*, 44(3), 513.
- Hobfoll, S. E. (2001). The influence of culture, community, and the nested-self in the stress process: Advancing conservation of resources theory. *Applied psychology*, 50(3), 337-421.
- Hochwarter, W. A., & Thompson, K. W. (2012). Mirror, mirror on my boss's wall: Engaged enactment's moderating role on the relationship between perceived narcissistic supervision and work outcomes. *Human Relations*, 65(3), 335-366.
- Hu, R., Wang, L., Zhang, W., & Bin, P. (2018). Creativity, proactive personality, and entrepreneurial intention: the role of entrepreneurial alertness. *Frontiers in psychology*, 9, 951.
- Huang, X., Iun, J., Liu, A., & Gong, Y. (2010). Does participative leadership enhance work performance by inducing empowerment or trust? The differential effects on managerial and non-managerial subordinates. *Journal of Organizational Behavior*, 31(1), 122-143.
- Huang, J., Wang, Y., Wu, G., & You, X. (2016). Crossover of burnout from leaders to followers: a longitudinal study. *European Journal of Work and Organizational Psychology*, 25(6), 849-861.
- Humphrey, R. H., Kellett, J. B., Sleeth, R. G., & Hartman, N. S. (2008). Research trends in emotions and leadership. *Research companion to emotion in organizations*.
- Hyder, S., & Lussier, R. N. (2016). Why businesses succeed or fail: a study on small businesses in Pakistan. *Journal of Entrepreneurship in Emerging Economies*, 8(1), 82-100.
- Ilies, R., & Judge, T. A. (2005). Goal regulation across time: the effects of feedback and affect. *Journal of applied psychology*, 90(3), 453.
- Inceoglu, I., Thomas, G., Chu, C., Plans, D., & Gerbasi, A. (2018). Leadership behavior and employee well-being: An integrated review and a future research agenda. *The Leadership Quarterly*, 29(1), 179-202.
- Iwasaki, Y., & Mannell, R. C. (2000). Hierarchical dimensions of leisure stress coping. *Leisure sciences*, 22(3), 163-181.
- Johnson, S. K. (2008). I second that emotion: Effects of emotional contagion and affect at work on leader and follower outcomes. *The Leadership Quarterly*, 19(1), 1-19.
- Jones, D. N., & Paulhus, D. L. (2014). Introducing the short dark triad (SD3) a brief measure of dark personality traits. *Assessment*, 21(1), 28-41.
- Kabins, A. H., Xu, X., Bergman, M. E., Berry, C. M., & Willson, V. L. (2016). A profile of profiles: A meta-analysis of the nomological net of commitment profiles. *Journal of Applied Psychology*, 101(6), 881.
- Kaluza, A. J., Schuh, S. C., Kern, M., Xin, K., & van Dick, R. (2020). How do leaders' perceptions of organizational health climate shape employee exhaustion and engagement? Toward a cascading-effects model. *Human Resource Management*, 59(4), 359-377.
- Kaplan, R. (1992). The psychological benefits of nearby nature. In Relf, D. (ed.), *The Role of Horticulture in Human Well-being and Social Development*. Timber Press, Portland, Oregon, 134-142.
- Karanci, A. N., & Erkam, A. (2007). Variables related to stress-related growth among Turkish breast cancer patients. *Stress and health: Journal of the International Society for the Investigation of Stress*, 23(5), 315-322.
- Keenan, A., & Shiri, A. (2009). Sociability and social interaction on social networking websites. *Library review*, 58(6), 438-450.
- Kelly, J. R., & Barsade, S. G. (2001). Mood and emotions in small groups and work teams. *Organizational behavior and human decision processes*, 86(1), 99-130.

- Kelly, C. M., Strauss, K., Arnold, J., & Stride, C. (2020). The relationship between leisure activities and psychological resources that support a sustainable career: The role of leisure seriousness and work-leisure similarity. *Journal of Vocational Behavior*, 117, 103340.
- Kiani, A., Ali, A., Biraglia, A., & Wang, D. (2023). Why I persist while others leave? Investigating the path from passion to persistence in entrepreneurship. *Journal of Small Business Management*, 61(6), 2818-2848.
- Kickul, J., & Gundry, L. (2002). Prospecting for strategic advantage: The proactive entrepreneurial personality and small firm innovation. *Journal of small business management*, 40(2), 85-97.
- Kim, T. Y., Hon, A. H., & Crant, J. M. (2009). Proactive personality, employee creativity, and newcomer outcomes: A longitudinal study. *Journal of Business and Psychology*, 24, 93-103.
- Klimchak, M., Carsten, M., Morrell, D., & MacKenzie Jr, W. I. (2016). Employee entitlement and proactive work behaviors: The moderating effects of narcissism and organizational identification. *Journal of Leadership & Organizational Studies*, 23(4), 387-396.
- Klotz, A. C., Hmieleski, K. M., Bradley, B. H., & Busenitz, L. W. (2014). New venture teams: A review of the literature and roadmap for future research. *Journal of management*, 40(1), 226-255.
- Klotz, A. C., & Neubaum, D. O. (2016). Article commentary: Research on the dark side of personality traits in entrepreneurship: Observations from an organizational behavior perspective. *Entrepreneurship Theory and Practice*, 40(1), 7-17.
- Klyver, K., Honig, B., & Steffens, P. (2018). Social support timing and persistence in nascent entrepreneurship: exploring when instrumental and emotional support is most effective. *Small Business Economics*, 51, 709-734.
- Köppe, C., Kammerhoff, J., & Schütz, A. (2018). Leader-follower crossover: exhaustion predicts somatic complaints via StaffCare behavior. *Journal of Managerial Psychology*, 33(3), 297-310.
- Kreiser, P. M., Marino, L. D., Kuratko, D. F., & Weaver, K. M. (2013). Disaggregating entrepreneurial orientation: the non-linear impact of innovativeness, proactiveness and risk-taking on SME performance. *Small business economics*, 40(2), 273-291.
- Kumar, R., & Raj, T. (2019). Role of entrepreneurship in boosting economic growth and employment in India. *SEDME (Small Enterprises Development, Management & Extension Journal)*, 46(4), 273-281.
- Kuvaas, B., & Dysvik, A. (2009). Perceived investment in employee development, intrinsic motivation and work performance. *Human resource management journal*, 19(3), 217-236.
- Lantz, A., Hansen, N., & Antoni, C. (2015). Participative work design in lean production: A strategy for dissolving the paradox between standardized work and team proactivity by stimulating team learning?. *Journal of Workplace Learning*, 27(1), 19-33.
- Leach, D. J., Wall, T. D., Rogelberg, S. G., & Jackson, P. R. (2005). Team autonomy, performance, and member job strain: Uncovering the teamwork KSA link. *Applied Psychology*, 54(1), 1-24.
- Lee, K. J., & Hwang, S. (2018). Serious leisure qualities and subjective well-being. *The Journal of positive psychology*, 13(1), 48-56.
- Lerman, M. P., Munyon, T. P., & Williams, D. W. (2021). The (not so) dark side of entrepreneurship: A meta-analysis of the well-being and performance consequences of entrepreneurial stress. *Strategic Entrepreneurship Journal*, 15(3), 377-402.
- Levy, K. N., Hlay, J. K., Johnson, B. N., & Witmer, C. P. (2019). An attachment theoretical perspective on tend-and-befriend stress reactions. *Evolutionary psychological science*, 5, 426-439.
- Li, Y., Wang, Z., Yang, L. Q., & Liu, S. (2016). The crossover of psychological distress from leaders to subordinates in teams: The role of abusive supervision, psychological capital, and team performance. *Journal of Occupational Health Psychology*, 21(2), 142.
- Liao, S., Zhou, X., Guo, Z., & Li, Z. (2019). How does leader narcissism influence employee voice: The attribution of leader impression management and leader-member exchange. *International journal of environmental research and public health*, 16(10), 1819.
- Lin, S. H., & Johnson, R. E. (2015). 'A suggestion to improve a day keeps your depletion away: Examining promotive and prohibitive voice behaviors within a regulatory focus and ego depletion framework'. *Journal of Applied Psychology*, 100(5), 1381-1397.
- Liu, M. L., Hsieh, M. W., Hsiao, C., Lin, C. P., & Yang, C. (2020). Modelling knowledge sharing and team performance in technology industry: the main and moderating effects of happiness. *Review of Managerial Science*, 14(3), 587-610.

- Liu, J., Kwan, H. K., Fu, P. P., & Mao, Y. (2013). Ethical leadership and job performance in China: The roles of workplace friendships and traditionality. *Journal of occupational and organizational psychology*, 86(4), 564-584.
- Liu, H., & Li, G. (2018). Linking transformational leadership and knowledge sharing: The mediating roles of perceived team goal commitment and perceived team identification. *Frontiers in Psychology*, 9, 1331.
- Liu, W., Tangirala, S., Lee, C., & Parker, S. K. (2019) 'New directions for exploring the consequences of proactive behaviors: Introduction to the special issue'. *Journal of Organizational Behavior*, 40(1), 1-4.
- Liu, D., Zhu, T., Huang, X., Wang, M., & Huang, M. (2021). Narcissism and entrepreneurship: a systematic review and an agenda for future research. *Frontiers in psychology*, 12, 657681.
- Lobbestael, J., de Bruin, A., Kok, E., & Voncken, M. (2016). Through rose-coloured glasses: An empirical test of narcissistic overestimation. *Personality and Mental Health*, 10(4), 305-316.
- Lomberg, C., Thiel, J., & Steffens, P. (2019). The hare and the tortoise: The impact of action-versus state-orientation on entrepreneurial progress and persistence. *International Small Business Journal*, 37(6), 604-625.
- Loo, R., & Thorpe, K. (2002). Using reflective learning journals to improve individual and team performance. *Team performance management: an international journal*, 8(5/6), 134-139.
- Lv, A., Lv, R., Xu, H., Ning, Y., & Ning, Y. (2018). Team autonomy amplifies the positive effects of proactive personality on work engagement. *Social Behavior and Personality: an international journal*, 46(7), 1071-1082.
- Macik-Frey, M., Quick, J. C., & Cooper, C. L. (2009). Authentic leadership as a pathway to positive health. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 30(3), 453-458.
- Malik K, Khan FN (2013). Narcissistic leadership at workplace and the degree of employee psychological contract: a comparison of public and private sector organizations in Pakistan. *Int J Econ Bus Manag Stud* 2(3):116–127.
- Mao, J., Chang, S., Gong, Y., & Xie, J. L. (2021). Team job-related anxiety and creativity: Investigating team-level and cross-level moderated curvilinear relationships. *Journal of Organizational Behavior*, 42(1), 34-47.
- Mayer, D. M., Kuenzi, M., Greenbaum, R., Bardes, M., & Salvador, R. B. (2009). How low does ethical leadership flow? Test of a trickle-down model. *Organizational behavior and human decision processes*, 108(1), 1-13.
- McFarlin, D. B., & Sweeney, P. D. (2000). *Where egos dare: The untold truth about narcissistic leaders and how to survive them*. Dover, NH: Kogan Page.
- McMullen, J. S., Brownell, K. M., & Adams, J. (2021). What makes an entrepreneurship study entrepreneurial? Toward a unified theory of entrepreneurial agency. *Entrepreneurship theory and practice*, 45(5), 1197-1238.
- Meijman, T. F., Mulder, G., Drenth, P. J. D., & Thierry, H. (1998). Psychological aspects of workload. *Handbook of Work and Organizational Psychology. Volume, 2*.
- Menguc, B., Auh, S., & Ozanne, L. (2010). The interactive effect of internal and external factors on a proactive environmental strategy and its influence on a firm's performance. *Journal of business ethics*, 94, 279-298.
- Mensmann, M., & Frese, M. (2019). Who stays proactive after entrepreneurship training? Need for cognition, personal initiative maintenance, and well-being. *Journal of Organizational Behavior*, 40(1), 20-37.
- Meressa, H. A. (2020). Growth of micro and small scale enterprises and its driving factors: Empirical evidence from entrepreneurs in emerging region of Ethiopia. *Journal of Innovation and Entrepreneurship*, 9, 1-22.
- Miller, D. (2015). A downside to the entrepreneurial personality?. *Entrepreneurship Theory and Practice*, 39(1), 1-8.
- Mitchell, T. R. and Daniels, D. (2003). Observations and commentary on recent research in work motivation. *Motivation and Work Behavior*, 7, 225–54.

- Morgeson, F. P., & Hofmann, D. A. (1999). The structure and function of collective constructs: Implications for multilevel research and theory development. *Academy of management review*, 24(2), 249-265.
- Morrison, A., Breen, J., & Ali, S. (2003). Small business growth: intention, ability, and opportunity. *Journal of small business management*, 41(4), 417-425.
- Murnieks, C. Y., Arthurs, J. D., Cardon, M. S., Farah, N., Stornelli, J., & Haynie, J. M. (2020). Close your eyes or open your mind: Effects of sleep and mindfulness exercises on entrepreneurs' exhaustion. *Journal of Business Venturing*, 35(2), 105918.
- Nägel, I. J., & Sonnentag, S. (2013). Exercise and sleep predict personal resources in employees' daily lives. *Applied Psychology: Health and Well-Being*, 5(3), 348-368.
- Neneh, B. N. (2019). From entrepreneurial alertness to entrepreneurial behavior: The role of trait competitiveness and proactive personality. *Personality and Individual Differences*, 138, 273-279.
- Nevicka, B., Van Vianen, A. E., De Hoogh, A. H., & Voorn, B. (2018). Narcissistic leaders: An asset or a liability? Leader visibility, follower responses, and group-level absenteeism. *Journal of Applied Psychology*, 103(7), 703.
- Nifadkar, S., Tsui, A. S., & Ashforth, B. E. (2012). The way you make me feel and behave: Supervisor-triggered newcomer affect and approach-avoidance behavior. *Academy of Management Journal*, 55(5), 1146-1168.
- Nikolaev, B., Boudreaux, C. J., & Wood, M. (2020). Entrepreneurship and subjective well-being: The mediating role of psychological functioning. *Entrepreneurship Theory and Practice*, 44(3), 557-586.
- Nogueira, T. F. (2019). Entrepreneurial learning: what do we mean by it?. *The Learning Organization*.
- OECD (2017). Small, medium, strong. Trends in SME performance and business conditions. Paris: OECD Publishing. doi: 10.1787/9789264275683-en.
- Ohana, M. (2016). Voice, affective commitment and citizenship behavior in teams: The moderating role of neuroticism and intrinsic motivation. *British Journal of Management*, 27(1), 97-115.
- Okoye, I. B. (2018). *Complex simulation of entrepreneurial opportunity emergence: The case of Nigerian entrepreneurship* (Doctoral dissertation, Cardiff Metropolitan University).
- Ostgaard, T. A., & Birley, S. (1996). New venture growth and personal networks. *Journal of business research*, 36(1), 37-50.
- Padilla, A., Hogan, R., & Kaiser, R. B. (2007). The toxic triangle: Destructive leaders, susceptible followers, and conducive environments. *The leadership quarterly*, 18(3), 176-194.
- Parker, S. K. (2007). That is my job' How employees' role orientation affects their job performance. *Human Relations*, 60(3), 403-434.
- Parker, S. K., Bindl, U. K., & Strauss, K. (2010). Making things happen: A model of proactive motivation. *Journal of management*, 36(4), 827-856.
- Parker, D. F., & DeCotiis, T. A. (1983). Organizational determinants of job stress. *Organizational behavior and human performance*, 32(2), 160-177.
- Parker, S. K., & Liao, J. (2016). Wise proactivity: How to be proactive and wise in building your career. *Organizational Dynamics*, 45(3), 217-227.
- Parker, S., & Wall, T. D. (1998). *Job and work design: Organizing work to promote well-being and effectiveness* (Vol. 4). Sage.
- Parker, S. K., & Wang, Y. (2015). Helping people to 'make things happen': A framework for proactivity at work. *International Coaching Psychology Review*, 10(1), 62-75.
- Parker, S. K., Wang, Y., & Liao, J. (2019) 'When Is Proactivity Wise? A Review of Factors That Influence the Individual Outcomes of Proactive Behavior'. *Annual Review of Organizational Psychology and Organizational Behavior*, 6(1), 221-248.
- Parker, S. K., Williams, H. M., & Turner, N. (2006). Modelling the antecedents of proactive behavior at work. *Journal of applied psychology*, 91(3), 636.
- Patry, D. A., Blanchard, C. M., & Mask, L. (2007). Measuring university students' regulatory leisure coping styles: Planned breathers or avoidance?. *Leisure Sciences*, 29(3), 247-265.
- Pearsall, M. J., Ellis, A. P., & Stein, J. H. (2009). Coping with challenge and hindrance stressors in teams: Behavioral, cognitive, and affective outcomes. *Organizational Behavior and Human Decision Processes*, 109(1), 18-28.

- Peng, K. Z., Li, W., & Bindl, U. K. (2021). Feeling energized to become proactive: A systematic literature review of the affect-proactivity link. *Emotion and Proactivity at Work*, 13-54.
- Petrou, P., Bakker, A. B., & van den Heuvel, M. (2017). Weekly job crafting and leisure crafting: Implications for meaning-making and work engagement. *Journal of Occupational and Organizational Psychology*, 90(2), 129-152.
- Pingel, R., Fay, D., & Urbach, T. (2019). A resources perspective on when and how proactive work behaviour leads to employee withdrawal. *Journal of Occupational and Organizational Psychology*, 92(2), 410-435.
- Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual review of psychology*, 63, 539-569.
- Pöllänen, S. (2015). Elements of crafts that enhance well-being: Textile craft makers' descriptions of their leisure activity. *Journal of leisure research*, 47(1), 58-78.
- Paul, J., Hermel, P., & Srivastava, A. (2017). Entrepreneurial intentions—theory and evidence from Asia, America, and Europe. *Journal of International Entrepreneurship*, 15(3), 324-351.
- Ragheb, M. G. (1980). Interrelationships among leisure participation leisure satisfaction and leisure attitudes. *Journal of leisure research*, 12(2), 138.
- Raskin, R., & Terry, H. (1988). A principal-components analysis of the Narcissistic Personality Inventory and further evidence of its construct validity. *Journal of personality and social psychology*, 54(5), 890.
- Rauch, A., & Frese, M. (2007). Let's put the person back into entrepreneurship research: A meta-analysis on the relationship between business owners' personality traits, business creation, and success. *European Journal of work and organizational psychology*, 16(4), 353-385.
- Resick, C. J., Hargis, M. B., Shao, P., & Dust, S. B. (2013). Ethical leadership, moral equity judgments, and discretionary workplace behavior. *Human relations*, 66(7), 951-972.
- Resick, C. J., Whitman, D. S., Weingarden, S. M., & Hiller, N. J. (2009). The bright-side and the dark-side of CEO personality: examining core self-evaluations, narcissism, transformational leadership, and strategic influence. *Journal of Applied Psychology*, 94(6), 1365.
- Roberson Jr, D. N. (2005). Leisure and learning: An investigation of older adults and self-directed learning. *Leisure/Loisir*, 29(2), 203-237.
- Rojas de Francisco, L., López-Sintas, J., & García-Álvarez, E. (2016). Social leisure in the digital age. *Loisir et Société/Society and Leisure*, 39(2), 258-273.
- Rooks, G., Sserwanga, A., & Frese, M. (2016). Unpacking the personal initiative–performance relationship: A multi-group analysis of innovation by Ugandan rural and urban entrepreneurs. *Applied Psychology*, 65(1), 99-131.
- Rosenthal, S. A., & Pittinsky, T. L. (2006). Narcissistic leadership. *The leadership quarterly*, 17(6), 617-633.
- Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological review*, 110(1), 145.
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual review of psychology*, 52(1), 141-166.
- Sakkar Sudha, K., & Shahnawaz, M. G. (2020). Grandiose narcissism and performance in organizations: Mediating role of subjective wellbeing. *Leadership, Education, Personality: An Interdisciplinary Journal*, 2, 101-111.
- Sandage, S. J., Jankowski, P. J., Bissonette, C. D., & Paine, D. R. (2017). Vulnerable narcissism, forgiveness, humility, and depression: Mediator effects for differentiation of self. *Psychoanalytic Psychology*, 34(3), 300.
- Sanecka, E. (2021). Grandiose and vulnerable narcissism and regulatory focus at work in relation to strengths use and deficit correction in the workplace. *Plos one*, 16(10), e0258609.
- Savelsbergh, C., Gevers, J. M., Van der Heijden, B. I., & Poell, R. F. (2012). Team role stress: Relationships with team learning and performance in project teams. *Group & organization management*, 37(1), 67-100.
- Schroeder, R. (2010). *Being There Together: Social interaction in shared virtual environments*. Oxford University Press.
- Schweda, A., Faber, N. S., Crockett, M. J., & Kalenscher, T. (2019). The effects of psychosocial stress on intergroup resource allocation. *Scientific reports*, 9(1), 18620.

- Scott, T. L., Masser, B. M., & Pachana, N. A. (2015). Exploring the health and wellbeing benefits of gardening for older adults. *Ageing & Society*, 35(10), 2176-2200.
- Sedikides, C., Rudich, E. A., Gregg, A. P., Kumashiro, M., & Rusbult, C. (2004). Are normal narcissists psychologically healthy?: self-esteem matters. *Journal of personality and social psychology*, 87(3), 400.
- Seibert, S. E., Crant, J. M., & Kraimer, M. L. (1999). Proactive personality and career success. *Journal of applied psychology*, 84(3), 416.
- Seibert, S. E., Kraimer, M. L., & Crant, J. M. (2001). What do proactive people do? A longitudinal model linking proactive personality and career success. *Personnel psychology*, 54(4), 845-874.
- Shiba, K., Nishimoto, M., Sugimoto, M., & Ishikawa, Y. (2015) 'The Association between Meditation Practice and Job Performance: A Cross-Sectional Study'. *PLoS One*, 10(5), e0128287.
- Shraga, O., & Shirom, A. (2009). The construct validity of vigor and its antecedents: A qualitative study. *Human Relations*, 62(2), 271-291.
- Sianoja, Syrek, C. J., de Bloom, J., Korpela, K., & Kinnunen, U. (2018). Enhancing Daily Well-Being at Work Through Lunchtime Park Walks and Relaxation Exercises: Recovery Experiences as Mediators. *Journal of Occupational Health Psychology*, 23(3), 428-442.
- Sonnentag, S. (2001). Work, recovery activities, and individual well-being: A diary study. *Journal of occupational health psychology*, 6(3), 196.
- Sonnentag, S., Arbeus, H., Mahn, C., & Fritz, C. (2014). Exhaustion and lack of psychological detachment from work during off-job time: moderator effects of time pressure and leisure experiences. *Journal of occupational health psychology*, 19(2), 206.
- Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: development and validation of a measure for assessing recuperation and unwinding from work. *Journal of occupational health psychology*, 12(3), 204.
- Sonnentag, S., & Natter, E. (2004). Flight attendants' daily recovery from work: Is there no place like home?. *International Journal of Stress Management*, 11(4), 366.
- Sonnentag, S., & Schiffrer, C. (2019). Psychological detachment from work during nonwork time and employee well-being: The role of leader's detachment. *The Spanish journal of psychology*, 22, E3.
- Sonnentag, S., & Zijlstra, F. R. (2006). Job characteristics and off-job activities as predictors of need for recovery, well-being, and fatigue. *Journal of applied psychology*, 91(2), 330.
- Spain, S. M., Harms, P. D., & Wood, D. (2016). Stress, well-being, and the dark side of leadership. In *The role of leadership in occupational stress* (pp. 33-59). Emerald Group Publishing Limited.
- Spivack, A. J., & McKelvie, A. (2018). Entrepreneurship addiction: Shedding light on the manifestation of the "dark side" in work-behavior patterns. *Academy of Management Perspectives*, 32(3), 358-378.
- Stebbins, R.A. (2007). Serious leisure: a perspective for our time. New Brunswick, NJ: Transaction.
- Stebbins, R. A. (2017). *Between work and leisure: The common ground of two separate worlds*. Routledge.
- Stein, M., Vincent-Hoeper, S., & Gregersen, S. (2020). Why busy leaders may have exhausted followers: A multilevel perspective on supportive leadership. *Leadership & Organization Development Journal*, 41(6), 829-845.
- Stephan, U., Strauss, K., Gorgievski, M. J., & Wach, D. (2024). How entrepreneurs influence their employees' job satisfaction: The double-edged sword of proactive personality. *Journal of Business Research*, 174, 114492.
- Strauss, K., Parker, S. K., & O'Shea, D. (2017) 'When does proactivity have a cost? Motivation at work moderates the effects of proactive work behavior on employee job strain'. *Journal of Vocational Behavior*, 100, 15-26.
- Svarstad, H. (2010). Why hiking? Rationality and reflexivity within three categories of meaning construction. *Journal of Leisure Research*, 42(1), 91-110.
- Taylor, S. E. (2006). Tend and befriend: Biobehavioral bases of affiliation under stress. *Current directions in psychological science*, 15(6), 273-277.
- Ten Brummelhuis, L. L., Haar, J. M., & Roche, M. (2014). Does family life help to be a better leader? A closer look at crossover processes from leaders to followers. *Personnel Psychology*, 67(4),

917-949.

- Tierney, P., Farmer, S. M., & Graen, G. B. (1999). An examination of leadership and employee creativity: The relevance of traits and relationships. *Personnel psychology*, 52(3), 591-620.
- Trenberth, L. (2005). The role, nature and purpose of leisure and its contribution to individual development and well-being. *British Journal of Guidance & Counselling*, 33(1), 1-6.
- Tsai, W. C., Chen, C. C., & Liu, H. L. (2007). Test of a model linking employee positive moods and task performance. *Journal of Applied Psychology*, 92(6), 1570.
- Twenge, J. M., Konrath, S., Foster, J. D., Keith Campbell, W., & Bushman, B. J. (2008). Egos inflating over time: A cross-temporal meta-analysis of the Narcissistic Personality Inventory. *Journal of personality*, 76(4), 875-902.
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of environmental psychology*, 11(3), 201-230.
- Underwood, B., & Froming, W. J. (1980). The mood survey: A personality measure of happy and sad moods. *Journal of personality Assessment*, 44(4), 404-414.
- Van den Broeck, A., Howard, J. L., Van Vaerenbergh, Y., Leroy, H., & Gagné, M. (2021). Beyond intrinsic and extrinsic motivation: A meta-analysis on self-determination theory's multidimensional conceptualization of work motivation. *Organizational Psychology Review*, 11(3), 240-273.
- Van den Heuvel, M., Demerouti, E., & Peeters, M. C. (2015). The job crafting intervention: Effects on job resources, self-efficacy, and affective well-being. *Journal of occupational and organizational psychology*, 88(3), 511-532.
- Van Mierlo, H., Rutte, C. G., Seinen, B., & Kompier, M. (2001). Autonomous teamwork and psychological well-being. *European Journal of Work and Organizational Psychology*, 10(3), 291-301.
- Van Mierlo, H., Rutte, C. G., Vermunt, J. K., Kompier, M. A. J., & Doorewaard, J. A. C. M. (2007). A multi-level mediation model of the relationships between team autonomy, individual task design and psychological well-being. *Journal of Occupational and Organizational Psychology*, 80(4), 647-664.
- Van Velsor, E., & Leslie, J. B. (1995). Why executives derail: Perspectives across time and cultures. *Academy of Management Perspectives*, 9(4), 62-72.
- Volmer, J., Koch, I. K., & Göritz, A. S. (2016). The bright and dark sides of leaders' dark triad traits: Effects on subordinates' career success and well-being. *Personality and Individual Differences*, 101, 413-418.
- Volmer, J., Schulte, E. M., & Fritz, C. (2023). Facilitating employee recovery from work: the role of leader-member-exchange. *Occupational Health Science*, 7(2), 297-319.
- Von Bonsdorff, M. E., Janhonen, M., Zhou, Z. E., & Vanhala, S. (2015). Team autonomy, organizational commitment and company performance—a study in the retail trade. *The International Journal of Human Resource Management*, 26(8), 1098-1109.
- Wang, A. C., Kim, T. Y., Jiang, Y., & Tang, G. (2022). Employee proactive goal regulation and job performance: The role modeling and interacting effects of leader proactive goal regulation. *human relations*, 75(2), 373-400.
- Wang, X. H. F., Kim, T. Y., & Lee, D. R. (2016). Cognitive diversity and team creativity: Effects of team intrinsic motivation and transformational leadership. *Journal of business research*, 69(9), 3231-3239.
- Warr, P., Bindl, U.K., Parker, S.K. & Inceoglu, I. (2014) Four-quadrant investigation of job-related affects and behaviours. *European Journal of Work and Organizational Psychology*, 23, 342–363.
- Westman, M., & Etzion, D. (2001). The impact of vacation and job stress on burnout and absenteeism. *Psychology & Health*, 16(5), 595-606.
- Wihler, A., Blickle, G., Ellen III, B. P., Hochwarter, W. A., & Ferris, G. R. (2017). Personal initiative and job performance evaluations: Role of political skill in opportunity recognition and capitalization. *Journal of Management*, 43(5), 1388-1420.

- Williams, H. M., Parker, S. K., & Turner, N. (2010). Proactively performing teams: The role of work design, transformational leadership, and team composition. *Journal of Occupational and Organizational Psychology*, 83(2), 301-324.
- Williamson, A. J., Battisti, M., Leatherbee, M., & Gish, J. J. (2018) 'Rest, Zest, and My Innovative Best: Sleep and Mood as Drivers of Entrepreneurs' Innovative Behavior'. *Entrepreneurship Theory and Practice*, 43(3), 582-610.
- Wirtz, N., & Rigotti, T. (2020). When grandiose meets vulnerable: narcissism and well-being in the organizational context. *European Journal of Work and Organizational Psychology*, 29(4), 556-569.
- Wolsink, I., Den Hartog, D. D., Belschak, F. D., & Oosterwijk, S. (2019). Do you feel like being proactive today? Trait-proactivity moderates affective causes and consequences of proactive behavior. *PloS one*, 14(8), e0220172.
- Wood, M. S., Bakker, R. M., & Fisher, G. (2021). Back to the future: A time-calibrated theory of entrepreneurial action. *Academy of management review*, 46(1), 147-171.
- Worku, Z. (2016). Barriers to the growth of small, micro and medium-sized business enterprises in the Vaal Triangle region of South Africa. *African journal of science, technology, innovation and development*, 8(2), 134-141.
- Wu, C. H., Parker, S. K., Wu, L. Z., & Lee, C. (2018). When and why people engage in different forms of proactive behavior: Interactive effects of self-construals and work characteristics. *Academy of Management Journal*, 61(1), 293-323.
- Wu, C. H., & Wang, Z. (2015). How transformational leadership shapes team proactivity: The mediating role of positive affective tone and the moderating role of team task variety. *Group Dynamics: Theory, Research, and Practice*, 19(3), 137.
- Zacher, H., Schmitt, A., Jimmieson, N. L., & Rudolph, C. W. (2019) 'Dynamic effects of personal initiative on engagement and exhaustion: The role of mood, autonomy, and support'. *Journal of Organizational Behavior*, 40(1), 38-58.
- Zhang, X., & Bartol, K. M. (2010). Linking empowering leadership and employee creativity: The influence of psychological empowerment, intrinsic motivation, and creative process engagement. *Academy of management journal*, 53(1), 107-128
- Zhang, K., & Cui, Z. (2022). The Impact of Leader Proactivity on Follower Proactivity: A Chain Mediation Model. *Frontiers in Psychology*, 13, 781110.
- Zovko, M. É., & Dillon, J. (Eds.). (2023). *Tourism and Culture in Philosophical Perspective*. Springer Nature.

Global Digital Platforms' Non-Market Strategies in Response to Institutional Pressure

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Abstract

Global digital platforms operate across areas ranging from social media to online marketplaces and hold dominant power in their respective areas. To counter the excess power of platforms, governments across the globe are taking regulatory action. The question how platforms respond to such interventions is a complicated one, because platforms, with their born-global mindset, operate in a range of different countries with contradictory, yet overlapping institutional demands. This paper analyses how platforms deal with such conflicting demands from home and host-country government intervention and manage the political connections between the two, using TikTok as an empirical case. Taking an institutional perspective on international business, it analyses the ramifications of government intervention on digital platforms. Although the US government has continuously challenged TikTok, the platform employs various non-market strategies in response, ranging from content moderation to legal actions and measures to mitigate institutional duality.

This paper provides insight into how host country government concerns and interventions shape a platform's choices for its non-market strategy. It shows that the nature of the institutional pressure was derived from resource competition between two countries. In addition, TikTok's scale and Chinese roots led to a higher level of scrutiny which resulted in different non-market strategy choices than domestic platforms.

Keywords

Digital platforms; international business; non-market strategy

Introduction

Globally, from the top five most valued public multinational enterprises (MNEs) by market capitalisation, four are technology firms built on digital platforms. These platforms operate across areas ranging from social media to online marketplaces and all hold dominant power in their respective areas (Cusumano et al., 2020). The growth of digital platforms has shaken up traditional industries and revolutionised the approach to internationalisation (Nambisan and Luo, 2021; Zeng, 2022). While European and US platforms dominate global platform markets, TikTok, a Chinese short-video platform, not part of the big three in China (Baidu, Alibaba, and Tencent), emerged quietly but has exerted substantial influence on the global stage. In 2019, TikTok shot to global prominence and quickly became one of the top-tier digital media platforms through its popularity and advanced algorithmic operation (Lin, 2020; Kaye et al., 2021). TikTok's emergence also stirred up discussions about the uncontrolled dominance of platforms. Government interference in platform markets used to be limited or lagged behind (Koopman et al., 2014) and platforms enjoyed unchecked dominance. In recent years, even if a single regulatory framework is lacking, government control has started reigning in the power of platforms. Government control tends to focus on two areas: content distribution and data security (Lin, 2020; Cammaerts and Mansell, 2020). Both Google and Facebook have repeatedly been fined for antitrust violations in the US and the EU, for example (Van Dijck et al., 2019).

As governments across the globe are taking regulatory action to counter and manage platforms' excess power (Flew and Gillett, 2021; Van Dijck et al., 2019), the question arises how platforms respond to such interventions. The answer to this question is not evident because platforms with their born-global mindset operate in a range of different countries with contradictory yet overlapping institutional demands. Digital firms leverage digital infrastructure

and borderless internet, often crossing multiple institutional boundaries (Parker et al., 2016). Consequently, platform-based MNEs often face two sets of institutional pressures both within the organisation and the host country, which is referred to as institutional duality (Kostova and Roth, 2002). Satisfying the needs and legitimacy requirement in one context may lead to not satisfying separate institutional forces in other contexts (Fan et al., 2023). As this multi-jurisdictional presence amplifies country-specific risks, it is important to understand how platforms interact with stakeholders across countries and navigate formal and informal institutions (North, 1990).

Platforms face unique socio-political challenges that require compromise between different stakeholders when entering new markets. Despite a vast body of literature on platform regulation, there is not much research analysing how platforms deal with conflicting demands from home and host-country governments and manage the political connections between the two (Sun et al., 2021). In this paper, we focus on the institutional pressure social media platforms face. Social media platforms possess instantaneous access to the personal data of citizens in countries where they operate, which makes their role in society rather sensitive compared to many other, more traditional industries. There is much concern about the influence of social media platforms on society, because of their potential role in political manipulation, privacy breaches, and control of social interactions (Keles et al., 2020).

TikTok provides a unique case to investigate how an emerging foreign platform adapts its strategies to better fit local policy frameworks and handles geopolitical tensions. Due to its exponential growth in the US while having Chinese roots, connections to the Chinese government have made the platform's internationalisation more than a simple story of market expansion as this process is subject to the interaction between two economic powerhouses. Therefore, we aim to examine how a digital platform employs non-market strategy to respond to the institutional duality

of conflicting home and host-country government intervention. To address this question, we draw on literature that proposes an institutional perspective on international business (IB) and analyses the ramifications of government intervention for digital platforms, using TikTok as an empirical case. Although the US government has continuously challenged TikTok, the platform has employed a multi-pronged non-market strategy in response, including measures ranging from content moderation to legal actions and attempts to shake off its Chinese roots. We provide insight into the dynamic interplay between government intervention and a platform's non-market strategic choices in a context of institutional duality.

The main contributions are twofold. First, the paper shows that using non-market strategy is pertinent for digital platforms to manage institutional duality due to their key resource: sensitive data about citizens. The empirical analysis shows that the strategic value of such data in today's world has the consequence that platforms owning the data can become a pawn in the high-stake competition between home and host countries. Second, we propose that the political sensitivity of digital platforms' handling of foreign citizens' data creates what we label as an *existentially salient issue*. Our analysis suggests that if an MNE platform fails to manage such issues effectively it risks having to exit the host country. At same time, though, the unique case of TikTok shows that non-market strategy can be effective in fending off host country government pressure, to some extent.

Literature review

Institutions and international business in the digital era

The impact of institutions on MNEs has long been an important topic in international business (IB). Verbeke et al. (2021, p.48) emphasise that an MNE's strategy should always be considered 'strategy in contexts.' IB scholars have discussed how differences in institutional

environment between host and home countries affect an MNE's strategy for market entry (Chen et al., 2006; Lehdonvirta et al., 2019). The differences create liabilities of foreignness (Zaheer, 1995; Kostova and Zaheer, 1999) and influence performance and behaviour (Kostova, 1999; Shenkar et al., 2008). Porter's (1980) industry-based view and the resource-based view (Barney, 1991) used to be the two main perspectives to study MNEs' international expansion. However, Peng et al. (2008) put forward an institutional-based view and proposed this view as the third leg of a strategy tripod, parallel to the industry- and resource-based view, to explain what drives MNEs' international expansion strategies.

The institutional-based view focuses on how institutions govern and guide MNEs' strategic decisions (Kostova and Roth, 2002; Peng et al., 2008; Curchod et al., 2020). Institutions refer to constraints ranging from formal (laws, policies and regulations) to informal 'rules of the game' (North, 1990), such as ethical norms, cultural traditions and society, which provide stability to social behaviour. Verbeke et al. (2021, p.47) describe institutions as a "trilogy: laws, rules, government agencies; dominant narratives; and norms that prescribe how things 'should' be done". Accordingly, MNEs' national identity affects how they perceive the influence of home and host-country institutions on their operations. By discussing institutional embeddedness in home, host and supranational contexts, Pinkse and Kolk (2012) argue that MNEs need to be well-embedded in the host country to overcome liabilities of foreignness but that a high level of embeddedness is not always advantageous in radically changing institutional environments. Institutions can challenge MNEs because, when entering a host country, local stakeholders tend to respond to their activities which can hinder operations (Verbeke et al., 2021).

The emergence of global digital platforms puts the interaction between MNEs and institutions in a different light. Many perceived barriers for MNEs to enter new markets, such as

liabilities of foreignness, are built on the assumption that MNEs lack knowledge about customers in the host country and need to respond to new legal regimes (Birkinshaw, 2022). However, for born-digital firms like platforms, such barriers are significantly reduced. Digital firms tend to be asset-light with less need for physical investment, which allows them to have a global-by-default identity. Digital assets operate as new kinds of firm-specific advantages for firms during their value-creation process (Verbeke and Hutzschenreuter, 2021). It is not unusual for platforms to enter a market before the host-country government can initiate entry barriers. For instance, platforms like Uber tend to be one step ahead of government as they already serve customers before entry barriers come into play (Uzunca et al., 2018). Robust legal interventions usually lag behind business activities which offers advantages to digital firms to steer how interventions affect their activities (Ko et al., 2022).

Government intervention to curtail platform power

The rise of platforms like Uber and Airbnb has boosted the market valuation of the digital economy but has led to a new wave of government intervention, too, pushing for regulation to ban or curtail their operations (Cannon and Summers, 2014; Rauch and Schleicher, 2015). Digital platforms are organised around a stable—but flexible—technological core that enables exchanges and facilitates interactions among distinct users from multiple sides of the platform who are connected in ways otherwise impossible (Gawer and Cusumano, 2014; Rochet and Tirole, 2003). Digital platform competition tends to lead to a ‘winner-take-all’ outcome through network effects; a first-mover advantage is reinforced through positive feedback loops to dominate the market (Cennamo and Santalo, 2013; Eisenmann et al., 2006). Platforms’ ability to develop an accessible infrastructure and manage a set of platform mechanisms, combined with its potential to leverage

network effects, have become crucial conditions for user accumulation which boosts platform power and creates high switching costs for users (Van Dijck et al., 2019; Nieborg and Poell, 2018).

Platforms' increasing power has raised questions about their governance and how they should be regulated. Scholars, politicians, and citizens increasingly question whether the available regulatory tools are sufficiently agile to address the authority of powerful platforms. Worries about platform power extend beyond simple economic concerns; such power not only affects markets but also society (Moore and Tambini, 2018; Van Dijck et al., 2019). In response to such worries, media platforms, in particular, have defended themselves by highlighting their role as intermediaries, not publishers of the content distributed on their platforms (Flew et al., 2019). In the US, the 1990s 'safe harbour' provision enshrined the rights of media platforms that they cannot be held liable for user-generated content (Flew and Gillett, 2021).

Growing platform power has led to questions about market dominance as well as privacy and threats to democracy. Privacy issues do not only refer to using data collection to target commercials to users, but also to data being used in malevolent ways, including collecting data from children without parental consent, political manipulation and potential government surveillance (Srnicek, 2017; Alleman et al., 2020). The Cambridge Analytica scandal underscored the malevolent use of personal data. While these instances court controversy, the sheer size and scale of the largest digital platforms have generated such capacity for market dominance that the call for more intense regulation has become almost inevitable. So far, a lack of regulatory action is due, in part, to digital platforms not entirely fitting within the earlier interventionist strategies to regulate media content or communication networks. Policymakers have struggled to devise efficient regulatory measures to address public concerns and potential threats posed by platforms (Cammaerts and Mansell, 2020). Although there has been an ideological preference for self-

regulation in the West, this approach is now deemed insufficient and has neglected the protection of public values and citizen welfare (Mansell, 2015).

Consequently, government intervention has started to abound in response to concerns about growing platform power and dominating positions in the global ‘datafication’ of markets (Cohen, 2017). Such government intervention is not new; lawmakers have a long history of attempting to curtail platform power. The United States vs Microsoft case in the 1990s set a landmark in the antitrust intervention of internet industries. The European Commission fined Google €2.4 billion for treating its products more favourably than those of competitors in the results of its search engine (Buttà, 2018), €4.3 billion for breaching European Competition rules, and another €1.5 billion for antitrust violations (Van Dijck et al., 2019). Most literature on platform regulation has focused on the West, especially US platforms. As Chinese platforms are gaining prominence globally, differences in the institutional environment between China and the West have brought challenges to platforms operating across these markets. While platform regulation in the West is underpinned by liberal democratic styles, China carries a paternalistic ideology with command-and-control regulation (Wang and Lobato, 2019). International platforms thus face an increasingly complex institutional environment. It is not clear how a host country’s interventions affect them, what role the home country plays in the background, and how platforms act in response.

Platforms’ non-market strategies

Non-market strategies are instrumental to MNEs in coping with pressures from two different institutional environments simultaneously, home and host country, which is referred to as institutional duality (Hillman and Wan, 2005; Mellahi et al., 2016; Ko et al., 2022). Kostova and Zaheer (1999, p.70) stress that the challenges MNEs face in ‘multiple country institutional

environments' differentiate them from local firms, such as different standards, which affect the institution's perception of the MNEs and their legitimacy. Extant literature provides valuable insight into how MNEs use non-market strategy to facilitate operations in host countries (Oliver, 1991; Doh et al., 2012; Curchod et al., 2020), find strategic fit with distinctive institutional environments (Keim and Hillman, 2008), and help them to develop firm-specific advantage in the host markets (Kolk and Pinkse, 2008). Clark et al. (2017) argue that an important determinant of how firms respond to institutional pressure in terms of resource and attention allocation is issue salience. Highly salient issues tend to attract more public and political scrutiny, and carry greater risks, which requires more nuanced strategies (Lynn et al., 2021; Bonardi and Keim, 2005). Non-market strategies can help MNEs navigate institutional complexities, especially when they are engaged in resource-intensive industries (Gao et al., 2010). Such strategies comprise corporate social responsibility (CSR) to build a social reputation and forestall potential government intervention (Baron, 1995; Khan et al., 2015; Doh et al., 2017), and corporate political activity (CPA) to gain government support and block unfavourable policies (Liedong et al., 2017; Doh et al., 2012).

While existing research has explored the efficacy of non-market strategies for traditional MNEs, less attention has been paid to the societal and political challenges platforms face (Yi et al., 2023) and how they re-configure their strategic plans to gain legitimacy while expanding in a host country (Sun et al., 2021). Developing an understanding of digital platforms' non-market strategies in an IB context is important for several reasons. First, these born-global firms often struggle to gain legitimacy while internationalising, which is particularly challenging for platforms which leverage borderless internet to create value (Khan et al., 2023). Second, as the challenges they face in host countries are often related to data privacy, cultural disparities, and political conflicts (Yi et

al., 2023), a continuously changing political and legal environment in the host country creates uncertainty and heightens the risks of failure. For example, Uber faced legitimacy challenges in London, while Google and Meta have repeatedly been fined for data privacy violations in the US and Europe. Third, platforms operate in ecosystems that encompass stakeholders from multiple sides and spread societal impacts across sectors (Gawer, 2009).

While non-market strategies could help platforms in addressing these concerns, only a few studies have explored these strategies. Curchod et al. (2020) examine how eBay used defensive and proactive non-market approaches to gain political legitimacy. With defensive strategies, platforms demarcate their responsibilities and focus on self-regulation to avoid potentially threatening government interventions, while with proactive approaches they shape institutions by contributing to the creation of new regulations. Uzunca's et al.'s (2018) case study of Uber sees countries as complex institutions and suggests that similar strategies have different results in shaping the institutional environment in host countries. Ko et al. (2022) argue that non-market strategies equip platforms to cultivate and leverage digital trust building which is an important building block in gaining political capabilities, essential for platforms to gain societal legitimacy. Digital platforms tend to actively pursue non-market strategies (Curchod et al., 2020), because the nature of their business brings together market and non-market stakeholders (Gillespie, 2017; Uzunca et al., 2018). Only through active stakeholder participation can platforms generate network effects. It is important for platforms to be perceived as legitimate entities to garner stakeholder support and non-market strategies play an important part in this process (Ko et al., 2022).

While there is a large body of IB literature examining the non-market strategies and digital platforms in isolation (Khan et al., 2023), there is limited research bringing them together. It is not yet clear how platforms use non-market strategy to address the risk of a surge in government

intervention and manage relations with home and host country governments. Next, we therefore analyse TikTok's non-market strategies to explain how platforms manage institutional pressures in the form of contradictory yet overlapping institutional demands from home and host-country governments.

Data and methods

TikTok is a live-streaming social networking service used to create and share short videos that typically last 15 seconds or less and can go up to three minutes. The app's parent company, ByteDance, is a Chinese technology firm that operates a range of content platforms. TikTok and its Chinese counterpart, Douyin, are two of its core products that provide nearly identical services. Late 2016, ByteDance launched Douyin in China while two years later it acquired the lip-syncing app Musical.ly and folded it under a new name TikTok (an overseas version of Douyin). TikTok was launched globally and has been one of the world's fastest-growing social media platforms since. It was the top app by worldwide downloads in Q1 2022 with over 36.9 billion Google Play and App Store downloads.¹ TikTok has over a billion monthly active users worldwide, with approximately 85 million in the US only.² However, being a platform developed by a Chinese parent, the platform logic developed domestically seems to contradict the international platform logic in terms of censorship style and commodification. As TikTok is becoming increasingly dominant in the US short-video app market, it has received scrutiny from US authorities for its lack of transparency, Chinese censorship style, and potential government surveillance. Our

¹ Sensor Tower (2022). *Store Intelligence Data Digest*. Accessed on 28 June 2022 from <https://go.sensortower.com/rs/351-RWH-315/images/Sensor-Tower-Q1-2022-Data-Digest.pdf>

² Statista (2022) *Number of TikTok users in the United States from 2020 to 2023*. Accessed on 25 June 2022 from <https://www.statista.com/statistics/1100836/number-of-us-tiktok-users/>

empirical analysis focuses on US government intervention to regulate TikTok and the platform's non-market strategy in response, for five years it has been operating in the US market (2018-2022).

We adopt a qualitative approach (Gioia et al., 2013) to analyse how TikTok has responded to various types of government intervention. While TikTok is available in over 150 markets, our analysis focuses on the US market. The US has the largest number of TikTok users and here its operations have suffered from intense investigations from the US government amid the increasing tension between the US and China. TikTok has received scrutiny for owning vast amounts of data collected from US citizens and for its Chinese roots. The analysis used three types of data to elaborate the US government's and TikTok's actions: (1) news articles and press releases, (2) blogs and magazines discussing each event identified in the timeline, and (3) archival documents, including the corporate archives and government announcements related to TikTok. Table 1 summarises the data sources and explains how they contributed to the analysis.

The core of the dataset used for the analysis is comprised of news articles from the *Financial Times*, *Wall Street Journal*, and *The New York Times* which report on government and public concerns about TikTok and the platform's responses in dealing with these concerns. We first collected relevant articles from these newspaper sources by searching for keywords in the Factiva database, including *TikTok* and *ByteDance*. The results were manually filtered to keep those relevant to company actions, strategies, and decisions made by TikTok's US operational team and its parent company ByteDance, and the government interventions targeting the firm. We created an event timeline of TikTok over the five years of development, expanding it by adding supplementary material collected from other archival sources such as websites, blogs, and government announcements.

----Insert Table 1 here----

The data was coded and analysed using NVivo. To identify TikTok's main moves and actions, we first established a timeline of events for TikTok to analyse what happened to the platform, and what they did to engage with the issues. This first step of the data collection involved exploratory coding and generated first-order themes, such as government concerns about TikTok, and the specific strategic approaches that TikTok took to address such concerns. As the research progressed, we were seeking for similarities and differences among identified categories and merged those that were similar. We then labelled the first-order themes with descriptive phrases, considering what were the causes of those events, and what types of approaches the firm took to address them. After developing these labels we moved from first-order themes to second-order themes and aggregate dimensions (Gioia et al., 2013). The data was coded with two focal points: the nature of the institutional pressure and the platform's non-market strategy approach.

Figure 1 shows the initial coding structure for government interventions and the underlying concerns. We started with collecting information about government decisions and reasons for raising questions or investigations about TikTok. Regarding the app's content control, many first-order themes revolved around TikTok's content distribution, but they led to different types of concerns that are shown as second-order themes. Some of the concerns related to misleading and harmful content on TikTok and political manipulation. The more intensive investigations related to TikTok's data management, such as data privacy and the potential threats to the US' national security, and some led to direct government intervention.

----Insert Figures 1 and 2 here-----

Figure 2 shows TikTok's non-market strategy approach. The first-order themes describe specific strategies TikTok has adopted to address different types of government concern. We first collected TikTok and its parent company ByteDance's actions in response to the institutional

pressures and potential threats. These strategic moves formed the first-order themes and were further classified into second-order themes depending on whether the strategies or responses directly or indirectly addressed the institutional pressures. For more direct responses, TikTok tends to take quick and prompt measures to ensure its content moderation system meets the institutional requirements, such as scaling up moderator teams, tighter guidelines and taking down inappropriate content. Sometimes the changes come with public announcements from TikTok's spokespeople before or after changes were made, including clarification on specific issues or official apologies. Legal actions were taken when TikTok's survival in the host country market was under threat, such as legal injunctions against the official order. There were also more indirect responses, some of which were externally encouraged by home-country government intervention. The data shows that TikTok made frequent human resources arrangements while trying to convince the host country that they are an independently operated subsidiary in the US market by negating its Chinese roots. Besides, adopting strategies strictly adhering to government demands, TikTok adopted more subtle approaches, such as self-regulation and improving the user experience to gain the trust of users.

Findings

Institutional Pressure

TikTok was not the first social media platform in the US market to come under regulatory investigation and suffer public criticism. However, apart from the legislation which is common to regulate content platforms such as YouTube and Twitter, TikTok faced fiercer challenges from the host-country government because of its Chinese roots and concerns about data security issues. The

host-country institutional pressure revolved around two themes: (1) content control and (2) data privacy and national security (see Table 2).

----Insert Table 2 here----

Content control

Content control refers to measures and concerns over videos and posts uploaded by the TikTok userbase. As a platform built on user-generated content, TikTok had much potentially misleading, distorted, and unverified content which put the platform in a difficult position between providing an open space for the user community and being a satisfactory moderator.

Misleading information. Among the vast amount of content uploaded to the platform daily, the fact that some content contains potentially misleading information is one of the biggest public concerns. By the first quarter of 2022, TikTok had accrued over 3.5 billion downloads and more than a billion users and became the world's most downloaded app only less than four years after its launch.³ However, the platform quickly turned into a source for unverified advice and news, which reflected shortcomings in content control moderation. In 2020, a notorious social media conspiracy theory – “PizzaGate” – was back on TikTok. Four years earlier, this groundless notion that Hillary Clinton was involved in running a child sex abuse ring spread across the internet ahead of the 2016 US presidential election.⁴ Just months before the next election in 2020, the conspiracy theory's return on TikTok illustrated how an idea with no proof to back it up could easily blossom on the platform which raised concerns how dangerous it could be.

In 2021, TikTok became a place to go for financial advice. Although TikTok was not the only platform providing personal finance content, it was a hit with young generations with its

³ Financial Times (2022). ‘*Elon, there are rules*’. Accessed on 15 Feb 2022 from <https://www.ft.com/content/07a19350-4737-4d1c-ba1b-462d85580e34>.

⁴ The New York Times (2020). *In TikTok Era, New Life for a Conspiracy Theory*. Accessed on 15 Nov 2022 from <https://www.nytimes.com/2020/06/27/technology/pizzagate-justin-bieber-qanon-tiktok.html>.

easily digestible, quick-hit content that could instantly capture the users' attention. But could users, who are mostly in their early 20s and high school students, trust the advice shared by so-called influencers on the social media platform about buying stocks or money investment? Concerns regarding the identity and qualifications of people providing such advice were also raised. Some TikTok content contained misleading information which could result in a huge financial loss, according to financial professionals and some users who came across that content.⁵

Before TikTok suspended livestreaming and new content uploads from Russia, it was one of the most popular social media platforms for users to watch live updates and video clips of the fighting in Ukraine. For the first time, TikTok had to deal with the flood of content about a single issue that was captivating a global audience. However, the platform was accused of distributing misleading and distorted information – many of which was unverified – and failed on proper moderation.⁶

Political manipulation. TikTok became more political over the years as it was increasingly being used as channel to spread information that could have an impact on the political stage. In 2019, TikTok banned political advertisements and a spokesperson explained that the platform is committed to bringing joy to the users rather than serving politicians as a weapon to win campaigns.⁷ Unlike the written press, most TikTok content is user-generated and catchier with background music and memes. In the last three weeks of 2019, the hashtag “#Trump2020” was viewed over 200 million times, and both major parties were considering using TikTok to reach out

⁵ The Wall Street Journal (2021). *TikTok Is the Place To Go for Financial Advice If You're a Young Adult*. Accessed 15 Nov 2022 from <https://www.wsj.com/articles/tiktok-financial-advice-11619822409>.

⁶ The New York Times (2022). *TikTok Is Gripped by the Violence and Misinformation of Ukraine War*. Accessed 15 Nov 2022 from <https://www.nytimes.com/2022/03/05/technology/tiktok-ukraine-misinformation.html>.

⁷ TechCrunch (2019). “*TikTok explains its ban on political advertising*”. Accessed on 11 Feb 2022 from <https://techcrunch.com/2019/10/03/tiktok-explains-its-ban-on-political-advertising/>.

to younger voters.⁸ In June 2019, thousands of teenagers were motivated by videos on TikTok, which encouraged viewers to reserve tickets for Mr. Trump’s rally without attending. It resulted in around 6000 people attending the rally – with at least one-third of the venue’s seats empty – but with more than one million ticket requests.⁹ Although it was mostly teens that inflated attendance, it was a grandmother who originated the ticket-claiming idea as a trolling effort. This “TikTok Grandma” had been hired by a grass-roots organisation, Biden Digital Coalition, to support Mr. Biden’s presidential campaign.¹⁰ TikTok was argued to shape politics, despite its parent company’s (ByteDance) claims of staying political-free. The New York Times found it was easy for the youth to find powerful political statements and activists as TikTok-specific algorithms help to facilitate connections between like-minded groups and enable collective political expressions.¹¹

Harmful and extreme content. Apart from misleading information on financial issues, TikTok was blamed for distributing content that could lead to potential harm to users, especially teenagers. In May 2022, it was accused of promoting unverified health advice which led to a wave of eating-disorder cases across the country. In the following month, in a lawsuit against TikTok, a mother claimed that her 10-year-old daughter passed away after attempting the ‘blackout challenge’ that she had seen on the app.¹² One month later, an expert warned the public against herbal

⁸ The Wall Street Journal (2020). “*TikTok Wants to Stay Politics-Free*”. That Could Be Tough in 2020. Accessed on 24 Nov 2022 from <https://www.wsj.com/articles/tiktok-wants-to-stay-politics-free-that-could-be-tough-in-2020-11578225601>

⁹ The Wall Street Journal (2020). *How TikTok Users Targeted Trump Rally*. Accessed on 24 Nov 2022 from <https://www.wsj.com/articles/how-tiktok-users-targeted-trump-rally-11592795368>.

¹⁰ The New York Times (2020). ‘*TikTok Grandma*’ Who Helped Tank Trump Rally Now Works for Biden. Accessed on 24 Nov 2022 from <https://www.nytimes.com/2020/06/26/technology/tiktok-grandma-trump-biden.html>.

¹¹ The New York Times (2020). *TikTok Is Shaping Politics. But How?* Accessed on 24 Nov 2022 from <https://www.nytimes.com/2020/06/28/style/tiktok-teen-politics-gen-z.html>.

¹² The Wall Street Journal (2022). *A mother is suing TikTok, alleging that her 10-year-old daughter died after attempting to do the "blackout challenge" that she saw on the app*. Accessed on 15 Nov 2022 from <https://www.wsj.com/articles/mother-sues-tiktok-after-alleging-10-year-old-daughter-died-from-doing-blackout-challenge-11652815865>.

remedies shown on TikTok which could cause abortion that ‘there isn’t any data on whether they work’ and informed the public those medicines ‘have adverse side effects’, and are ‘highly toxic’.¹³

Data privacy and national security

Since the app’s launch in 2018, TikTok has been accused of monitoring US users and censoring politically sensitive speech. The worries largely come down to a breach of data privacy regulations and are linked to the platform’s country of origin.

Data privacy violations. TikTok has been blamed for failing to keep users’ data safe on their servers. Multiple cases were related to children data protection. In May 2020, TikTok was accused of breaching a settlement which the app had agreed with the Federal Trade Admission (FTA) over child privacy. The settlement concerned major changes to settle charges of the children’s only privacy law that its processor, Musical.ly, had violated, including collecting information about children under 13 without parental permission. According to consumer groups, TikTok had failed to obtain parents’ permission, to remove accounts of children under 13, and had allowed minors to register a new over-13 account simply using a fake birth date.

Since 2019, TikTok has come under scrutiny, too, for not doing enough about protecting children from potential predators. According to the Financial Times, the US Department of Homeland Security (DHS) conducted seven times as many investigations into TikTok-related child exploitation between 2019 and 2021. In April 2022, TikTok was investigated over its handling of child-abuse content on its app. The unit chief of child exploitation investigations of DHS

¹³ The New York Times (2022). *Toxic and Ineffective: Experts Warn Against ‘Herbal Abortion’ Remedies on TikTok*. Accessed on 15 Nov 2022 from <https://www.nytimes.com/2022/07/11/well/herbal-abortion-tiktok-mugwort-pennyroyal.html>.

commented: ‘It is a perfect place for predators to meet, groom and engage children.’¹⁴ With over 10,000 human moderators worldwide who had taken down 96 per cent of content that violated the community guidelines before anyone viewed them, a few flagged videos still slipped through.

National data security threats. Government authorities were dissatisfied about the content TikTok showed or what was not allowed on the platform. In May 2019, a US senator called for an investigation into suspicious issues and claimed that TikTok is an information weapon of China, used to modify people’s understanding of events as it seemed to follow the same censorship guidelines that govern Chinese firms, such as Baidu and Tencent. At that moment, TikTok’s decisions about content distribution were opaque. ByteDance provided no information or details about the content they removed. There was no public resource for researchers to gain an insider view. Both content bans led to concerns about TikTok’s Chinese-style censorship and its purported data independence from ByteDance.

In 2020, the popularity of TikTok had soared under the pandemic lockdown. Regulatory concerns escalated as it went viral among teenagers. In January, an Israel-based cybersecurity firm exposed that TikTok’s database had ‘serious vulnerabilities’¹⁵ that allowed attackers to manipulate user accounts and reveal personal information through the company’s website. In July, regulators again expressed concerns that TikTok was collecting users’ private data the Chinese government could use. President Trump said he was considering taking steps to ban TikTok from the US, citing national security risk concerns.

In 2021, discussions about data security and potential threats of TikTok continued between ByteDance and US national security officials. In February, the Biden Administration reconsidered

¹⁴ Financial Times (2022). *TikTok under US government investigation on child sexual abuse material*. Accessed 22 Nov 2022 from <https://www.ft.com/content/d5549d48-8f02-464c-9c7d-17404a5b6d02>.

¹⁵ The New York Times (2020). *Major TikTok Security Flaws Found*. Accessed 24 Nov 2022 from <https://www.nytimes.com/2020/01/08/technology/tiktok-security-flaws.html>.

the former president's ban on TikTok which was shelved after Mr. Trump lost the presidential election. In June, President Biden revoked the ban on TikTok. Instead of implementing the executive order from the Trump-era, the new administrative order launched a review of a broader range of foreign-owned apps over potential data security concerns. The non-stop calls for investigation show US officials' sustained pressure on TikTok. Although the Biden Administration has been considering various measures to restrain the potential national security risks of TikTok and its Beijing-based parent firm, it has publicly pushed the platform to isolate itself from its Chinese roots.

Government intervention. While some government concerns about TikTok would remain concerns, others were evolving into concrete government intervention. In August 2020, President Trump considered following India's lead and vowed to ban the app from US app stores over national security concerns. Although TikTok agreed to sell its US operations in full to a local firm to save it, Mr Trump insisted on the action and commented: 'any deal is not acceptable...as we are not an M&A (merger and acquisition) country.'¹⁶ However, he changed his mind, claiming he would support such deals if the US would get a substantial percentage from the sale. He issued two executive orders. The first order demanded that all transactions with ByteDance should be halted and gave TikTok 45 days to find a local buyer, or the app would be permanently removed from US app stores. The second order provided TikTok with a 90-day deadline to divest its operations. The decision weighed heavily on ByteDance. Zhang Yiming, ByteDance's CEO at that time, wrote to employees: 'as a company, we must abide by the local laws...we have no choice

¹⁶ Financial Times (2020). *ByteDance races to salvage TikTok deal after Trump vows ban*. Accessed on 13 March 2022 from <https://www.ft.com/content/40368c06-d824-4188-ae1d-ac3d58ea3221>

but to comply...and it was not our purpose.’¹⁷ Although the accusation was vague, and ByteDance said it was willing to offer an ‘unprecedented level of transparency’ to ease the suspicion,¹⁸ TikTok’s presence still seemed threatening to US regulators, and President Trump insisted on acting. At the start of 2021, TikTok was officially banned in India. In the US, TikTok survived Trump’s potential ban after he lost the presidential election. The Biden administration left the negotiation in limbo. However, in April 2021, lawmakers reintroduced legislation to ban TikTok from government devices. The bill was passed in May after the original bill, “No TikTok on Government Devices Act”, had been passed by the US Senate Committee in August 2020.¹⁹

TikTok’s non-market strategy

Not every part of the non-market strategy that TikTok adopted was to address specific government concerns, but most measures aimed to solve related issues. TikTok used direct non-market responses as well as indirect ones (see Table 3).

----Insert Table 3 here----

Directly responding to institutions’ requirements

TikTok addressed government concerns with issue-specific moves. The data shows how TikTok responded to regulations directly, taking various measures.

Content moderation. TikTok is a content firm as all their services revolve around content distribution. In 2019, when the platform was questioned about censoring content to please the Chinese government, it first clarified that their content moderation and guidelines were led by US-

¹⁷ Financial Times (2020). *Chinese group had ‘no choice’ but to comply with demands from US regulators and sell app*. Accessed on 17 March 2022 from <https://www.ft.com/content/235b431c-bf4d-4baf-b84a-ff8ab5f45761>

¹⁸ BBC (2020). *TikTok and WeChat: US to ban app downloads in 48 hours*. Accessed on 13 March 2022 from <https://www.bbc.co.uk/news/technology-54205231>

¹⁹ Reuters (2021). *Bill to ban TikTok on U.S. government devices passes committee*. Accessed on 05 June 2022 from <https://www.reuters.com/technology/bill-ban-tiktok-us-government-devices-passes-committee-2021-05-12/>

based teams. The platform hired law firms to help and advice its internal reviewing team on content policies. Following the moderation team's expansion, they embedded moderation programming within the app's built-in video-creating suite to ensure videos contain no banned content such as violence or nudity, even before the video is ready for uploading. In addition, TikTok uses a combination of AI and human moderators as an extra safety measure, with more than 10,000 human moderators worldwide. It had been rapidly hiring staff even amid the pandemic.

When faced with allegations of promoting harmful, extreme, and misleading information, TikTok tended to react quickly, right after raised concerns. In the first quarter of 2020, TikTok overhauled its community guidelines to clarify what kinds of videos are prohibited, covering over ten categories of content from racial slurs to misleading and unverified medical advice, amid increasing scrutiny over its content distribution and data security. A spokesperson explained that the expanded guidelines are to provide enough clarity for users where they did not do so previously.²⁰

Public announcements. TikTok used public announcements as one of the direct responses in addressing government concerns, often in the form of clarification, disclaimers, and official apologies. In November 2019, after national security investigations were raised claiming that TikTok is an information weapon as the platform censored videos that were deemed sensitive under Beijing's regulations, TikTok posted three public statements on its website within thirty days, stating the following to address data privacy concerns: 'We store all TikTok US user data in the United States... our data centres are located entirely outside of China, and none of our data is

²⁰ The Wall Street Journal (2020). *TikTok Tightens Rules on Video Content and User*. Accessed on 25 Nov 2022 from <https://www.wsj.com/articles/tiktok-tightens-rules-on-video-content-and-users-11578510808>

subject to Chinese law.’²¹ To address concerns about content control, the platform argued: ‘Let us be very clear: TikTok does not remove content based on sensitivities related to China. We have never been asked by the Chinese government to remove any content, and we would not do so if asked.’ Two of the three statements were written by TikTok’s general manager, Venessa Papas, who emphasised that the US-based leadership team and the moderation team behind TikTok would remain independent of demands from Beijing regulators, and that TikTok has built a sturdy US-based team composed of experts in trust and safety issues.²²

Following these public statements, TikTok made an apology to a teenager who had her account suspended after posting a video that was deemed sensitive under Chinese censorship guidelines and claimed it had been a ‘human moderation error’. TikTok restored the video and her account and published the timeline clarifying that the takedown was triggered by a different video by the user featuring photos of Bin Laden, which was strictly prohibited by the platform’s terms and conditions on terror-related material.²³

Such a direct response arguing incorrect content moderation is not unique to TikTok. Many digital platforms, such as Google and Facebook, are always quick to apologise when they are caught or questioned doing things that are inappropriate, illegal, or controversial. They ‘break’ things and ask for forgiveness afterwards and make promises to take corrective approaches that are often not fulfilled. As concerns continued to grow after the first call for investigations on the platform’s censoring mechanisms, TikTok has been actively updating its transparency report every six months. This report included a list of the firm’s detailed responses to address take-down

²¹ TikTok (2019). *Statement on TikTok's content moderation and data security practices*. Accessed on 5 June 2022 from <https://newsroom.tiktok.com/en-us/statement-on-tiktoks-content-moderation-and-data-security-practices>

²² TikTok (2019). *Explaining TikTok's approach in the US*. Accessed on 06 June 2022 from <https://newsroom.tiktok.com/en-us/explaining-tiktoks-approach-in-the-us>

²³ TikTok (2019). *An update on recent content and account questions*. Accessed on 06 June 2022 from <https://newsroom.tiktok.com/en-us/an-update-on-recent-content-and-account-questions>

requests from governments across the globe,²⁴ showcasing collected data and analysis regarding government requests, intellectual property removal requests, and private information requests.

Legal actions. When institutional pressure could not be effectively mitigated through subtle non-market strategies and pressure led to a survival-threatening situation for the business, TikTok took legal action against official government orders by requesting legal injunctions and filing lawsuits. In 2020, while ByteDance hoped to reach a deal to sell its US operations of TikTok in exchange for permission to remain in the US, a new set of regulations announced by the China Ministry of Commerce put the whole plan at risk. The new rule updated 23 restrictions on export controls, including ‘personalised information recommendation services based on data analysis.’²⁵ It implied that firms must through a licensing procedure and obtain approval from the Chinese government for any technology exports, which affected ByteDance, as TikTok’s whole operation is built on algorithms. China Daily, the Chinese state media, condemned the deal and criticised it, arguing that Beijing had no reason to approve such an agreement.²⁶ One month after Beijing’s release of the new export control terms, TikTok filed a lawsuit and requested a legal injunction against Trump’s app store ban, claiming that there was insufficient time to obtain permission from the home-country government to fulfil the order’s requests.²⁷ ByteDance succeeded, as it was

²⁴ TikTok (2020). *Our first Transparency Report*. Accessed on 08 June 2022 from <https://newsroom.tiktok.com/en-us/our-first-transparency-report>

²⁵ Financial Times (2020). *TikTok’s US sale put at risk by new Chinese tech rules*. Accessed on 17 March 2022 from <https://www.ft.com/content/b87186b4-081c-49a6-a269-6d6db52fc1c8>

²⁶ The Wall Street Journal (2020). *Chinese State Media Signal Beijing’s Disdain for ‘Dirty and Unfair’ TikTok Deal*. Accessed on 17 March 2022 from <https://www.wsj.com/articles/chinese-state-media-signal-beijings-disdain-for-dirty-and-unfair-tiktok-deal-11600878455>.

²⁷ Financial Times (2020). *TikTok requests injunction against US app store*. Accessed on 17 March 2022 from <https://www.ft.com/content/e8c5cb67-f16b-4790-8617-f142f4dc013a>

granted reprieve from the ban after a judge in Washington D.C. temporarily blocked the order one minute before it would have taken effect.²⁸

Before reaching the second order's deadline, Biden was elected as US President. TikTok filed another legal petition, requesting a 30-day extension on the order that forced TikTok to sell its US operation.²⁹ The Committee on Foreign Investment in the United States (CFIUS) granted the firm a one-week extension to finalise the terms of the deal.³⁰ Although TikTok is still under scrutiny from the Biden Administration, it has survived and did not lose its US operations. The data show an interesting incentive behind more aggressive approaches: Chinese government intervention. Home-country support had helped TikTok to gain bargaining power in its negotiations with US authorities.

Indirectly addressing institutional pressure

TikTok addressed government concerns with more general strategic moves in a more indirect way with various measures.

Human resource management. Since the start of the global expansion, TikTok has been making constant adjustments to its human resource management. First, they tried to build a localised management team, but then more arrangements were made to distance the US subsidiary from home country China. In 2018, after merging with Musical.ly, ByteDance recognised it needed to show that its allegiance lies with the US, not China, in the US market. Authorities believed that TikTok's not mentioning its ties to China made it suspicious. TikTok managed to become a

²⁸ The Guardian (2020). *Court temporarily blocks Trump order banning TikTok from US app stores*. Accessed on 24 March 2022 from <https://www.theguardian.com/technology/2020/sep/28/us-judge-temporarily-blocks-trump-order-banning-tiktok-app-store-downloads>

²⁹ Reuters (2020). *China's ByteDance challenges Trump's TikTok divestiture order*. Accessed on 24 March 2022 from <https://www.reuters.com/article/usa-tiktok-idUSKBN27R07W>

³⁰ Reuters (2020). *The U.S. not extending TikTok divestiture deadline, but talks will continue*. Accessed on 24 March 2022 from <https://www.reuters.com/article/us-usa-tiktok-exclusive-idUSKBN28F00V>

seemingly local US firm which started with the plan to give US managers greater control. In 2018, TikTok first hired YouTube's former global head of creative insights, Venessa Pappas, as general manager.³¹ Then it recruited former Facebook executive, Blake Chandlee, to accelerate its global expansion in the hope to scale platform's advertising business.³² Shortly after, in June, ByteDance registered its first lobbyist and expanded the group the following month, including several former Members of Congress.³³

Since 2020, TikTok has stepped up efforts to prove its independence from China by hiring US executives as the US-China relationship had been escalating. In January 2020, ByteDance was reported seeking new executives to oversee its Chinese business to let founder and CEO Yiming Zhang focus on US market issues. In May, Disney's former streaming executive, Keven Mayer, was hired as TikTok's CEO in the US.³⁴ However, Mayer resigned only three months later amid worsening US-China relations, i.e., one week after the US Administration issued the ban on TikTok. Meanwhile, TikTok handed out cash bonus rewards to its full-time global employees, which were worth half their monthly base salary, to help 'overcome the pandemic and the changing environment.'³⁵ After a year of challenging US authorities, in 2020 ByteDance announced its biggest restructuring since its launch by replacing its CEO. In April 2021, ByteDance appointed its new CFO from Singapore, Shouzi Chew, as the new TikTok CEO, only after five weeks of

³¹ The New York Times (202). *The Woman Taking Over TikTok at the Toughest Time*. Accessed on 19 May 2022 from <https://www.nytimes.com/2020/09/11/technology/tiktok-vanessa-pappas-bytedance.html>

³² CNN News (2021). *She was promoted just in time to lead TikTok through a 'Category 5 storm'*. Accessed on 19 May 2022 from <https://edition.cnn.com/2021/01/04/tech/tiktok-interim-head-vanessa-pappas/index.html>

³³ Politico (2019). *Former congressman will lobby for TikTok*. Accessed on 03 June 2022 from <https://www.politico.com/newsletters/politico-influence/2019/11/19/former-congressman-will-lobby-for-tiktok-782697>

³⁴ The New York Times. *Disney's Head of Streaming Is New TikTok C.E.O.*. Accessed on 15 May 2022 from <https://www.nytimes.com/2020/05/18/business/media/tiktok-ceo-kevin-mayer.html>

³⁵ Reuters (2020). *ByteDance to hand out cash bonuses to staff amid U.S. pressure on TikTok*. Accessed on 17 May 2022 from <https://www.reuters.com/article/us-china-bytedance-bonuses-idUSKBN25Z0MM>

joining ByteDance.³⁶ In November, ByteDance announced Chew would vacate the CFO position to solely focus on overseeing TikTok.³⁷

Home country intervention. Beijing's intervention on TikTok's operations in the US market never weakened. When ByteDance promised an initial public offering (IPO) for TikTok to satisfy Trump's executive orders, the plan reached a deadlock due to Chinese government involvement.³⁸ Beijing overhauled its overseas IPO rules to include new requirements that Chinese firms with over one million users must undergo a cybersecurity review when seeking to be listed abroad, not to risk national security.³⁹ Previously, Chinese firms did not need government approval to be listed overseas. Interestingly, ByteDance took more note of such Chinese involvement than the Chinese ride-hailing app Didi Global. Didi went ahead with its IPO plans in the US, despite the Chinese cybersecurity administrator's warning to delay and conduct a self-examination of its network security, weeks before its listing.⁴⁰ In 2021, when the pressure from the Trump Administration subsided and the Biden Administration cast aside the ban, ByteDance's final decision was to put the IPO plan on ice after meeting with Chinese regulators that asked the firm to focus on data security risks.⁴¹

³⁶ Financial Times (2021). *TikTok names Shouzi Chew as new CEO*. Accessed on 05 June 2022 from <https://www.ft.com/content/c7cf94c1-ea4e-46d2-8e27-99fa71adb5c2>

³⁷ BBC News (2021). *ByteDance: TikTok's co-founder to step down as chief executive*. Accessed on 05 March 2022 from <https://www.bbc.co.uk/news/business-57181225>

³⁸ Financial Times (2020). *ByteDance proposes US IPO for TikTok to woo White House*. Accessed on 24 March 2022 from <https://www.ft.com/content/8d2c74d6-d742-4fa9-b7cf-5af9bb85af6b>

³⁹ China Briefing (2022). *China Spells Out Rules for Overseas IPOs of Domestic Companies, VIEs*. Accessed on 08 June 2022 from <https://www.china-briefing.com/news/china-spells-out-rules-for-overseas-ipos-of-domestic-companies-vie/>

⁴⁰ The Wall Street Journal (2021). *Chinese Regulators Suggested Didi Delay Its U.S. IPO*. Accessed on 07 June 2022 from https://www.wsj.com/articles/chinese-regulators-suggested-didi-delay-its-u-s-ipo-11625510600?mod=article_inline

⁴¹ The Wall Street Journal (2021). *ByteDance Shelved IPO Intentions After Chinese Regulators Warned About Data Security*. Accessed on 07 June 2022 from <https://www.wsj.com/articles/bytedance-shelvedipo-intentions-after-chinese-regulators-warned-about-data-security-11626078000?mod=djemalertNEWS>

Shake off home country roots. Although TikTok had increased its efforts to localise content moderation team in the US, concerns over its Chinese identity still lingered. To distance itself from investigations, in March 2020, TikTok announced it would stop using more than 100 China-based moderators for overseas markets, not only for the US but for Germany, too, and move those jobs outside China.⁴² In the same month, TikTok publicly announced sharing ongoing efforts to earn the trust of the user community and policymakers, stating that they ‘hired a global General Counsel, a Chief Information Security Officer, and expanded our Trust & Safety hubs in the US, Ireland, and Singapore led by experienced industry veterans.’⁴³ TikTok realised that there are no one-size-fits-all solutions. To offset the investigations into its ties to China, TikTok has continually taken non-market actions and kept its guidelines up-to-date with US government requirements. In 2022, TikTok announced plans to provide more transparency to regulators and the broader public by granting researchers access to the platform’s public data to allow conducting relevant tests.⁴⁴

To further convince regulators about data security, in June 2022 TikTok announced it would route all US user data to Oracle’s cloud server in a bid to prove that it had been taking steps to keep China from gaining access to its data.⁴⁵ TikTok’s CEO explained more details in a letter to US Senators, stating that it would operate from US machines and be audited by third parties. China-based moderation teams would only have access to its data when ‘subject to a series of

⁴² The Wall Street Journal (2020). *TikTok to Stop Using China-Based Moderators to Monitor Overseas Content*. Accessed on 07 June 2022 from <https://www.wsj.com/articles/tiktok-to-stop-using-china-based-moderators-to-monitor-overseas-content-11584300597>

⁴³ TikTok (2020). *TikTok to launch Transparency Center for moderation and data practices*. Accessed on 04 Dec 2022 from <https://newsroom.tiktok.com/en-us/tiktok-to-launch-transparency-center-for-moderation-and-data-practices>

⁴⁴ The Verge (2022). *TikTok to provide researchers with more transparency as damaging reports mount*. Accessed on 25 Nov 2022 from <https://www.theverge.com/2022/7/27/23280406/tiktok-researchers-api-transparency-damaging-reports-china>.

⁴⁵ The New York Times (2022). *TikTok says its American traffic is going through Oracle servers, but it retains backups*. Accessed on 15 Nov 2022 from <https://www.nytimes.com/2022/06/17/technology/tiktok-oracle-servers.html>.

robust cybersecurity controls and authorization approval protocols overseen by our US-based security team.’⁴⁶

Leverage the users. The winner-take-all nature of platforms makes it difficult to dethrone them, which further reinforces customer loyalty and generates high switching costs. Being market leader lets platforms leverage their vast user base to strengthen their bargaining position. By improving their users’ experience, they motivate them to use their voice in politics to speak in favour of the platform and help justify their authenticity in a more indirect way. To leverage its user base in the political arena, since 2019 TikTok had been implementing a series of functional improvements for the app, making it more user-friendly and creating better opportunities for creators for monetisation. In December 2019, TikTok modified its new content moderation mechanisms, putting the control directly into the hands of its users, including enabling comment control and report features, and automatically flagging content that may potentially violate the platform’s rules and guidelines. For creators, TikTok extended the maximum video length from 15 seconds to 60 in July 2021, and further expanded it to up to 3 minutes in 2022, allowing for more flexibility and variety in content. The platform added a built-in feature that can automatically add subtitles to videos without having users to manually translate text, which eased the burden on creators and made the app more accessible for users with hearing difficulties.

While such app improvements were to improve functionality, TikTok also implemented them to keep users on their side when pressured. In August 2020, when Trump threatened to ban TikTok, general manager Vanessa Pappas shared a one-minute video, with hashtag #SaveTikTok, of herself from TikTok’s Los Angeles office and told the community ‘we are not going

⁴⁶ The New York Times (2022). *TikTok tells Republican senators how it plans to keep American data away from China*. Accessed on 20 Nov 2022 from <https://www.nytimes.com/2022/07/01/technology/tiktok-tells-republican-senators-how-it-plans-to-keep-american-data-away-from-china.html>.

anywhere.’⁴⁷ She mentioned the one billion dollar fund they had prepared to support creators, over ten thousand jobs the platform would be bringing to the US, and a commitment to safety being a priority. For creators with millions of followers, for whom posting creative content on the app has become their career, a TikTok ban would be devastating. As a content creator with over 4 million TikTok followers stated: ‘If TikTok did shut down, it would be like ... losing all the progress and work I did to get a big following.’⁵² Another creator emphasised the high switching costs: ‘I have 7 million followers on TikTok, but it doesn't translate to every platform... no matter what it's going to be hard to transfer all the people I have on TikTok.’⁴⁸

Discussion and Conclusion

Summary of findings

The purpose of this paper was to investigate the non-market strategies that digital platforms employ in a global context. It provides an analysis of a dynamic interaction between government intervention to curtail the power and influence of a global social media platform and the platform’s response in the form of non-market strategy. Based on archival data, we explored TikTok’s five-year development in the US market to shed light on how it addressed mounting institutional pressure. Our findings provide insight into platforms’ strategic responses to institutional duality and heed the call for more research on how political connections can cross borders (Sun et al., 2021). We suggest that while TikTok’s non-market strategy was mainly a response to US government involvement, their Chinese origins led to additional challenges. We found that the effectiveness of the platform’s non-market strategy was significantly influenced by the home

⁴⁷ The New York Times (2020). *The Woman Taking Over TikTok at the Toughest Time*. Accessed on 20 Nov 2022 from <https://www.nytimes.com/2020/09/11/technology/tiktok-vanessa-pappas-bytedance.html>.

⁴⁸ The New York Times (2020). *What if the U.S. Bans TikTok?* Accessed on 20 Nov 2022 from <https://www.nytimes.com/2020/07/10/style/tiktok-ban-us-users-influencers-taylor-lorenz.html>.

country's intervention, which did not only support but also limit the platform's strategic choices. The extant literature has several strands that inform the effectiveness of non-market strategy in helping firms to overcome institutional duality, such as social, legal, and cultural barriers that constrain firms' activities (Doh et al., 2012), and how such strategic choices vary across countries under different institutional contexts (Kolk and Pinkse, 2008). Different from traditional MNEs, though, the intricate political tension between China and the US has exacerbated challenges associated with liability of foreignness. This tension has added additional complexity for MNEs to manage institutional duality with consequences for the effectiveness of non-market strategy in doing so.

With our case study, we bridge IB research on non-market strategy and digital platforms (Khan et al., 2023). We make two key contributions and reveal how digital platforms' unique role in an IB context requires a sophisticated non-market strategy to cope with institutional duality (Peng et al., 2008; Kostova et al., 2008). First, based on our findings we argue that digital platforms' most important resource is data. Since countries are increasingly considering data as a strategically valuable resource, platforms facilitating the handling and exchange of data run the risk of getting caught up in countries' competition for this global resource. The politically sensitive nature of personal data creates a context against which platforms must use non-market strategy to deal with government intervention of their home and host country. Second, the strategic importance and politically sensitive nature of data has the consequence that the stakes of using non-market strategy to manage institutional duality might be higher than is usual in a typical IB context. We argue that global platforms face what we refer to as an *existentially salient issue*, which, when not managed effectively, might threaten an MNE's survival in a host country.

Data as a resource for competition

Our analysis shows that the nature and duality of institutional pressure faced by social media platforms is partly driven by resource competition between governments over the platform's ownership and access to data and information. Unlike traditional information providers, social media platforms as online sites that host and organise users' shared content have limited liability for the content they facilitate (Freedman, 2008). Today, social media platforms are at the centre of intense debate among users, policymakers, the press, and international governments as delegates who permit and moderate contentious speech (Bucher and Helmond, 2018). While data has become a strategically valuable resource, as people's physical and digital lives have become increasingly intertwined, platforms' ownership of data has evolved into a subject of political contention.

It is widely accepted that resource ownership has been one of the reasons for political tension. It is evident that corporate-owned resources can have implications on global politics, leading to political tension between governments (Click and Weiner, 2010). In traditional industries, MNEs use non-market strategy to gain government support and intangible assets to mitigate illegitimacy associated with home-country origins and create firm-specific advantages in the host market (Kolk and Pinkse, 2008; Fengyan et al., 2022). However, the tension from institutional duality is more intense and politically sensitive for social media platforms because the nature of such conflict is derived from the resources that the platforms hold, which tend to be more political, rather than economic. This became acutely evident when the discussion on TikTok affected the US presidential election in 2020.

Our findings indicate that most institutional pressures TikTok faced were data-related, including collecting US citizen's data and concerns around national data security. It is not

uncommon to see other leading US platforms facing institutional duality and being challenged over data issues. In the past, both Google⁴⁹ and Meta⁵⁰ were fined and sanctioned by the EU for violating data privacy regulations. However, the severity of their situations has never escalated to the extent of TikTok which has faced the threat of a complete host-country market exit. To mitigate host-country government concerns, driven by data privacy and security, TikTok made several announcements clarifying that the platform is independent from ByteDance, based in China, and it routed all US user data to a local cloud service company. Regardless, the discursive and radically growing user content has still forced the platform to actively engage with host-country institutional pressure.

While on the surface TikTok's non-market strategy might have looked like a battle between a global platform and a host country, the platform was at the mercy of how its home country was waging a conflict with the host country. Instead of the territorial dispute, the confrontation among countries has shifted to the digital space. Digital data ownership, influence over the internet, and access to digital networks are the three main pillars of this competition (Tekir, 2020). Another case which demonstrates this is Huawei, one of the largest MNEs in telecommunication from China. Huawei was banned in the US in 2019 after allegations were made that their business posed a national security threat by building 5G networks. On the one hand, the threats were coming from building their 5G networks, which is seen as one of the vital infrastructures in the US. Dominance over information and communication infrastructure has constituted a source of conflict for over a century (Hills, 2010).

⁴⁹ The Gaurdian (2019). *Google fined record £44m by French data protection watchdog*. Available at <https://www.theguardian.com/technology/2019/jan/21/google-fined-record-44m-by-french-data-protection-watchdog>

⁵⁰ Financial Times (2023). *Facebook owner Meta hit with record €1.2bn fine over EU-US data transfers*. Available at <https://www.ft.com/content/d1607121-0a2e-4b74-b690-d368d0c290e8>

Our case further demonstrates that, when a platform tries to address host-country government intervention, support from the home country may be a liability rather than an asset. China's refusal to cooperate with the IPO in the US stock market might not only have prevented TikTok from gaining legitimacy but also stopped it from implementing its non-market strategy to avoid a potential ban. Before negotiations between TikTok and potential US buyers were settled, China announced updated regulations on technology export restrictions, which considerably slowed TikTok's deal as it now needed approval from host and home-country institutions.

Our case strengthens understanding of how home-based political connections transfer across national borders (Sun et al., 2021). Existing IB literature shows that MNEs often use political ties, also known as corporate political connections, as non-market strategy (Doh et al., 2012; Frynas et al., 2006; Boddewyn, 2016) to enhance competitive advantage in the international market, gain legitimacy, and safeguard business survival in the host market (Sun et al., 2012; Zheng et al., 2015; Brockman et al., 2013). Although most pressure comes from the host country, our study shows that a home country's political relations can put MNEs in a difficult position and become a liability instead, as the home government's involvement can limit an MNE's strategic choices to address the host country's institutional pressures.

TikTok's non-market strategy choices and issue salience

The corporate political activity literature has argued that an issue's saliency might affect the type of non-market strategy a firm adopts. According to Bonardi and Keim (2005), *widely salient issues* tend to receive a considerable amount of media attention and are deemed important by the public, whereas *narrowly salient issues* are only salient to limited groups and resolved without public disclosure. We found that TikTok's choice of non-market strategy was indeed

related to its assessment of the public opinion on the issue. It approached widely salient issues differently than narrowly salient issues. However, we also found that this distinction does not cover the full extent of variance in TikTok's non-market strategy. In addition to narrowly and widely salient issues, we propose a third type: *existentially salient issues*. Unlike narrowly and widely salient issues, existentially salient issues refer to political challenges that specifically target a focal firm and threaten its survival in a market. Existentially salient issues are characterized by their profound impact. They can fundamentally impact a firm's existence and cause trouble beyond immediate operational risks or reputation concerns (King and Whetten, 2008). Examples include radical public policy changes and political instability (Meyer et al., 2018). While Pinkse and Kolk (2012) suggest that MNEs need to be well-embedded in the host-country environment to address host country pressure and overcome liabilities of foreignness, existentially salient issues represent extreme institutional shifts that require MNEs to engage in more unconventional strategic action to cope with the threat. TikTok's ownership of US citizens' data is what led to how it handled data becoming an existentially salient issue because it posed potential national security to the host country. Therefore, TikTok has attracted more intense scrutiny than its competitors in the US. Its non-market strategy involved taking relatively radical measures to regain legitimacy, such as taking legal action against government orders.

The fact that the government and the public have concerns about content and the handling of private data pose uniform threats to all social media platforms, rather than to TikTok alone. When the pressure was limited, reflecting a narrowly salient issue, TikTok's response was obedient with self-regulation such as expanding the moderation team, overhauling community guidelines, and issuing public announcements. Like other platforms, TikTok complied with government demands to protect operations rather than wait for intrusive government intervention which could

harm the business. However, TikTok reacted more quickly to widely salient issues such as concerns over fake news, harmful content, data privacy violations and content control. While these issues were having an impact across the entire social media industry, TikTok's circumstances were unique due to its Chinese roots and the political tension between their home and host country. To deal with this tension, the platform tried to become more embedded in the host country (Pinkse and Kolk, 2012). TikTok tried to integrate US citizens by appointing managers with job experience in other US platforms. TikTok also made continuous efforts to distance itself from its Beijing-based parent, because most national security concerns and investigations associated with content distribution were rooted in its Chinese identity. As the US-China relationship escalated and TikTok risked having to exit the US market, parent company ByteDance appointed a new CEO for TikTok from Singapore, Shouzi Chew, to mitigate the increasingly fierce political conflict between home and host country. TikTok also played the 'user card' to leverage its vast user base to improve its negotiation position with the US government. Digital platforms can gain users' trust and use that to their advantage helping to offset the host market's institutional pressure. While digital platforms responding to institutional duality may prove challenging as their activities are politically sensitive, they have a vast user base at their disposal to speak for them, and it opens new avenues to improve their bargaining position.

Our findings show that only when TikTok encountered *existentially salient issues*, it decided to adopt a more proactive and assertive non-market strategy to safeguard operations and its existence. Different from US platforms such as Google and Meta, TikTok's Chinese roots added an extra layer of complexity to the nature of such concerns. It was considered being politically manipulative in collecting and owning data and information. Even if it would result in significant financial losses and have potentially serious consequences for the platform's operations, TikTok

was willing to compromise in exchange for continued operability and legitimacy. However, when the more conventional non-market measures did not stop the issue from escalating, instead of trying to mitigate institutional pressure by unconditionally complying with government requests, TikTok confronted the pressure head-on. This type of confrontational approach was evident when ex-US President Donald Trump tried to force TikTok to hand over its US operations. TikTok first adhered to the demands and actively engaged in talks with potential buyers, including Microsoft, Walmart, and Oracle, aiming to reach a deal ahead of the 90-day deadline and save the platform. Then, TikTok agreed to file an IPO on a US stock market to avoid the ban, even if it was not told to do so. When these measures proved ineffective, it first filed a lawsuit against Trump's ban, claiming it was not given sufficient time to complete the request, and then requested another legal injunction asking for a time extension. TikTok succeeded in both cases.

Limitations and future research

As with all research, the limitations of this study may provide potential avenues for further research. First, the period of our study (2018-2022) may be the period when the US-China relationship had become more intense, which led to heightened liabilities of origin for the focal firm (Ramachandran and Pant, 2010). Although we know that different political environments between host and home governments can shape MNEs' strategic choices (Meyer et al., 2009), it is unclear whether our findings are generalisable to other platforms operating in different institutional settings. Our case was unique in the sense that the digital platform that we studied both handled a politically sensitive resource – data – and found itself in the middle of a complex global competition between two superpowers. Future research could disentangle these two conditions,

for example by studying other social media platforms that operate across borders of countries with fewer tensions between them.

Second, our findings are based on social media platforms. Given that they are categorised as platform-based businesses, they carry platform characteristics such as network effects and tend to have winner-take-all outcomes. However, the primary function and nature of the interactions they facilitate are different from certain types of transactional platforms. Platforms exemplified by Amazon marketplace and Booking.com have a digital architecture to facilitate the exchange of goods and services with a focus on commercial transactions. Further studies should expand on this and investigate whether and how the institutional duality may differ across digital platforms and how important non-market strategy is, as a result.

References

- Alleman, J., Baranes, E. & Rappoport, P. N. (2020). Multisided Markets and Platform Dominance. *Applied Economics in the Digital Era*. Springer.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, 17, 99-120.
- Baron, D. P. (1995). Integrated strategy: Market and nonmarket components. *California management review*, 37, 47-65.
- Birkinshaw, J. (2022). Move fast and break things: Reassessing IB research in the light of the digital revolution. *Global Strategy Journal*.
- Boddewyn, J. J. (2016). International business–government relations research 1945–2015: Concepts, typologies, theories and methodologies. *Journal of World Business*, 51, 10-22.
- Bonardi, J.-P. & Keim, G. D. (2005). Corporate political strategies for widely salient issues. *Academy of Management Review*, 30, 555-576.
- Brockman, P., Rui, O. M. & Zou, H. (2013). Institutions and the performance of politically connected M&As. *Journal of International Business Studies*, 44, 833-852.
- Bucher, T. & Helmond, A. (2018). The affordances of social media platforms. *The SAGE handbook of social media*, 1, 233-254.

- Buttà, A. (2018). Google Search (Shopping): an Overview of the European Commission's Antitrust Case. *Antitrust & Public Policies*, 5.
- Cammaerts, B. & Mansell, R. (2020). Digital platform policy and regulation: Toward a radical democratic turn. *International Journal of Communication*, 14, 20.
- Cannon, S. & Summers, L. H. (2014). How Uber and the sharing economy can win over regulators. *Harvard business review*, 13, 24-28.
- Cennamo, C. & Santalo, J. (2013). Platform competition: Strategic trade-offs in platform markets. *Strategic management journal*, 34, 1331-1350.
- Chen, H., Griffith, D. A. & Hu, M. Y. (2006). The influence of liability of foreignness on market entry strategies: An illustration of market entry in China. *International Marketing Review*.
- Clark, C. E., Bryant, A. P. & Griffin, J. J. (2017). Firm engagement and social issue salience, consensus, and contestation. *Business & Society*, 56, 1136-1168.
- Click, R. W. & Weiner, R. J. (2010). Resource nationalism meets the market: Political risk and the value of petroleum reserves. *Journal of International Business Studies*, 41, 783-803.
- Cohen, J. E. (2017). Law for the platform economy. *UCDL Rev.*, 51, 133.
- Curchod, C., Patriotta, G. & Wright, M. (2020). Self-categorization as a nonmarket strategy for MNE subsidiaries: Tracking the international expansion of an online platform. *Journal of World Business*, 55, 101070.
- Cusumano, M., Yoffie, D. & Gawer, A. (2020). *The future of platforms*, MIT Sloan Management Review.
- Doh, J., Rodrigues, S., Saka-Helmhout, A. & Makhija, M. 2017. International business responses to institutional voids. Springer.
- Doh, J. P., Lawton, T. C. & Rajwani, T. (2012). Advancing nonmarket strategy research: Institutional perspectives in a changing world. *Academy of management perspectives*, 26, 22-39.
- Eisenmann, T., Parker, G. & Van Alstyne, M. W. (2006). Strategies for two-sided markets. *Harvard business review*, 84, 92.
- Fan, D., Su, Y. & Peng, M. W. (2023). A configurational approach to political risks and institutional logics. *Journal of International Management*, 101088.

- Fengyan, Y., Hongjuan, Z., Tan, J. & Qi, L. (2022). Non-Market Strategies and Credit Benefits: Unpacking Heterogeneous Political Connections in Response to Government Anti-Corruption Initiatives. *Journal of Management Studies*, 59, 349-389.
- Flew, T. & Gillett, R. (2021). Platform policy: Evaluating different responses to the challenges of platform power. *Journal of Digital Media & Policy*, 12, 231-246.
- Flew, T., Martin, F. & Suzor, N. (2019). Internet regulation as media policy: Rethinking the question of digital communication platform governance. *Journal of Digital Media & Policy*, 10, 33-50.
- Freedman, D. (2008). *The politics of media policy*, Polity.
- Frynas, J. G., Mellahi, K. & Pigman, G. A. (2006). First mover advantages in international business and firm-specific political resources. *Strategic Management Journal*, 27, 321-345.
- Gao, G. Y., Murray, J. Y., Kotabe, M. & Lu, J. (2010). A “strategy tripod” perspective on export behaviors: Evidence from domestic and foreign firms based in an emerging economy. *Journal of International Business Studies*, 41, 377-396.
- Gawer, A. (2009). Platforms, markets and innovation: An introduction.
- Gawer, A. & Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of product innovation management*, 31, 417-433.
- Gillespie, T. (2017). Governance of and by platforms. *SAGE handbook of social media*, 254-278.
- Gioia, D. A., Corley, K. G. & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods*, 16, 15-31.
- Hillman, A. J. & Wan, W. P. (2005). The determinants of MNE subsidiaries' political strategies: Evidence of institutional duality. *Journal of International Business Studies*, 36, 322-340.
- Hills, J. (2010). *The struggle for control of global communication: The formative century*, University of Illinois Press.
- Kaye, D. B. V., Chen, X. & Zeng, J. (2021). The co-evolution of two Chinese mobile short video apps: Parallel platformization of Douyin and TikTok. *Mobile Media & Communication*, 9, 229-253.
- Keim, G. D. & Hillman, A. J. (2008). Political environments and business strategy: Implications for managers. *Business Horizons*, 51, 47-53.

- Keles, B., McCrae, N. & Grealish, A. (2020). A systematic review: the influence of social media on depression, anxiety and psychological distress in adolescents. *International journal of adolescence and youth*, 25, 79-93.
- Khan, Z., Lew, Y. K. & Park, B. I. (2015). Institutional legitimacy and norms-based CSR marketing practices: Insights from MNCs operating in a developing economy. *International Marketing Review*, 32, 463-491.
- Khan, Z., Zeng, J., Knight, G., Rajwani, T. & Pattnaik, C. (2023). Non-Market Strategies and disruptive innovation in the platform economy. *Journal of International Management*, 29, 101047.
- King, B. G. & Whetten, D. A. (2008). Rethinking the relationship between reputation and legitimacy: A social actor conceptualization. *Corporate Reputation Review*, 11, 192-207.
- Ko, G., Amankwah-Amoah, J., Appiah, G. & Larimo, J. (2022). Non-market strategies and building digital trust in sharing economy platforms. *Journal of International Management*, 28, 100909.
- Kolk, A. & Pinkse, J. (2008). A perspective on multinational enterprises and climate change: Learning from “an inconvenient truth”? *Journal of International Business Studies*, 39, 1359-1378.
- Koopman, C., Mitchell, M. & Thierer, A. (2014). The sharing economy and consumer protection regulation: The case for policy change. *J. Bus. Entrepreneurship & L.*, 8, 529.
- Kostova, T. (1999). Transnational transfer of strategic organizational practices: A contextual perspective. *Academy of management review*, 24, 308-324.
- Kostova, T. & Roth, K. (2002). Adoption of an organizational practice by subsidiaries of multinational corporations: Institutional and relational effects. *Academy of management journal*, 45, 215-233.
- Kostova, T., Roth, K. & Dacin, M. T. (2008). Institutional theory in the study of multinational corporations: A critique and new directions. *Academy of management review*, 33, 994-1006.
- Kostova, T. & Zaheer, S. (1999). Organizational legitimacy under conditions of complexity: The case of the multinational enterprise. *Academy of Management review*, 24, 64-81.

- Lehdonvirta, V., Kässi, O., Hjorth, I., Barnard, H. & Graham, M. (2019). The global platform economy: A new offshoring institution enabling emerging-economy microproviders. *Journal of management*, 45, 567-599.
- Liedong, T. A., Rajwani, T. & Mellahi, K. (2017). Reality or illusion? The efficacy of non-market strategy in institutional risk reduction. *British Journal of Management*, 28, 609-628.
- Lin, J. (2020). One app, two versions: TikTok and the platformization from China. *AoIR Selected Papers of Internet Research*.
- Lynn, T., Rosati, P. & Murphy, B. Does size matter? Non-market social and political engagement by accounting firms in the# Brexit discourse on Twitter. *Accounting Forum*, 2021. Taylor & Francis, 58-84.
- Mansell, R. (2015). Platforms of power. *Intermedia*, 43, 20-24.
- Mellahi, K., Frynas, J. G., Sun, P. & Siegel, D. (2016). A review of the nonmarket strategy literature: Toward a multi-theoretical integration. *Journal of management*, 42, 143-173.
- Meyer, K. E., Ding, Y., Li, J. & Zhang, H. (2018). Overcoming distrust: How state-owned enterprises adapt their foreign entries to institutional pressures abroad. *State-Owned Multinationals: Governments in Global Business*, 211-251.
- Meyer, K. E., Estrin, S., Bhaumik, S. K. & Peng, M. W. (2009). Institutions, resources, and entry strategies in emerging economies. *Strategic management journal*, 30, 61-80.
- Moore, M. & Tambini, D. (2018). *Digital dominance: the power of Google, Amazon, Facebook, and Apple*, Oxford University Press.
- Nambisan, S. & Luo, Y. (2021). Toward a loose coupling view of digital globalization. *Journal of international business studies*, 52, 1646-1663.
- Nieborg, D. B. & Poell, T. (2018). The platformization of cultural production: Theorizing the contingent cultural commodity. *New media & society*, 20, 4275-4292.
- North, D. C. (1990). *Institutions, institutional change and economic performance*, Cambridge university press.
- Oliver, C. (1991). Strategic responses to institutional processes. *Academy of management review*, 16, 145-179.

- Parker, G. G., Van Alstyne, M. W. & Choudary, S. P. (2016). *Platform revolution: How networked markets are transforming the economy and how to make them work for you*, WW Norton & Company.
- Peng, M. W., Wang, D. Y. & Jiang, Y. (2008). An institution-based view of international business strategy: A focus on emerging economies. *Journal of international business studies*, 39, 920-936.
- Pinkse, J. & Kolk, A. (2012). Multinational enterprises and climate change: Exploring institutional failures and embeddedness. *Journal of International Business Studies*, 43, 332-341.
- Porter, M. E. (1980). *Competitive Strategy*. The Free Press.
- Ramachandran, J. & Pant, A. (2010). The liabilities of origin: An emerging economy perspective on the costs of doing business abroad. *The past, present and future of international business & management*. Emerald Group Publishing Limited.
- Rauch, D. E. & Schleicher, D. (2015). Like Uber, but for local government law: the future of local regulation of the sharing economy. *Ohio St. LJ*, 76, 901.
- Rochet, J.-C. & Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the european economic association*, 1, 990-1029.
- Shenkar, O., Luo, Y. & Yeheskel, O. (2008). From “distance” to “friction”: Substituting metaphors and redirecting intercultural research. *Academy of management review*, 33, 905-923.
- Srnicek, N. (2017). *Platform capitalism*, John Wiley & Sons.
- Sun, P., Doh, J. P., Rajwani, T. & Siegel, D. (2021). Navigating cross-border institutional complexity: A review and assessment of multinational nonmarket strategy research. *Journal of International Business Studies*, 52, 1818-1853.
- Sun, P., Mellahi, K. & Wright, M. (2012). The contingent value of corporate political ties. *Academy of Management Perspectives*, 26, 68-82.
- Tekir, G. (2020). Huawei, 5G network and digital geopolitics. *International Journal of Politics and Security*, 2, 113-135.
- Uzunca, B., Rigtering, J. C. & Ozcan, P. (2018). Sharing and shaping: A cross-country comparison of how sharing economy firms shape their institutional environment to gain legitimacy. *Academy of management discoveries*, 4, 248-272.

- Van Dijck, J., Nieborg, D. & Poell, T. (2019). Reframing platform power. *Internet Policy Review*, 8, 1-18.
- Verbeke, A. & Hutzschenreuter, T. (2021). The dark side of digital globalization. *Academy of Management Perspectives*, 35, 606-621.
- Verbeke, A., Van Tulder, R., Rose, E. L. & Wei, Y. (2021). *The multiple dimensions of institutional complexity in international business research*, Emerald Publishing Bingley.
- Wang, W. Y. & Lobato, R. (2019). Chinese video streaming services in the context of global platform studies. *Chinese Journal of Communication*, 12, 356-371.
- Yi, J., Li, J. & Chen, L. (2023). Ecosystem social responsibility in international digital commerce. *Journal of International Business Studies*, 54, 24-41.
- Zaheer, S. (1995). Overcoming the liability of foreignness. *Academy of Management journal*, 38, 341-363.
- Zeng, J. (2022). Orchestrating ecosystem resources in a different country: Understanding the integrative capabilities of sharing economy platform multinational corporations. *Journal of World Business*, 57, 101347.
- Zheng, W., Singh, K. & Mitchell, W. (2015). Buffering and enabling: The impact of interlocking political ties on firm survival and sales growth. *Strategic Management Journal*, 36, 1615-1636.

Figures and Tables

Figure 1 Institutional Pressure

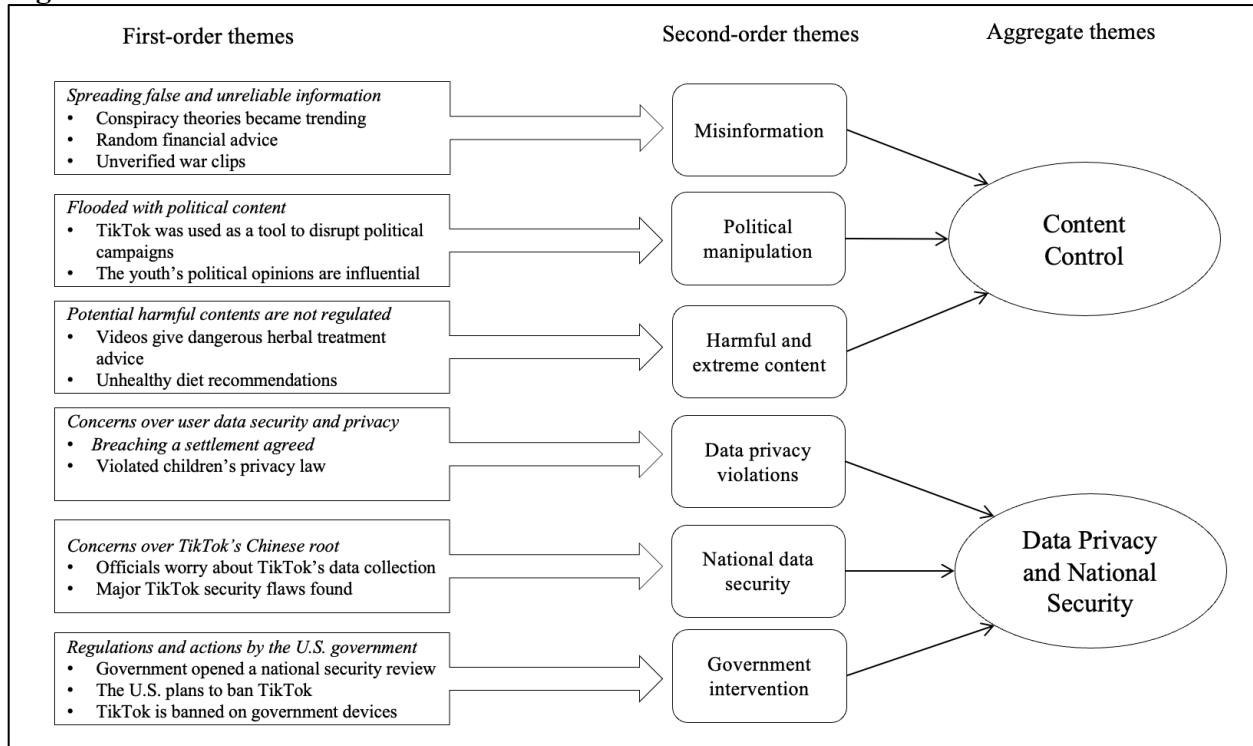


Figure 2 TikTok's Non-Market Strategies

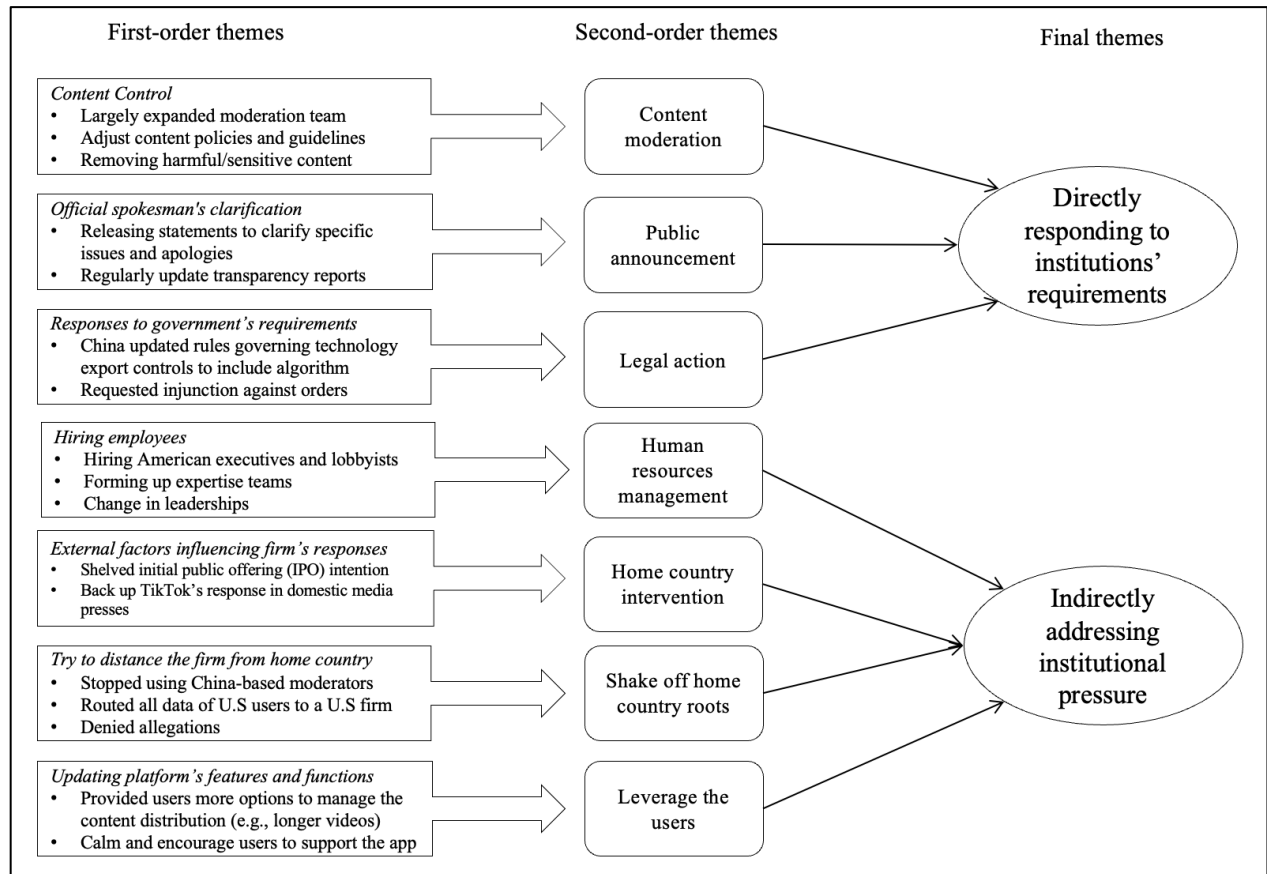


Table 1 Details on Data Collection

Type of data	Sources (collected)	Use in the analysis
Press	Financial Times (229) Wall Street Journal (281) The New York Times (254)	Get an overview of what happened during TikTok's five-years development
Magazine and blogs	TechNode (23) Tech Crunch (31) Reuters (6) The Drum (2) Politico (3) China Briefing (7)	Enrich the data collection of other smaller issues
Archival documents	TikTok Official Website (5) The White House (3) Federal Trade Commission (2)	Identify relevant official announcements

Table 2. Quotation table with evidence from secondary data: institutional pressure

First-order concepts	Data supporting institutional pressure
	<i>Data supporting "Content Control"</i>
Spreading false and unreliable information	"TikTok is not proactively going out and looking for videos with potentially false and dangerous ideas and removing them. There were more than 80 million views of TikTok videos with PizzaGate-related hashtags". "TikTok is the place to go for new dances, viral taco recipes—and, now, financial advice... But can TikTok users... trust the financial advice that is increasingly being offered on the social-media platform?" "Islamic State militants have been posting short propaganda videos to TikTok... featured corpses paraded through streets, Islamic State fighters with guns, and women who call themselves "jihadist and proud."
Flooded with political content	"President Trump's smaller-than-expected crowd at his campaign rally in Tulsa, Okla., Saturday has led TikTok users to say that their videos helped drive down attendance." "Content on TikTok has become more political in the last year: Videos of dance challenges are now mixed with those of users reacting to President Trump's impeachment or lip-syncing memes about the threat of nuclear war featuring the rapper Lil Dicky's song "Pillow Talk."."
Potential harmful contents are not regulated	"For days, mythical-sounding herbs that seemed plucked right out of Hogwarts... shared by TikTok users as ingredients they claimed would bring on menstruation or cause a miscarriage... But according to medical experts and trained herbalists, herbal abortifacients can be dangerous and there isn't any data on whether they work". "TikTok is flooding teen users with videos of rapid-weight-loss competitions and ways to purge food that health professionals say contribute to a wave of eating-disorder cases spreading across the country."
Concerns over user data security and privacy	<i>Data supporting "Data Privacy and National Security"</i> "They are accusing TikTok of violating the Children's Online Privacy Protection Act, known as Coppa, alleging that TikTok makes it too easy for children under 13 to join the app without their parents' permission." "Twenty advocacy groups have accused TikTok of violating child privacy regulations in the US and breaching a settlement that the viral video app agreed with the Federal Trade Commission last year over a previous privacy complaint."
Concerns over TikTok's Chinese root	"Chinese-owned TikTok has faced scrutiny as concerns grow that Beijing could tap the platform's information to gather data on Americans. TikTok has said it wouldn't hand U.S. user data to Chinese authorities." "TikTok...had serious vulnerabilities that would have allowed hackers to manipulate user data and reveal personal information."
Regulations and actions by the U.S. institutions	"U.S. Launches National Security Review of Video App TikTok; Move follows concerns from U.S. senators that Chinese-owned company censors content to appease Beijing" "President Trump issued a pair of executive orders that would impose new limits on Chinese social media apps TikTok... It also formalizes Mr. Trump's earlier calls for shutting down TikTok should Microsoft or another American buyer fail to complete a deal within 45 days." "The U.S. military has banned its members from using TikTok, signalling increasing concern about possible security risks related to the popular video app's Chinese ownership."

Table 3. Quotation table with evidence from secondary data: TikTok's strategies

First-order concepts	Data supporting TikTok's strategies
Content Control	<i>Data supporting "Directly responding to institutions' requirements"</i> "TikTok has poached hundreds of content moderators in Europe from outsourcing companies that serve social media rivals such as Facebook, as the group seeks to tackle a growing problem with harmful content". "TikTok has overhauled its guidelines to clarify what kind of content is off-limits, from racial slurs to critical remarks about other users' hygiene, at a time when the popular video app is facing increased scrutiny over its security". "TikTok said it had removed 96 per cent of content that violated its minor-safety policies before anybody had viewed them. Videos of minors drinking alcohol and smoking accounted for the majority of removals under these guidelines".
Official spokesman's clarification	"We will continue to provide updates and transparency in the months and years ahead," said TikTok U.S. General Manager Vanessa Pappas in the post". "Last month TikTok published its first transparency report, sharing details about information requests from governments and the circumstances behind pulling content from the platform.
Responses to government's requirements	"China's Ministry of Commerce revealed ... that the government had expanded its list of technologies subject to export controls to include new rules related to artificial intelligence. "ByteDance has told the White House it is willing to divest its US operation in full through a sale". "TikTok has asked a federal judge to prevent the Trump administration from blocking downloads of the video-sharing ... as its parent company ByteDance nears a deadline for resolving the app's future in the US".
Hiring employees	<i>Data supporting "Indirectly addressing institutional pressure"</i> "Blake Chandlee, a former head of advertising at Facebook who is now in charge of building TikTok's US ad partnerships". "TikTok announced Tuesday it has hired Kevin Mayer, formerly The Walt Disney Company's top streaming executive, as the chief executive officer of the popular short video app. "The social media company, which one year ago had virtually no lobbying presence in the nation's capital, has hired a small army of more than 35 lobbyists to work on its behalf, including one with deep ties to President Trump.
External factors influencing firm's responses	"ByteDance Ltd., the Chinese owner of popular short-video app TikTok, put on hold indefinitely its intentions to list offshore earlier this year after government officials told the company to focus on addressing data-security risks, people familiar with the matter said. "China has no reason to give the green light to such a deal, which is dirty and unfair and based on bullying and extortion," wrote the China Daily, the Chinese government's English-language mouthpiece newspaper."
Try to distance the firm from home country	"Popular short-video app TikTok said it would halt using China-based moderators to monitor overseas content and shift that work to those outside of China. The decision will result in the transfer of more than 100 China-based moderators to other positions within the company, according to people familiar with the matter." "TikTok said it has hit a milestone in its latest attempt to respond to concerns about the security of data for its U.S. users. The popular short-form video app said on Friday traffic for all U.S. user data is now being routed through the cloud infrastructure of its partner Oracle Corp". "A TikTok spokesman said that the Chinese government has never asked the company for user data and that it would refuse such a request. "TikTok has an American CEO and is owned by a private company that is backed by some of the best-known U.S. investors," he added."
Leverage the users	"TikTok gives users robust account-level and video-specific options to customize their content settings, like limiting who can comment on or duet with a video they've created. Users also can enable comment filters by creating a custom list of keywords that will be automatically blocked from any comments on their videos". "TikTok is moving beyond the short-form video format that made the social-media app famous, giving the online stars it helped create and others more airtime amid heightened competition for eyeballs".

Green CSR Initiatives and Customer Outcomes: A Meta-analysis

Green Corporate Social Responsibility (CSR), connecting companies' green CSR initiatives to consumer purchasing decisions, remains a pivotal force in marketing. Given the inconclusive nature of consumer responses to green CSR in terms of magnitude and direction, this meta-analysis examines evidence from 56 studies, elucidating main and moderator effects. This research categorises green CSR initiatives into two distinct types: substantial (characterised by concrete, product/process-oriented claims) and symbolic initiatives (comprising vague, image/fact-oriented claims). The findings reveal a more pronounced effect of substantial green CSR on consumer behavioural responses, while symbolic green CSR demonstrates a stronger impact on attitudinal responses. Moreover, the study identifies various communication styles—such as emotional, informative, and conversational—that significantly moderate the effect of green CSR initiatives on customer outcomes. Contributions are also discussed.

Keywords: Green CSR Initiatives; Customer Outcomes; Meta-Analysis

Track: Social Responsibility & Ethics

1. Introduction

Green CSR initiatives refer to management practices that minimise the impact on the environment and meet the sustainability principles that organisations have developed to successfully achieve CSR (Williamson, Lynch-Wood, and Ramsay, 2006; Shrivastava, 1995). Firms view it as an important element of their business strategy which may achieve a role shift from being purely production and service organisations to eco-management centres. This implies that green CSR initiatives help firms maximise their pursuit of differentiated advantages and realise their vision of green growth (Shrivastava, 1995).

Scholars, exemplified by Packard and Berger (2021), emphasise the importance of communication styles in marketing, suggesting even subtle variations can enhance customer outcomes by around 10%. However, the focus of communication style in green CSR initiatives varies: Delta Hotel conveys emotional style by planting a tree in the customer's name for participating in the "GreenSTAY" initiative, while green clothing brand Reformation focuses on conversational style on social media. Despite the fact that 43% of consumers expect companies to implement green CSR practices, green products account for less than 20% of the global market share (Deloitte, 2022; NYU, 2023). This fact proves that complex social and environmental challenges require an overarching framework; therefore, this study will answer a key question: whether green CSR initiatives and which communication style affect consumer outcomes?

Despite the popularity of green CSR initiatives, existing empirical research is fragmented. Previous studies have provided valuable insights into consumer responses to green CSR, inconsistent findings still exist. For example, Xie, Bagozzi, and Grønhaug (2015) suggest that firm's green actions positively effect customer outcomes, while Orazi and Chan (2020) find that environmental and green claims have no significant impact on consumer brand attitudes. A recent systematic literature review finds that the positive contributions of green CSR on customer outcomes are relatively obscure and ambiguous and calls for using meta-analyses to *synthesise empirical findings* (Dijkstra-Silva, Schaltegger, and Beske-Janssen, 2022).

Furthermore, this study considers important *boundary conditions* of the impact of green CSR initiatives on customer outcomes. While previous research recognises content and communication style as influential factors (Segev, Fernandes, and Hong, 2016; Shen, Yang, Conlin, and Wang, 2023), the marketing literature reveals conflicting findings on the relationship between communication style and consumer outcomes. For instance, Matthes, Wonneberger, and Schmuck (2014) observe positive motivation with emotional green

appeals, but Kuhn, Zajontz, and Kollmann (2014) suggest firm struggle to strengthen customers' outcomes through emotional stimuli. Previous studies relied on single factors (e.g., one type of communication style), so it is important to compare the effectiveness of different communication styles, a key contribution of our study.

In summary, this study assesses the impact of different green CSR initiatives (i.e., substantial initiative vs. symbolic initiative) on customer outcomes, and further looks at the moderating role of communication style (e.g., conversational styles, informative styles, and emotional styles).

2. Research Hypotheses

2.1. Main effect of green CSR initiatives on customer outcomes

The effectiveness of marketing initiatives depends on how customers perceive the motivations behind companies' messages (Reich & Soule, 2016). Green CSR initiatives, delivering sustainable content and show authentic "going green" motivation, positively influence consumer outcomes (da Luz, Mantovani, and Nepomuceno, 2020). Further, the direct link between subjective norms and behavioural intentions suggests that these initiatives aim to enhance connections and interactions with customers, fostering positive brand attitudes and purchase intentions (Romani, Grappi, and Bagozzi, 2016). Furthermore, attribution theory asserts that goal success is due to competence, shaping consumers respond to competence-related behaviour. Perceived attributions result from customers' knowledge of a company's activities, influencing their views of the company (Folkes, 1988)

H1: Green CSR initiatives have positive effects on customer outcomes.

As suggested by the literature (e.g., Homburg, Stierl, and Bornemann, 2013), we consider the impact of different types of green CSR initiatives on customer outcomes, namely substantial (i.e., concrete, product/process-oriented claims) and symbolic initiatives (i.e., vague, image/fact-oriented claims) (Truong, Mazloomi, and Berrone, 2021). Specifically, symbolic actions are intended to manage stakeholder impressions with minimal implementation, leaving daily activities and strategic goals remain unchanged. Substantive actions, on the other hand, induce changes in the daily activities, reducing environmental footprint and realigning strategic goals to the new environmental commitments.

From the perspective of impression management, Rodrigue, Magnan, and Cho (2013) argued that symbolic initiatives are designed to present an appearance of conformity with societal expectations and are rarely implemented. These initiatives, emphasising external

customer impressions, tend to be more noticeable and evoke stronger attitudes compared to substantial initiatives that focus on internal organisational processes. Their study also stated that an important element of this is consistency, highlighting that highly visible initiatives that are aligned with customer expectations are used to demonstrate the company's consistency. Consistency theory suggests that individuals are more likely to have positive attitudes towards an object or phenomenon perceived as consistent with their characteristics, due to the reduction and elimination of inconsistencies between personal opinions and the phenomenon (Osgood & Tannenbaum, 1955). Thus, if customers perceive a firm in a certain way and the firm acts accordingly, perceived consistency leads to positive attitudes.

H2a: Symbolic green CSR initiatives have a stronger impact on customer attitude than substantial green CSR initiatives

Substantial initiatives, on the other hand, involve changes in strategic goals and daily activities, requiring more organisational resources and potential organisational changes to enhance actual performance (Rodrigue et al. 2013). Wang, Krishna, and McFerran (2017) noted that hotels' substantial "green" efforts are more likely to stimulate substantive behaviours (purchase behaviour) than just symbolically "talking" about being green (symbolic initiatives). Driven by social norms and reciprocity theory, consumers are more willing to fulfil their "go green" obligation and engage in actual behaviour (purchase behaviour) when witnessing a company's substantial efforts. Furthermore, detailed and specific substantive green claims are more likely to evoke purchase intentions (Janssen, Swaen, and Du, 2022).

H2b: Substantial green CSR initiatives have a stronger impact on purchase behaviour than symbolic green CSR initiatives.

2.2. The moderating effect of communication style

The persuasion knowledge model posits that understanding persuasive knowledge enhances consumer interpretation of marketing messages, leading to positive outcomes. Research on persuasion knowledge asserts that elements of the persuasion process (communication style) moderate the effects of persuasive knowledge and deliver positive consumer assessments, intentions, and responses (Eisend & Tarrahi, 2022). Applying the lens of advertising creativity, Akpınar & Berger (2017) find that emotional styles increase sharing, while informative styles promote consumer evaluations and purchases.

Inspired by the persuasion knowledge model and advertising creativity, our study considers communication styles as possible moderators of the link between green CSR initiatives and customer outcomes. We classify them into conversational styles (casual

language that encourages sociability and interaction with the target audience), emotional styles (language that evokes emotions and facilitates emotional experiences for the target audience), and informative styles (rational and conducive to intellectual interpretation for the target audience).

Marketing communication research (Packard & Berger, 2021) indicates customers perceive conversational styles—vivid, concrete, detailed, tangible—as more credible and reliable, enhancing customer outcomes. Persuasion knowledge suggests that informative style's pragmatic and functional aspects facilitate rational and smooth communication, helping convey specific information about green CSR initiatives and assisting customers in their decision-making process. Emotional style stimulates consumer attention to elicit behaviours and responses, such as Xie et al. (2015) who argued that corporate green CSR initiatives with positive emotional style (e.g., gratitude and ethical style) trigger consumer support in comparison with neutral style.

***H3:** The three communication styles (a) conversational, (b) emotional, and (c) informative style positively moderate the relationship between green CSR initiatives and customer outcomes, such that higher levels of these communication styles are associated with stronger positive relationships between green CSR initiatives and customer outcomes.*

3. Methodology

Procedure. This study assesses the effect of different types of green CSR initiatives (substantial initiatives and symbolic initiatives) on different customer outcomes (customers' attitude and purchase behaviour). Papers for the meta-analysis have been identified by searching all relevant online databases¹. Since the green CSR-related terminology was first introduced by Shrivastava in 1995, the literature search for this study covers the period from 1995 to 2023. The final data consists of publications that meet the following criteria: a paper must report an empirical study of green CSR and its related initiatives and rely on customer response and report sufficient information on effect sizes. The exclusion criteria for this study are: 1) information on green CSR initiative are not included in the paper; 2) the variables do not include customer outcome; 3) the study is not quantitative-empirical; 4) the study does not

¹ We used the following search terms: "corporate environmental performance" OR "sustainable CSR" OR "green business" OR "environmental-related marketing" OR "green CSR" OR "environmental CSR" OR "environmental business" OR "green marketing" OR "environmental marketing" OR "green-related marketing" OR "green movement" OR "green advertising".

focus on the business and management domain; 5) the study does not contain an effect between any green CSR initiative and any customer outcome. This process led to a final sample of 56 studies that report 155 effect sizes. All effect sizes are transformed into correlation coefficients and then transformed into Fisher's Z (Lipsey & Wilson, 2001; Peterson & Brown, 2005), using the following code: generate $z = \text{atanh}(r)$; generate $sez = \sqrt{1/(n - 3)}$.

Coding. 1). *IV (green CSR initiatives)*. Substantial (concrete, product/process-oriented claims: e.g., brand's commitment and actions in protecting/doing less harm to the environment) and symbolic green CSR (vague, image/fact-oriented claims: e.g., general environmental claims). 2). *DV (customer outcomes)*. Customer attitude (customer's emotional, and attitudinal outcomes: e.g., customer attitude, engagement, satisfaction) and purchase behaviour (actual purchase action). 3). *Moderator (communication styles)*. Conversational style (casual language that encourages sociability and interaction with the audience: e.g., emoji use, greetings, talk with customers), emotional style (language that evoke emotions and facilitates emotional experiences in the target audience: e.g., moral/social/ecological emotion), and informative style (rational and conducive to intellectual interpretation for the target audience: e.g., numerical values and information related to the initiative; product attributes/applications/price/value; initiative performance/benefits)

4. Findings

The Q-test of the sample ($I^2 = 97.3\% > 50\%$, and $P < 0.1$) suggests strong heterogeneity between the papers, allowing for the selection of a random effects model. Based on the data in this study, it is highly plausible that the heterogeneity comes from 1) the inconsistent impact of the two categories of green CSR initiatives on customer outcomes and/or 2) the presence of moderating effects of communication style.

4.1. Main Effect

Combined effect. The meta-analysis reveals an overall positive and significant impact of green CSR initiatives on customer outcome ($r = 0.214$, 95% CI [0.143, 0.284]), supporting hypothesis 1. Notably, green CSR initiatives positively affect both customer attitude ($r = 0.196$, 95% CI [0.120, 0.272]) and purchase behaviour ($r = 0.332$, 95% CI [0.309, 0.336]).

Sub-groups of initiatives. Looking at the different types of initiatives, substantial initiatives exhibit stronger impact on purchase behaviour ($r = 0.445$, 95% CI [0.428, 0.462])

than on customer attitude ($r = 0.096$, 95% CI [0.073, 0.119]), supporting H2b. H2a is partially supported: symbolic initiatives significantly and positively affect customer attitude ($r = 0.513$, 95% CI [0.423, 0.603]), while the impact on purchase behaviour is not significant ($r = 0.016$, 95% CI [-0.043, 0.075]).

4.2. Moderation Analysis (results can be found in Tab. 1)

IV (substantial/symbolic initiatives) – DV (customer outcomes). Moderation analyses found that all three communication styles positively moderate the link between green CSR initiatives and customer outcomes. H3a, H3b, and H3c are accepted. Specifically, all moderation effects stronger for symbolic initiatives, indicating communication styles are more effective when firm choose symbolic initiatives over substantial one. More precisely, conversational style was the most influential for substantive initiatives ($r = 0.230$), whereas informative style ($r = 0.360$) was optimal for symbolic initiatives.

The moderation analysis also tests sub-type of initiatives (substantial and symbolic initiatives) and sub-type of customer outcomes (customer attitudes and purchase behaviour):

- 1). *IV (symbolic initiatives)– DV (purchase behaviour).* Emotional style does not moderate the relationship between symbolic initiatives and purchase behaviour (n.s.), while informative ($r = 0.187$) and conversational style ($r = 0.070$) have marginally significant moderation effects.
- 2). *IV (symbolic initiatives)– DV (customer attitude).* All three communication styles showed moderate and significant effects.
- 3). *IV (substantial initiatives)– DV (purchase behaviour).* Emotional style has a stronger impact compared to informative and conversational style.
- 4). *IV (substantial initiatives)– DV (customer behaviour).* All three styles show marginally significant effects. Overall, all three communication styles effectively enhance customer attitudes under symbolic initiatives (emotional: $r = 0.520$; informative: $r = 0.526$; conversational: $r = 0.545$). However, their impact on purchase behaviour is minimal. For substantive initiatives, emotional styles are most suitable for purchase behaviours ($r = 0.615$), with informative ($r = 0.464$) and conversational styles ($r = 0.484$) also viable.

Table 1. Moderation Results

IV	DV	Moderator	K	r	Sig. or n.s.
Substantial initiatives	Customer outcomes	emotional	24	0.179	Yes
		informative	30	0.177	Yes
		conversational	27	0.230	Yes
Symbolic initiatives	Customer outcomes	emotional	18	0.271	Yes

		informative	22	0.360	Yes
		conversational	24	0.280	Yes
Symbolic initiatives	Purchase behaviour	emotional	13	0.021	n.s.
		informative	10	0.187	Yes
		conversational	15	0.070	Yes
Symbolic initiatives	Customer attitude	emotional	11	0.520	Yes
		informative	11	0.526	Yes
		conversational	11	0.545	Yes
Substantial initiatives	Purchase behaviour	emotional	12	0.615	n.s.
		informative	12	0.464	Yes
		conversational	16	0.484	Yes
Substantial initiatives	Customer attitude	emotional	12	0.080	n.s.
		informative	12	0.112	Yes
		conversational	16	0.124	Yes

5. Contribution

From the theoretical perspective, this study synthesises empirical results on the impact of green CSR initiatives on customer outcomes. We find that the impact of different types of green CSR initiatives on outcomes varies and identify the moderating role of the communication styles (informative, emotional, and conversational styles) that lead to the link between green CSR initiatives and outcomes.

From the practical perspective, researchers and marketing managers are informed about the viability of green CSR initiatives as a strategy to improve customer outcomes. To be more precise, marketers can use substantive initiatives to increase customer purchase behaviour, (complementing emotional style works best, while informative and conversational styles are also good options, providing flexibility depending on the companies' needs). Symbolic initiatives are useful to enhance customer attitudes (all three styles are almost equally effective). This study also recommends that marketing practitioners give more consideration to the conversational style when implementing substantive initiatives, and that the informative style is more applicable to symbolic initiatives. In a word, marketers can better design marketing strategies to improve the effectiveness of their communications to achieve performance growth.

References

- Akpinar, E., & Berger, J. (2017). Valuable virality. *Journal of Marketing Research*, 54, 318-330.
- da Luz, V. V., Mantovani, D., & Nepomuceno, M. V. (2020). Matching green messages with brand positioning to improve brand evaluation. *Journal of Business Research*, 119, 25-40.
- Deloitte. (2022). *Shifting sands: How consumer behaviour is embracing sustainability*. Retrieved from <https://www2.deloitte.com/ch/en/pages/consumer-business/articles/shifting-sands-sustainable-consumer.html> (Last accessed: November 25, 2023).
- Dijkstra-Silva, S., Schaltegger, S., & Beske-Janssen, P. (2022). Understanding positive contributions to sustainability. A systematic review. *Journal of Environmental Management*, 320, 115802.
- Eisend, M., & Tarrahi, F. (2022). Persuasion knowledge in the marketplace: A meta-analysis. *Journal of Consumer Psychology*, 32, 3-22.
- Folkes, V. S. (1988). Recent attribution research in consumer behavior: A review and new directions. *Journal of consumer research*, 14, 548-565
- Homburg, C., Stierl, M., & Bornemann, T. (2013). Corporate social responsibility in business-to-business markets: How organizational customers account for supplier corporate social responsibility engagement. *Journal of Marketing*, 77, 54-72.
- Janssen, C., Swaen, V., & Du, S. (2022). Is a specific claim always better? The double-edged effects of claim specificity in green advertising. *Journal of Business Research*, 151, 435-447.
- Kuhn, M., Zajontz, Y., & Kollmann, V. (2014). Sustainability Marketing Strategies in Advertising Campaigns—Boon or Bane?. *Proceedings of the 2011 Academy of Marketing Science (AMS) Annual Conference* (p. 405). Coral Gables, AMS.
- Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Thousand Oaks: SAGE.
- Matthes, J., Wonneberger, A., & Schmuck, D. (2014). Consumers' green involvement and the persuasive effects of emotional versus functional ads. *Journal of Business Research*, 67, 1885-1893.
- NYU. (April, 2023). *Sustainable Market Share Index*. Retrieved from <https://www.stern.nyu.edu/sites/default/files/2023-09/Final%202022%20CSB%20Report%20for%20website.pdf> (Last accessed: November 25, 2023).

- Orazi, D. C., & Chan, E. Y. (2020). "They did not walk the green talk!:" How information specificity influences consumer evaluations of disconfirmed environmental claims. *Journal of Business Ethics*, 163, 107-123.
- Packard, G., & Berger, J. (2021). How concrete language shapes customer satisfaction. *Journal of Consumer Research*, 47, 787-806.
- Peterson, R. A., & Brown, S. P. (2005). On the use of beta coefficients in meta-analysis. *Journal of Applied Psychology*, 90, 175.
- Reich, B. J., & Soule, C. A. A. (2016). Green demarketing in advertisements: Comparing "buy green" and "buy less" appeals in product and institutional advertising contexts. *Journal of Advertising*, 45, 441-458.
- Rodrigue, M., Magnan, M., & Cho, C. H. (2013). Is environmental governance substantive or symbolic? An empirical investigation. *Journal of Business Ethics*, 114, 107-129.
- Romani, S., Grappi, S., & Bagozzi, R. P. (2016). Corporate socially responsible initiatives and their effects on consumption of green products. *Journal of Business Ethics*, 135, 253-264.
- Segev, S., Fernandes, J., & Hong, C. (2016). Is your product really green? A content analysis to reassess green advertising. *Journal of advertising*, 45, 85-93.
- Shen, F., Yang, G., Conlin, J., & Wang, X. (2023). Effects of green messages in advertisements: a meta-analysis. *International Journal of Advertising*, 9, 1-17.
- Shrivastava, P. (1995). The role of corporations in achieving ecological sustainability. *Academy of management review*, 20, 936-960.
- Truong, Y., Mazloomi, H., & Berrone, P. (2021). Understanding the impact of symbolic and substantive environmental actions on organizational reputation. *Industrial Marketing Management*, 92, 307-320.
- Wang, W., Krishna, A., & McFerran, B. (2017). Turning off the lights: Consumers' environmental efforts depend on visible efforts of firms. *Journal of Marketing Research*, 54, 478-494.
- Williamson D, Lynch-Wood G, Ramsay J. 2006. Drivers of environmental behaviour in manufacturing SMEs and the implications for CSR. *Journal of Business Ethics*. 67, 317–330.
- Xie, C., Bagozzi, R. P., & Grønhaug, K. (2015). The role of moral emotions and individual differences in consumer responses to corporate green and non-green actions. *Journal of the academy of Marketing Science*, 43, 333-356.

AMBS Doctoral Conference Best Social Responsibility Competition Submission

Name of Student: Kashfia Ameen

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Division: PMO

Name of Supervisor(s): Dr Arjan Keizer, Dr Matthew Alford

Title: Worker Power in the Garment Global Value Chain: Evidence from the Bangladeshi Garment Industry

Wordcount: 497

This study builds on the concepts of worker power from global labour studies. The focus is on structural and associational power. Structural power arises from workers' position in the economic system and the capacity it provides for disrupting capital accumulation, associational power results from their collective organization (Wright, 2000). A global value chain (GVC) framework is used to understand the extent to which the state can promote or constrain power resources among workers. In GVC scholarship, the concept of public governance indicates the role of the state. Much analysis of worker power in the garment GVC has not adequately examined how the state shapes worker power. Existing literature has established that transnational corporations outsource production to developing countries where public governance is weakly enforced. Scholars agree that workers in the garment GVC are employed under exploitative conditions and have low power resources. Union organization is discouraged by the state, and workers have limited freedom of association. These developments are predominantly apparent in Bangladesh, a world leading garment exporter. In these premises, this study seeks to address the following central research question: 'What are the implications of the role state for promoting or constraining worker power in the Bangladeshi garment industry?' Preliminary findings suggest that worker power is typically exercised as strike action. The study argues that worker power is heavily influenced by prevailing public governance mechanisms and dynamic state-labour relations.

This research is socially responsible and strives to develop knowledge that benefits the broader society, locally and globally. Theoretically, the study will contribute to emerging GVC research on the role and functions of the state. This will broaden the GVC framework. A key theoretical argument based on preliminary findings is that a wider conceptualization of the intersection between governance and worker power is necessary. Empirically, the research highlights how GVCs 'touch down', and what can be done by public actors to create decent jobs where worker power is not inhibited. The policy implications will inform national regulations to address the fundamental challenges faced by workers in accessing power resources in the garment GVC. The study can influence policy to re-evaluate the vulnerable position of workers in the Global South. The study thus makes valuable contributions in both theoretical and practical domains to examine critical current issues.

The research values methodological pluralism. The study utilizes a qualitative research strategy and case study research design. Primary data is collected from semi-structured and structured interviews of workers. For triangulation, the research uses insight from different stakeholders such as supervisors, factory managers, trade union leaders, government officials and civil society. Rigor in method and results is maintained. The study is also interdisciplinary in nature, drawing from labour geography, international business and employment relations literatures. The study will be widely circulated through publications, conferences and open access publishing.

The research will directly impact stakeholders connected to the garment GVC. The study has important societal implications, with the results benefiting workers. These efforts will boost freedom of association and collective organization among workers.

References:

Marslev K, Staritz C & Raj-Reichert G (2022) Rethinking Social Upgrading in Global Value Chains: Worker Power, State–Labour Relations and Intersectionality. *Development and Change* 53(4): 827–859.

Wright EO (2000) Working-class power, capitalist-class interests, and class compromise. *American Journal of Sociology* 105(4): 957–1002.

Enhancing Social Responsibility in Business Schools: A Comparative Analysis of Responsible Management Learning and Education Integration Patterns and Connection to Responsible Research in Business and Management

Drake Keyang Zhou

IMP Division

This research, dedicated to the integration of Responsible Management Learning and Education (RMLE) within the curricula and strategic framework of business schools, stands at the confluence of the basic principles of Responsible Research in Business and Management (RRBM). Venturing beyond traditional academic boundaries, it scrutinizes the critical influence of business models on the adoption of RMLE embedded patterns in business schools. This inquiry does not merely aspire to augment scholarly understanding of RMLE's incorporation but aims to sculpt a more ethical, responsible, and sustainable panorama of business practices, thereby enhancing societal welfare.

(Principle 1) Service to Society: A Beacon of Enlightenment

At the heart of this research is an urgent call for business schools to develop future leaders who are adept at dealing with the diverse social and environmental challenges of our time. Through identification and analysis of RMLE embedded patterns, this study reveals potent strategies for embedding Ethics, Responsibility, and Sustainability (ERS) into the process of management education. This research directly benefits society by equipping emerging leaders with the ability and resolve to spearhead socially responsible initiatives, reflecting the study's profound commitment to societal upliftment.

(Principle 2) Valuing Both Theoretical and Practical Contributions: A Dual Commitment

This research represents a delicate balance of theoretical depth and practical utility, contributing richly to the dialogue surrounding RMLE while simultaneously offering business schools tangible blueprints for fostering social responsibility. This blend of theory and application ensures that the study's outcomes are not only anchored in scholarly rigor but are also closely connected with immediate relevance to the pressing challenges confronting our world.

(Principle 4) Sound Methodology: The Backbone of Rigor

By adopting a robust methodological framework that synergizes a systematic literature review with qualitative comparative analysis, the study exemplifies reliability and validity in its quest to decode RMLE integration within business schools. This methodology enables a nuanced dissection of the various factors influencing RMLE strategies, providing a solid foundation for insightful analysis.

(Principle 5) Stakeholder Involvement: A Collaborative Process

This research is a collaborative process that encompasses thematic and qualitative comparative analyses, thereby knitting together perspectives from academia and the business sphere. This reflective examination of the impact of business schools' models on their RMLE strategies reflects the diverse aspirations and concerns of a broad stakeholder spectrum, including students, educators, business leaders, and the wider community, ensuring that the study resonates with a broad audience.

(Principle 6) Impact on Stakeholders: A Vision for Transformation

Poised to leave a mark on the strategic orientations of business schools globally, this study heralds a new way for embedding ERS in educational offerings. Its findings promise to catalyze strategic realignments within business schools, amplifying their societal impact and fostering an environment where future leaders are not only aware of but are actively engaged in addressing the challenges and opportunities of sustainable and responsible management.

In conclusion, this research embodies the essence of RRBM, advocating for a recalibration of business schools' strategic focus towards social responsibility, sustainability, and ethical leadership. It is a call for creating a more equitable, sustainable, and thriving global society, emphasizing the commitment to pioneering research that not only illuminates the academic landscape but also propels us towards a more socially responsible future.

The Effect of Disaggregated Assets and Liabilities Held for Sale Disclosure in Partial-Firm Acquisitions

By: Achmad Faizal Azmi (Lancaster University Management School)

This study examines whether the disaggregated disclosure of fair value of assets and liabilities held for sale provides more relevant information for acquiring shareholders regarding assets being acquired. I exploit a discretion of disaggregation of disclosure of fair value of assets and liabilities held for sale by target firms. I find that higher disaggregation of assets and liabilities held for sale disclosure leads to higher absolute cumulative abnormal return by acquirers around the date of disclosure by target firms. This result suggests that more relevant information is conveyed to acquiring shareholders regarding asset sales when target firms disclose the value of assets and liabilities held for sale in a clearly disaggregated manner. I find that the disaggregated disclosure of assets and liabilities held for sale is more relevant when ratio of deal price and gain on disposal to total assets of acquirer is higher. I also find that a higher difference between amortized cost and fair value makes more granular fair value information more relevant to the acquiring shareholders. However, I also find that the positive effect of disaggregation is more muted when there is a financial information about assets being acquired in the deal press release. Finally, these findings are robust to several concern of omitted variables, such as blockholders ownership and segment reporting disclosure.

My study contributes to three streams of literature. First, I add to the literature on disaggregation in accounting disclosure. Most studies in this literature mainly focus on the usefulness of disaggregation of income statement components. I contribute to this literature by determining whether the disaggregation of balance sheet items for assets and liabilities held for sale is informative for acquiring shareholders in evaluating the acquisition decision. Second, I add to the literature on fair value measurement and disclosure during the acquisition process. I contribute to this literature by showing whether the fair value disclosure provided by target firms during the acquisition process is also relevant for acquiring shareholders in evaluating the acquisition decision by acquirers. Finally, this paper contributes to the literature on regulatory disclosure during merger and acquisition. Most studies in this literature mainly focus on the post-acquisition disclosure that is mandated for the buyers in the form of purchase price allocation (Shalev, 2009; Zhang and Zhang, 2017). However, less emphasis is put on the pre-acquisition disclosure by sellers in the form of fair value for assets and liabilities held for sale. This finding will provide important input for the SEC, which is particularly interested in regulating the disclosure of value-relevant information in the context of M&A. Overall, these findings are relevant for the SEC and standard setters in determining whether there should be a rigid rule on the aggregation of assets and liabilities held for sale.

Making way for education: the localised effects of reusing confiscated Mafia houses in the South of Italy

Abstract

“The path of simple repression, which strikes at the outgrowth, but does not change the economic, social and political humus in which the Mafia has its roots, has not led and could not lead to definitive results (...)”

Pio La Torre (1976)

Real estate confiscation is a widespread practice to fight organised crime throughout European countries. During the last decades a few countries also introduced the possibility to reuse the real estate confiscated from criminal groups for social purposes. The Italian policy for the Social Reallocation and Reuse (SRR) of confiscated mafia houses allows reallocating confiscated mafia properties to municipalities, enabling local NGOs to run activities that empower the local disadvantaged groups. While properties confiscation directly hinders mafia families coming with their arrest, the reuse of mafia houses as local amenities may play a substantial role in regenerating the community engagement of mafia-ridden neighbourhoods.

The recent literature focusing on the evaluation of the SRR policy found that reallocating mafia real estate increases market competition and housing prices locally (Boeri et al., 2023; Ferrante et al., 2021). However, only 17% of the reallocated mafia houses are effectively used by the local NGOs, leaving the mechanisms behind this effect unclear. Moreover, the localised impact of the SRR policy on the targeted disadvantaged groups has not been analysed so far. Using novel data about schools' dropout rates from 2015 to 2022, I evaluate the impact of the staggered reuse of mafia houses on the nearby schools' dropout rates under a difference-in-differences design. I focus on the outcomes of at-risk of dropping out students concentrated in low-performing schools, following the literature about the detrimental effects of organised crime on education and human capital (Acemoglu et al., 2020; Caglayan et al., 2017, 2021) and the empirical works evaluating the impact of localised welfare policies on at-risk juveniles (Garcia et al., 2019; Sviatschi, 2022).

I present two sets of results and several robustness exercises which reveal a slight decrease in dropout rates for schools being surrounded by reused mafia houses within a buffer distance between 200 and 500 meters. First, I provide evidence that even though the reuse of mafia real estates has zero effect on dropout rates when considering all schools, there is a consistent negative effect of the SRR policy on the dropout rates of low-performing schools. This finding supports the hypothesis that the SRR policy is affecting the targeted at-risk juveniles within the local community, proposing new role models, and increasing their investment in education. Second, I further investigate the mechanisms behind my main results showing that the effect of the SRR policy is driven by the mafia real estates reused for educational purposes. Additionally, I am collecting data about the presence of mafia families at the neighbourhood level to examine the potential heterogeneity between mafia-ridden neighbourhoods and those that are not. These findings can have implications in reprioritizing public funds to enhance anti-mafia initiatives improving human and social capital in mafia strongholds, as well as addressing the bureaucratic issues that impede their effective restoration.

Title: The impact of a safe motherhood cash transfer programme on intimate partner violence in India

Author: Shoumeli Das

Affiliation: Doctoral candidate – 2nd year, Economics group, University of Liverpool

Abstract

In this paper, I estimate the effect of a safe motherhood cash transfer programme in India on women's perception of prevalence of intimate partner violence (IPV) in their communities. The Janani Suraksha Yojana (JSY) is one of the world's largest cash transfer schemes within which women from socioeconomically marginalised populations are provided a one-time assistance, conditional on giving birth at government facilities/ accredited private institutions. The empirical strategy of this study exploits the programme's categorisation of states as low and high performing based on rates of institutional deliveries. Using data from two waves of the India Human Development Survey (IHDS) panel and a Difference-in-Differences methodology, I find that the JSY led to a significant reduction in IPV prevalence within households in the 10 low performing states where the scheme had wider coverage. Specifically, the scheme led to an 8-14 percentage point reduction in women's perception of IPV prevalence in their communities in 2011-12, six years after it was launched. The results are robust to the variation in caste-geography eligibility of individual women as well as to variation in the actual coverage of the scheme at the district level. Further, I use data from four phases of the Demographic and Health Survey (DHS) from 1998-99 to 2019 to estimate the impact of the scheme on women's actual experiences on four types of spousal violence. My findings are consistent with non-cooperative models of household bargaining. I show that women in the treated states experienced a significant improvement in intra-household agency by having a greater say in household decision-making and re-negotiating domestic responsibilities. This paper contributes to the academic literature by providing new evidence on the effectiveness of maternity benefit cash assistance in reducing IPV within Indian households. The findings also have important policy implications in re-prioritising resource allocation to social policy in general and social protection schemes in particular.

Energy Efficiency Capitalization

Davidmac Ekeocha

Energy efficiency offers unlimited opportunities for mutual benefit through the implementation of aggressive energy conservation policies (Allcott and Greenstone 2012; Fowlie et al. 2018). These benefits involve reductions in externalities (health problems and climate change). In 2004, the residential sector accounted for 17.9% of final energy demand in South Africa. Much of this energy consumed is biomass-based. Thus, presenting opportunities for energy savings and pollution mitigation measures of international significance. Hence, the national government sought for policies to improve energy efficiency in the country via the national energy efficiency strategy (NEES). They set a target for the residential sector of a 10% improvement in energy efficiency by 2015. Consequently, efficiency improvements between 2000 and 2012 have resulted in a fall in household energy consumption by 28% significantly above the NEES target.

This study makes four important contributions to the developing countries' literature. First, it is the first study to document evidence on the effect of energy efficiency on household energy use in developing countries. Indeed, in developed countries such as in North America and Europe, the literatures have documented significant decreases in household's average energy consumption due to energy efficiency improvements (Adan and Fuerst 2016; Allcott and Greenstone 2012; Costa and Kahn 2011; Fowlie et al. 2018). However, Davis et al. (2014) evinced a heterogeneous effect of energy efficiency on energy consumption in Mexico.

Second, it is the first study to use quasi-experimental designs to investigate the effect of energy efficiency on the house prices and rents for a developing country. NEES established a mandatory standard on the energy performance of new residential housings in South Africa (South African National Standard: Energy Efficiency in Buildings 2011). This raises the question, whether energy efficiency is capitalised in the housing market in South Africa? The closest literatures on house prices and rents are in Europe and North America (Dastrup et al. 2012; Ferentinos et al. 2023; Gaur and Lang 2023). Albeit these papers used quasi-experimental designs, their results are inconclusive due to different identification strategies in developed countries. Moreover, whereas previous causal studies inconclusively focused on the capitalization of energy efficiency on house prices in developed countries, this study provides causal evidence of its effect on house prices and rents for a developing country. The results showed that, indeed energy efficiency is capitalised in the housing market in South Africa by increasing property values and rents of low-income households.

Third, it examines the effect of energy efficiency on the environment—pollution outcomes. Given the importance of energy efficiency in reducing the externalities from climate change, this study provides causal evidence on the effect of energy efficiency improvements on the environment in terms of pollution (littering, air, and water) and land degradation. The literature on pollution reduction effect of energy efficiency is quite meagre and comes from engineering, lacking causal evidence. In addition, this literature exclusively focused on the environmental impact on one pollution outcome—air pollution (Zhang et al. 2014; 2015). This could be attributed to lack of available data. This study attempts to extend this literature by presenting the first causal evidence on the environmental impact of energy efficiency improvements, focusing on air, water, and noise pollution, littering and land degradation in a developing country. The results are consistent with the pollution reductions argument of energy efficiency improvements. This evidence of pollution reductions will provide deeper explanations on the transmission mechanisms of environmental improvements—due to energy efficiency—to public health gains.

The fourth contribution examines the effect of energy efficiency on public health outcomes. Many literatures have argued for the public health benefits of abated air pollution and vice versa, in terms of morbidity and mortality rate reductions in both adults and children (Greenstone and Hanna 2014; Schlenker and Walker 2016; Sheldon and Sankaran 2017). However, they neglect the effect of energy efficiency. They argued for a pathophysiological transmission mechanism on public health benefits of pollution reductions. This study presents a more global picture of public health gains ascribing it to energy efficiency improvements. It argues that the pollution reductions effect of energy efficiency improvements serves as a conduit towards public health gains in terms of non-chronic morbidity—respiratory infections, diarrhoea, and severe tuberculosis (TBC) in South Africa. I further document evidence of mental health gains caused by energy efficiency upgrades.

This study exploits the exogenous variation provided by the NEES programme in South Africa to argue the above contributions. This identification strategy involves the use of only the share of NEES-eligible low-income

households. Similar identification strategy has been used by Davis et al. (2014) in Mexico. The TWFE estimates and event study designs is employed to determine the effect of the energy efficiency on the outcomes before and after the roll-out of NEES interventions to low-income households between 2011 and 2012. The confidence in the recovered causal impacts rest on several robustness checks conducted including pre-trends testing, potential selection issues, internal validity checks, and alternative specifications and quasi-experimental design.

The main limitation of this study is unavailability of panel data for low-income households in South Africa. Instead, I use a repeated cross-sections making it impossible to control for household and village fixed effects. However, I did in fact control for provincial fixed effects and linear trends, clustering the standard errors at the province level and then bootstrapped the standard errors to account for any within provincial correlations and precision of the estimates.

The results from this study have far-reaching policy implications. First, the causal evidence would inform governments in developing countries on the significance of embarking on an energy efficiency programme. Thus, providing a blueprint of potential expectations from such endeavour should they adopt a similar programme as in South Africa. For the South African government, it provides them clear evidence on the impact of their energy efficiency programme on the targeted group in terms of the residential energy sector, housing market, environment, and public health, which would guide future evolution and possible consolidation of the programme in a different domain.

References

- Adan, H., & Fuerst, F. (2016). Do energy efficiency measures really reduce household energy consumption? a difference-in-difference analysis. *Energy Efficiency*, 9, 1207–1219.
- Allcott, H., & Greenstone, M. (2012). Is there an energy efficiency gap? *Journal of Economic perspectives*, 26(1), 3–28.
- Dastrup, S. R., Zivin, J. G., Costa, D. L., & Kahn, M. E. (2012). Understanding the solar home price premium: Electricity generation and “green” social status. *European Economic Review*, 56(5), 961–973.
- Davis, L. W., Fuchs, A., & Gertler, P. (2014). Cash for coolers: Evaluating a large-scale appliance replacement program in Mexico. *American Economic Journal: Economic Policy*, 6(4), 207–238.
- Ferentinos, K., Gibberd, A., & Guin, B. (2023). Stranded houses? the price effect of a minimum energy efficiency standard. *Energy Economics*, 120, 106–555.
- Gaur, V., & Lang, C. (2023). House of the rising sun: The effect of utility-scale solar arrays on housing prices. *Energy Economics*, 106–699.
- Greenstone, M., & Hanna, R. (2014). Environmental regulations, air and water pollution, and infant mortality in India. *American Economic Review*, 104(10), 3038–3072.
- Greenstone, M., & Hanna, R. (2014). Environmental regulations, air and water pollution, and infant mortality in India. *American Economic Review*, 104(10), 3038–3072.
- Schlenker, W., & Walker, W. R. (2016). Airports, air pollution, and contemporaneous health. *The Review of Economic Studies*, 83(2), 768–809.
- Sheldon, T. L., & Sankaran, C. (2017). The impact of Indonesian forest fires on Singaporean pollution and health. *American Economic Review*, 107(5), 526–529.
- South African national standard: Energy efficiency in buildings (1st ed.). (2011). South African Bureau of Standards.

Zhang, S., Worrell, E., & Crijns-Graus, W. (2015). Evaluating co-benefits of energy efficiency and air pollution abatement in China's cement industry. *Applied Energy*, 147, 192–213.

Zhang, S., Worrell, E., Crijns-Graus, W., Wagner, F., & Cofala, J. (2014). Co-benefits of energy efficiency improvement and air pollution abatement in the Chinese iron and steel industry. *Energy*, 78, 333–345.

The Effect of Pay Secrecy Bans on Wages and Discrimination Complaints:

Abstract

Luke Walsh

Policymakers seek to combat inequality within firms through pay secrecy bans and other pay transparency regulations. Over the past decade, policymakers across the U.S. and Europe have implemented such regulations with renewed interest to provide workers with greater information about their co-workers' wages and reduce pay secrecy regimes. However, the effectiveness of such laws is unclear. We evaluate the impact of state-level bans on pay secrecy policies on future wages and whether such laws raise the number of discrimination-based lawsuits. Using data from the Current Population Survey from 1977–2021, we evaluate the impact of the staggered introduction of laws in a difference-in-differences framework to identify the effect of pay transparency legislation on wages. We focus on whether groups with protected characteristics such as sex, race, age, and disability are differentially impacted by such laws to establish the ability of pay secrecy bans to increase equality. To further understand the underlying mechanisms behind the effectiveness of pay secrecy bans, we test whether changes in state-level pay secrecy lead to an increase in the number of discrimination charges filed with the EEOC.

We present three main sets of results contributing to the literature on pay transparency and discrimination in the workplace. First, we provide new evidence on whether pay secrecy bans, as implemented by policymakers, impact wages and pay gaps. We show that pay secrecy bans had zero impact on wages, for all workers as well as for workers with protected characteristics. Importantly, pre-legislation wages exhibit no differential trends, suggesting the timing of when states pass pay secrecy bans is uncorrelated with the dynamics of wages over time, and we allow for departures from the assumption of treatment effects homogeneity. Second, we show that despite having zero impacts on wages, pay secrecy bans increase workers' perception of discrimination in the workplace. Three to four years after the introduction of pay secrecy bans, discrimination complaints filed with the EEOC increased by 25–40%. Complaints increase significantly across all protected characteristics such as race, sex, disability, and age, suggesting that pay secrecy bans unequivocally increase employees' perceptions of discrimination in the workplace. Finally, we provide a comprehensive discussion of the underlying reasons behind why bans lead to increases in discrimination complaints but no change in wages. We argue that even if employees do learn of the pay of others and employers comply with pay secrecy bans, profit-maximizing employers may keep wages low and continue to discriminate if the expected costs of discrimination through litigation are low.

Partisan Capital Structure

Zhiju Cai, Emiel Jerphanion, and Maria Marchica

Abstract: In recent decades, partisan affiliations and partisan perceptions among opposing political party members have become more pervasive around the world. A growing line of related literature in political science documents an increasing polarization. This increasing partisan divergence can result in substantially different beliefs about the future state of the economy. The idea of “partisan perception screen” argues that party identification shapes the beliefs about political and economic issues through a psychological force: individuals have a more positive and optimistic assessments of future economic conditions when their views align with the ruling party. Further evidence reveals that these partisan beliefs of individuals directly affect their economic decision making. However, it remains unclear whether the political affiliation of corporate executives also affects corporate decisions. In particular, we will investigate whether partisan alignment with the ruling party affects corporate capital structure choices. According to the trade-off theory of capital structure, corporate leaders aim for an optimal level of capital structure by balancing the tax shield of borrowing and the costs of financial distress. We posit that partisan-affiliated corporate leaders will be, on average, more optimistic about the future economic conditions if they align with the ruling party. Hence we expect that they will tend to leverage more debt, anticipating stronger cash flows in the future and lower financial distress risk. Using a newly assembled database of political affiliation for a large sample of executives of US companies, this study will employ a difference-in-differences (DiD) methodology. We will exploit the 2016 and 2020 U.S. presidential elections to explore the capital structure choices of corporate leaders with divergent political affiliations before and after these electoral events. The chosen elections serve as suitable exogenous shocks, characterized by their tightly contested nature that will provide a robust framework to identify the impact of partisan perception on corporate decision-making.

Common ownership and venture capital

Abstract

ID Number: 11416726

Qi Chen

Common ownership refers to institutional investors holding equity in multiple firms within the same industry. Both anecdotal evidence and empirical studies suggest that common investors significantly influence the strategies of their portfolio firms (He & Huang, 2017). This raises question about whether common investors can create value through actively engaging in resource allocation among their portfolio firms. Research on this issue is scarce, except for Li et al. (2023), who investigate the capital allocation in the venture capital scenario. However, little is known about the allocation of non-capital resources and its associated efficiency. Exploring the allocation of non-capital resources among portfolio companies is crucial, particularly in the context of innovation. Since innovation involves experimenting with new ideas and carries significant risk and cost, optimizing the use of innovation resources not only conserves capital for investors but also enhances societal well-being.

Venture capital (VC) presents an ideal setting to investigate this question, given VC backers' substantial control rights and active involvement in monitoring startups. What's more, common ownership is also prevalent in the VC industry (Eldar & Grennan, 2021). Therefore, studying the allocation of innovation resources within the common VC framework is of academic interest and substantial economic importance. This research specifically targets inventors, considering their central role as essential innovation resources. Thus, my research questions are as follows: First, is common VC investment related to higher inventor mobility? Second, if so, what are the determinants of inventor mobility? Third, does inventor mobility increase innovation productivity as characterized by patent numbers and quality?

To address the endogeneity issue and disentangle the "screening" and "monitoring" effects, I employ an identification strategy by using the introduction of new airline routes that reduce the travel time between VCs' headquarters and their portfolio firms as an exogenous variation. The idea is that a reduction in travel time helps VCs better understand firm's condition and identify potential synergistic opportunities among inventors.

This study is most closely related to Li et al. (2023), who find that common ownership prompts VCs to restrict funding to lagging startups, thereby improving overall innovation efficiency. My research explores how common VC ownership influences non-capital resources allocation—inventor mobility. Additionally, I broaden its scope beyond pharmaceuticals to offer insights with wider applicability. This research is also related to González-Urbe (2020), who shows that exchange of innovation resources is prevalent among startups with common VCs. My research tries to differentiate the "screening" and "monitoring" effect of common VCs and extends her work by assessing the impact of resource allocations on innovation productivity.

Venture capital investment, patent, and inventor data are mainly collected from Refinitiv Workspace, the USPTO PatEx database, and LinkedIn, spanning from 2000 to 2020.

Title: Do corporate environmental resolutions mitigate greenwashing? A regression discontinuity approach
(provisional)

Student Name: Ziyi Huang

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Supervisors: Professor Ning Gao and Alice Liang Xu (Accounting and Finance department)

Abstract:

Environmental, including climate, issues have become a global challenge. As a primary source of pollutants and greenhouse emissions, the corporate sector has received heightened attention from investors, regulators, and other stakeholders. Greenwashing, a type of selective disclosure behaviour, arises from the pressure on companies to abate pollution and maintain financial performance simultaneously. Under such pressure, companies often are motivated to selectively disclose their environmental conduct and even convey false information to users like investors and consumers (Lyon and Maxwell, 2011). In recent years, due to the increased awareness of environmental risks, shareholders submit more environment-related proposals (e.g., toxic emissions reduction and emissions abatement) in annual meetings. Some of these proposals got passed after voting. In principle, passed resolutions represent majority shareholders' concerns and should be implemented subsequently. As a result, companies' environmental profiles could improve after shareholder resolutions, which reduces the need for greenwashing. However, it is also possible that actual improvement in a company's environment is costly and takes years to achieve. Under the pressure of environmental resolution, managers have a stronger incentive to falsify their environmental profile, which exacerbates greenwashing. It is, therefore, an empirical question whether environment-related shareholder resolutions will make companies truly improve environmental performance or just make companies more inclined to greenwash. In this study, we will apply the Regression Discontinuity Design (RDD) in Cunnat et al. (2012) as a primary research method. The RDD is ideal for overcoming selection bias because whether a proposal is passed is random within any small interval near the threshold. Our study will suggest effective ways to enhance corporate environmental disclosure. We will also contribute to the literature on the determinants of greenwashing and suggest ways to mitigate companies' greenwashing behaviour which otherwise generates substantial private and social costs. Moreover, a better understanding of the determinants of greenwashing will enable better management of environmental risk and reduce related social and private costs.

References:

- Cuñat, V., Gine, M., & Guadalupe, M. (2012). The vote is cast: The effect of corporate governance on shareholder value. *The journal of finance*, 67(5), 1943-1977.
- Lyon, T. P., & Maxwell, J. W. (2011). Greenwash: Corporate environmental disclosure under threat of audit. *Journal of economics & management strategy*, 20(1), 3-41.

Title: Does Corporate Culture Impact on Firms' Carbon Emissions?

Guo Lu

This study seeks to answer what role corporate culture plays in a firm's carbon reduction and whether a specific type of corporate culture improves or hinders a firm's carbon performance. The answers to these questions are essential for improving our understanding of corporate actions and performance related to carbon emissions.

We are motivated to focus on this topic due to the growing concern about the climate-related challenges arising from carbon emissions. Carbon reduction is closely related to several sustainability goals proposed by the United Nations, such as climate action, life below water and life on land (OECD, 2021). Issues related to transition risk also arise due to a mix of uncertainties in the process of adjustments towards a low-carbon economy; these can be related to potential changes in climate policies, reputation risk, the development of norms and the appearance of new technologies (Bolton and Kacperczyk, 2021b; Semieniuk et al., 2021).

We argue that corporate culture, defined as a set of ideas invented and accepted throughout a firm (Gittell and Godwyn, 2011), can substantially impact on firms' carbon emissions. Given its influence on employee behaviours and an influence on organisational commitments, corporate culture is deemed as people's psychological connections to their organisations, including the sense of job participation, loyalty, and dedication to the organisations' principles (O'Reilly, 2008). We therefore believe that firms' cultural characteristics can affect their carbon-related policies and performance.

In this study, we adopt the Competing Value Framework (CVF). Proposed by Quinn and Rohrbaugh (1983) and further developed by Cameron et al. (2006), CVF is a widely accepted framework used in many empirical studies (Fiorellesi and Ricci, 2014; Fiorellesi et al., 2019; Nguyen et al., 2019; Bhandari et al., 2022; Chen et al., 2022). This framework classifies corporate culture into 4 types: collaboration, control, competition, and creation. To measure each dimension of corporate culture, we construct culture scores by using textual analysis on 10-K filings. Our initial findings show that competition culture has a negative relationship with carbon emissions indicating that firms with this type of culture tend to have better carbon performance than their peer firms.

This study can make several contributions to the literature. Firstly, it can add to the recent research on corporate culture by capturing its influence on non-financial performance. Secondly, this study can contribute to the literature using natural language processing on large sample data to measure corporate cultures. Additionally, this paper can add to research on the determinants of carbon emissions. Finally, the results of this paper can have some practical implications for capital markets as it can help market participants understand the critical role of corporate culture on a firm's carbon performance.

Abstract

Faria Rista

Sustainability reporting has evolved into a standard practice across corporations, with the past decade witnessing substantial growth. Presently, the adoption rate is near 100 percent among the globe's largest enterprises (KPMG, 2022). The primary goal of sustainability assurance (SA) is to enhance the credibility of sustainability reports. However, the unregulated status of SA, in contrast to financial audits, results in non-standardised protocols and lets market forces dictate its scope and objectives, creating a varied and evolving SA environment. Concurrently, the voluntary and unregulated nature of sustainability reporting prompts concerns over the reliability and credibility of disclosed information (Farooq and De Villiers, 2017). To address the issue, nearly half of the world's highest-grossing firms have embraced independent third-party sustainability assurance, underscoring its importance in boosting report credibility, with anticipated regulatory reforms likely to increase its adoption (KPMG, 2022). Discussions on financial stability and sustainable development currently dominate the political agenda. The creation of the International Sustainability Standards Board (ISSB) and the release of its initial standards in June 2023, the activation of the EU's Corporate Sustainability Reporting Directive (CSRD) in January 2023, and the adoption of the European Sustainability Reporting Standards (ESRS) by the European Commission in July 2023 have all marked recent advancements in sustainability standards globally (Venter and Krasodomska, 2024). Therefore, this sparked the need for complementary international assurance standards on corporate sustainability reporting. The International Auditing and Assurance Standards Board (IAASB) has prioritised sustainability assurance by initiating a project to create a new, distinct sustainability assurance standard aimed at becoming the globally accepted baseline for sustainability reporting assurance. The goal of the International Standard on Sustainability Assurance (ISSA) 5000 is to establish a comprehensive standard for sustainability reporting assurance. The IAASB is now reviewing feedback from the consultation phase, with plans to release the final standard by the end of 2024 (IAASB, 2023). Thus, based on this backdrop, the research will utilise a qualitative approach to analyse stakeholder comments made during the consultation stage to identify and understand the issues highlighted and the influences of various parties involved in the consultation process. However, the interpretation of documents is inherently subjective, which can impact the objectivity and precision of research outcomes. The research outcome will contribute to reflective insights into standard-setting processes, elucidating the roles and viewpoints of the involved stakeholders.

References:

Farooq, M.B. and De Villiers, C. (2017) 'The market for sustainability assurance services: A comprehensive literature review and future avenues for research', *Pacific Accounting Review*, 29(1), pp. 79–106. Available at: <https://doi.org/10.1108/PAR-10-2016-0093>.

IAASB (2023) *PROPOSED INTERNATIONAL STANDARD ON SUSTAINABILITY ASSURANCE 5000 APPROVED FOR PUBLIC CONSULTATION BY UNANIMOUS VOTE*. Available at: <https://www.iaasb.org/news-events/2023-06/proposed-international-standard-sustainability-assurance-5000-approved-public-consultation-unanimous>.

KPMG (2022) *Big shifts, small steps- Survey of Sustainability Reporting 2022*. Available at: <https://assets.kpmg.com/content/dam/kpmg/se/pdf/komm/2022/Global-Survey-of-Sustainability-Reporting-2022.pdf>.

Venter, E.R. and Krasodomska, J. (2024) 'Research on extended external reporting assurance: An update on recent developments', *Journal of International Financial Management & Accounting*, p. jifm.12200. Available at: <https://doi.org/10.1111/jifm.12200>.

**Citizens' Voice Matter:
The Unintended Environmental Consequences of Qui Tam Whistleblowing Laws**

Huanzhen Yu

Supervised by Prof. Viet Anh Dang and Prof. Edward Lee

This study examines whether and how whistleblowing laws affect corporate environmental performance. Existing studies on whistleblowing have mainly focused on the economic consequences of the Dodd-Frank whistleblowing provision. They show that this provision affects the probability of financial fraud and deters financial misstatement, tax aggressiveness, and even insider trading (Berger and Lee, 2022; Raleigh et al., 2023; Wiedman and Zhu, 2023; Wilde 2017). However, there is limited evidence of how and to what extent qui tam-based whistleblowing laws affect firms' environmental performance. In such qui tam laws, individuals who assist in prosecution can obtain for themselves a portion of the damages or financial penalties recovered by the government. My study seeks to fill this gap.

To identify the causal effect of whistleblowing laws on corporate environmental performance, most of the existing literature utilizes the passage of the Dodd-Frank whistleblowing provision as a quasi-natural experiment. Nevertheless, this provision operates within a broad framework of several other corporate governance codes and regulations within the Dodd-Frank Act, rendering it extremely difficult to isolate the deterrence effects of the whistleblowing program from other provisions. As such, the identification strategy of my study exploits the state-level staggered compliance with the False Claims Act (FCA). Since 1986, many states have adopted their own FCAs to assert economic interests at the state level, which provides a more plausibly exogenous setting to examine the effects of whistleblowing law on the environment.

Specifically, my empirical design is a staggered difference-in-difference (DID) regression based on the passage of each state-level general FCA. To identify states more exposed to climate transition risk, I use the civil cases from the Environmental Protection Agency as a conditioning variable in my empirical specification. My outcome variable is the emissions intensity calculated based on TRI (Toxics Release Inventory) emissions. The tension in my research question arises from two competing hypotheses. On the one hand, the deterrence effect hypothesis posits that the enactment of FCA will monitor and discourage emissions activities among firms situated in states with a higher frequency of environmental lawsuits, thereby improving corporate environmental performance. On the other hand, the financial constraint hypothesis predicts that being exposed by whistleblowers complicates firms' access to external resources, thereby impeding their ability to implement emission abatement measures and reducing their environmental performance. My study contributes to the growing literature on climate finance which examines diverse factors influencing corporate environmental performance. Additionally, it enriches the extensive literature exploring the impacts and significance of whistleblowers. Overall, my research also provides potential policy implications for the environmental protection role of whistleblowing laws.

PhD IMP – STIP

Abstract

Academic and policy interests in the field of Innovation Management have focused traditionally on high technology industries. These industries, such as advanced manufacturing, pharmaceuticals, and digital technology, are characterised by tradable or exportable goods and services that are produced usually from high research and development (R&D) intensity. Further investment in high technology industries is associated with large multiplier effects, such as greater economic growth, higher wage levels, and the “levelling up” of less developed regions. The latest UK Digital Strategy, for example, states that ‘The UK’s economic future, jobs, wage levels, prosperity, national security, cost of living, productivity, ability to compete globally and our geopolitical standing in the world *are all reliant on continued and growing success in digital technology*’ (Philp, 2022: 10m, italics added). Similarly, the latest UK Innovation Strategy prioritises the need to increase R&D investment to new records, and boost private sector innovation in British firms (BEIS & DSIT, 2023).

Contrary to the mainstream discourses noted above is that R&D for private sector innovation, usually in advanced industries, yields relatively small public benefits at the aggregate scale of whole societies. As highlighted by Hansen (2022: 1033), ‘There is very scarce evidence that European regions with high levels of innovativeness and successful development of high-tech industries are characterized by reduced levels of poverty and social deprivation – rather the opposite’. Social scientists have advanced the concept of “the foundational economy” (FE) to engage critically with the relationship between industrial development and the conditions of everyday life that characterise the public’s day-to-day lived experience. First introduced by Bentham et al. (2013), the FE concept encompasses “welfare-critical” sectors such as food, education, healthcare, and housing, which deliver relatively mundane yet essential goods and services. FE authors argue that these sectors have been deprioritised in Western economic policies, resulting in low levels of innovativeness, insufficient provisional capabilities, and unsustainable patterns of production and consumption (see FEC, 2022).

This thesis explores how social and environmental problems can be tackled simultaneously through sustainable innovation in the FE. The FE literature lacks empirical material to illustrate how innovations may be ideated, developed, commercialised and diffused within FE sectors; between the FE and high technology sectors; and how the policy environment may influence such innovation processes. By taking a comparative, qualitative case study approach involving the UK and international examples, the thesis explores firm-level innovations for sustainability in FE sectors and their positioning within wider economic policy frameworks. The selection of empirical material is a challenge for this research, due to the breadth of the FE concept. It includes multiple, large sectors that manifest at local, regional, and national levels. To negotiate these problems, the thesis will apply selection criteria focusing on policies with an overt FE-focus and firms included within the ambit of these policies.

(460 words)

References

Bentham, J., Bowman, A., de la Cuesta, M., Engelen, E., Ertürk, I., Folkman, P., Froud, J., Johal, S., Law, J., Leaver, A., Moran, M., Williams, K., 2013. MANIFESTO FOR THE FOUNDATIONAL ECONOMY. CRESC Working paper 131 1–23.

Department for Business, Energy & Industrial Strategy [BEIS] and Department for Science, Innovation & Technology [DSIT]. (2023). ‘UK Innovation Strategy: leading the future by creating it’, [online]. Available at: <https://www.gov.uk/government/publications/uk-innovation-strategy-leading-the-future-by-creating-it/uk-innovation-strategy-leading-the-future-by-creating-it-accessible-webpage> (Accessed 28 March 2023.)

Froud, J., Johal, S., Moran, M., Salento, A., Williams, K., et al., [Foundational Economy Collective – FEC]. (2022). *Foundational Economy: The Infrastructure of Everyday Life*, New Edition. ed, Foundational Economy Collective. Manchester University Press, Manchester.

American and Chinese Firms' response to geopolitical tension in global supply chain

Linyi Guo

Research Background: The intensification of geopolitical conflicts has led countries to prioritize the protection of national security in critical supply chains. Some countries, led by the U.S., mainly implement trade protectionism and technological blockade in order to ensure their own autonomy in key products and the competitiveness of their enterprises in the domestic and international markets. The U.S. has trade protectionist policies and the trade war with China. Since the U.S. and China are the world's largest and second largest economies, as well as the two main participants in the global supply chain, involving a long chain and a wide range of industries, the conflict between China and the U.S. not only affects American and Chinese companies, but also directly or indirectly affects the global supply chain. Some scholars have found that China has also deepened its trade with Vietnam and Mexico, even as the U.S. States has tried to reshore some of its industries from China or move them to other countries, such as Vietnam and Mexico. China has shifted from a direct participant in commodity trade with the U.S. to an indirect participant in commodity trade. It can be seen that global supply chains and production networks are being reshaped. Therefore, how could companies react to such changes is important. However, little is known about the mechanisms of supply chain decoupling and coupling. This study will conduct a comparative study of firms in China and the U.S. that participate in global supply chains.

Research Questions: What is the response of both American and Chinese firms to such geopolitical uncertainty?

- (1) What is the effect of the American and Chinese supply chain policies on American and Chinese firms who participate in global supply chains?
- (2) What is the response of both American and Chinese firms in terms of technological innovation to the restriction of technology communication?
- (3) What is the role of both American and Chinese firms in decoupling and recoupling supply chains and product networks?
- (4) Under the situation of reconfiguring the global supply chain and production network, how could both American and Chinese firms keep the supply chain stable?

Research Methods: This study will select both the American and Chinese new energy vehicle companies as the research object and conduct a multi-case comparative study to explore. The new energy vehicle industry is a knowledge-intensive industry and has a long value chain in a global scale, which is a proper research object in this study. Data sources will include the American and Chinese supply chain policies, firms' patent data, supplier relationship data, R&D expenditure on the firm level, and the number of technical employees, supplemented by archival data (press releases, annual reports, company documents, company websites, public speeches by senior executives, and direct company observations and interviews). First, this study will analyze the supply chain policies by comparing the U.S. and China. Second, using the patent dataset, R&D expenditure, and the number of technical employees to explore the reaction of technology restriction under geopolitical tension. Third, this study will compare the supply chain relationship of American and Chinese firms in different years to see the change in supply chains.

Organizing R&D for Rare Diseases: A Collaborative Effort by Different Stakeholders

Developing treatments for rare diseases is an urgent medical and social need that must be met globally. So far, over 7,000 rare diseases have been discovered,¹ most of which lack a cure. The number of people worldwide living with a rare disease is estimated at 300 million². Over 80% of rare diseases are genetic-related³, meaning the hereditary nature of these diseases will continue to affect patients for generations if no permanent medical solution is available. The scale, severity and complexity of rare diseases make this issue a “grand challenge” in healthcare.

However, the limited patient population of each rare disease results in an unattractive market for commercial companies to invest in, causing a “market failure” to address the unmet medical needs. The varied effectiveness of policy efforts aimed at encouraging rare disease R&D over the past three decades further highlights challenges in government intervention to address the issue. Thus, rare diseases R&D provides an interesting context for innovation management and policy scholars to study how an innovation process could be successfully and efficiently carried out when there’s a salient contrast between meagre market incentives and compelling societal benefits.

Management literature in the past years has mainly focused on individual stakeholders involved in the rare disease R&D process. These stakeholders include for-profit organisations in the biopharmaceutical industry, university researchers, clinicians, patient advocacy groups, and regulatory agencies, to name a few. Within this literature, policy impacts, clinical challenges and how these stakeholders navigate through the market landscape are the most frequently areas of discussion. Despite recurring calls in the literature for strengthening collaboration among these stakeholders to facilitate rare disease R&D, there is still a lack of research exploring the stakeholder network or the orchestration of their roles and efforts.

This research aims to study collaborative activities among various stakeholders throughout the R&D process, focusing on how efforts exerted by these stakeholders are organised in order to develop innovative products for rare diseases. The stakeholder network within the rare disease ecosystem, particularly from the collaborative engagement perspective, will be closely examined with the aim of shedding light on overcoming both market and policy challenges to facilitate rare disease R&D. Methodologically, this research will rely on mapping out the relationships of different stakeholders in the rare disease ecosystem and examining how their perceived roles, motivations, and strategic goals influence their behaviours.

Despite the research context is predominantly focused on organising R&D for rare diseases, its contribution and implications are likely to exceed the boundaries of the healthcare sector. Other industries and “grand challenges” that share similar market traits and innovation obstacles of rare diseases can benefit from its results and utilise the findings to improve their own R&D practices.

¹ *The UK rare diseases framework*. GOV.UK. (n.d.). <https://www.gov.uk/government/publications/uk-rare-diseases-framework/the-uk-rare-diseases-framework>

² Hlawulani. (2019, October 15). *New Scientific Paper confirms 300 million people living with a rare disease worldwide*. Rare Diseases International. <https://www.rarediseasesinternational.org/new-scientific-paper-confirms-300-million-people-living-with-a-rare-disease-worldwide/>

³ Melnikova, I. (2012). Rare diseases and orphan drugs. *Nature Reviews Drug Discovery*, 11(4), 267–268. <https://doi.org/10.1038/nrd3654>

How does the knowledge sharing of individuals with different knowledge backgrounds impact the organizational innovative capability under the impacts of organizational culture?

Yunwen Xu

Resource-based view is the concepts that help organizations cope with the uncertain competitive environment through using their core resource with 4 characteristics (VRIO: adds value, rareness, hard to imitate, able to organized) (Barney, 2002). Knowledge, as the resource that meets the criteria of resource heterogeneity, is been seen as a core resource and therefore deriving the knowledge-based view from the resource-based view theory (Grant, 1996). Therefore, from a knowledge perspective, the DC can be seen as the ability to sense and seize new opportunities and to compete sustainably through a range of configurations of a company's knowledge resources, including the management activities of knowledge change, updating, and utilization (Nielsen, 2006; Teece, 1998). In these processes, innovation is seen as an integral part, therefore innovative capability is seen as a key component of dynamic capabilities that support organizations to proactively shape change (Helfat et al., 2007; Wang and Ahmed, 2007). The micro-foundation of DC provides a deconstructing view to explain the origin of capability through the focus on constructed units and the aggregation scheme of organization (Felin et al., 2012). From a micro-foundation view, individuals 'creativity is the key component of innovative capability which can be stimulated by knowledge sharing (Lawson and Samson, 2001; Perry-Smith, 2006) However, the process of knowledge sharing can be thwarted by some obstacles such as misunderstanding and unwillingness to share due to the different knowledge backgrounds of individuals (Riege, 2005). Meanwhile, Barney and Felin (2013) also highlight that the aggregation methods between individuals or organizational factors should also be focused on explaining the impact of individuals on organizational-level outcomes except for the concern of individuals. Culture, as one of the organizational elements, can coordinate the knowledge-sharing process and aggregate individual creativities between different individuals (Mueller, 2014). Previous research studies the effect of culture on knowledge sharing such as trust relationship building, fostering shared value, and encouraging shared willingness, but it seems to lack the links that the individual level's creativity impacts the organizational innovative capability. To fill this research gap, this paper aims to study how the knowledge sharing of individuals with different knowledge backgrounds impacts the organizational innovative capability under the impacts of organizational culture.

To study this problem, the methodology will be separated into two main steps: 1. Reviewing the literature and building a conceptual framework. 2) Testing the conceptual framework with through a mixed methods case study to analyze different innovation practices. The aim of this research is to shed light on how organizational culture helps minimize misunderstandings and overcome the lack of common language issues that exist in the cross-knowledge sharing process and provide guidance for organizations that want to increase their innovative capability by organizing their culture.

The main two problems in the process of resolving are a) Addressing the different sharing paths of different knowledge (know-what and know-how); and b) building the general cross-level model that how the innovative capability is integrated from the individual level.

Reference list:

- Barney, J. B. (2002). Strategic management: From informed conversation to academic discipline. *Academy of Management Perspectives*, 16(2), pp. 53-57.
- Barney, J. A. Y., & Felin, T. (2013). What are microfoundations?. *Academy of Management Perspectives*, 27(2), pp. 138-155.
- Felin, T., Foss, N. J., Heimeriks, K. H., & Madsen, T. L. (2012). Microfoundations of routines and capabilities: Individuals, processes, and structure. *Journal of management studies*, 49(8), pp. 1351-1374.
- Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17, Special Issue, pp. 109-22.
- Helfat, C.E., Finkelstein, S., Mitchell, W., Peteraf, M.A., Singh, H., Teece, D.J. and Winter, S.G. (2007), *Dynamic Capabilities: Understanding Strategic Change in Organizations*, Blackwell Publishing, Oxford

Young, Gary

Searching for a partner: A firm-centric match-making framework to optimise University-Industry Collaboration.

University-Industry collaboration (UIC) is widely recognised as a vehicle for driving innovation and as such is considered by many firms to represent an important and strategic method of improving their overall business performance. However, UIC relationships come with no guarantee of success and vary widely in terms of their breadth, depth and complexity. Existing literature into UIC explores the multifaceted nature of these relationships and provides valuable insights into the differing forms of collaboration (Perkmann et al, 2013 and Perkmann et al, 2021), motivations behind and potential consequence of participation (Ankrah et al, 2013, D'Este & Patel, 2007, Degl'Innocenti et al, 2019 and Laursen & Salter, 2004), enablers and inhibitors of success (Ankrah & AL-Tabbaa, 2015, Bruneel et al, 2010, de Wit-de Vries et al, 2019 and O'Shea et al, 2005), measures of effectiveness (Perkmann et al, 2011) and the potential outcomes arising from such collaborations (Ankrah & AL-Tabbaa, 2015 and Ankrah et al, 2013).

Recognising this complexity, a key challenge for firms looking to partner with universities, is which university or universities should they target and on what basis? Indeed, this position is exacerbated by the heterogeneous nature of the UK's academic landscape (Barrioluengo et al, 2022 and Uyarra, 2010), the lack of guidance to inform objective 'search and match' decision making (Perkmann & Walsh, 2007) and the relative scarcity of firm-centric research studies.

As such, this study proposes to build on existing literature by exploring, from the perspective of the firm, how the introduction of a 'search and match' process model could be used to inform and optimise UIC partner identification. This is important given the prevalence of informal and subjective influences on UIC partner selection, often related to the pre-existence of inter-personal or inter-organisational relationships and reliance on geographic, alumni or wider academic networks (Perkmann & Walsh, 2007).

The study will address this gap by exploring the UIC activities of the UK subsidiary of a large multi-national IT services firm. The scale of the firm is such that its UIC activities typically operate as a series of independent ecosystems and as such provides access to multiple UIC relationships, held with both domestic and international universities. From these a cross-section of 9 live and established university collaborations have been identified for study. Analysed through the use of questionnaires and semi-structured interviews held with both firm and academic stakeholders, the study will adopt the conceptual process framework for UIC offered by Ankrah & AL-Tabbaa (2015) as a blueprint. This will support the development of detailed case studies capturing each collaboration's key characteristics, relative strengths and weaknesses and the extent to which they both influenced and were influenced by the original partner identification and selection process. The findings of this analysis will in turn inform the development of objective 'search and match' decision criteria.

It is anticipated that as a virtue of stakeholders being personally or institutionally invested in the UIC relationships they have nurtured, the study will need to overcome problems related to personal bias, such as stakeholder self-justification or the overstating of benefits. Similarly due to the distinct features that characterise individual engagements additional attention will be required to maintain the confidentiality of stakeholders and collaborators.

This study will make a contribution to the literature, by providing a firm-centric insight into the nature and impact of UIC 'search and match' decision making processes considered in the context of the UK's heterogeneous academic landscape. In turn it will contribute to practice by empowering firms to make better informed decisions when identifying and selecting prospective university partners based on their individual aims and objectives.

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Division: IMP (PhD)

Supervisors: Dr Mabel Sanchez barrioluengo, Prof Raquel Ortega-Argiles, Dr Reza Salehnejad

Presentation title: explore the impact of AI adoption on firm-level productivity: Evidence from UK.

Abstract

In recent decades, average technology diffusion rates have increased in all developing and developed countries, and technology adoption has dramatically increased (Diermeier and Goecke, 2017). Artificial Intelligence (AI) is the most prominent, regarded as a new predictive, modular, and general-purpose technology, with a rapid, penetrating, and far-reaching use over many industrial sectors (Brynjolfsson et al., 2021; Aghion, 2018; Czarnitzki et al., 2023). Countries globally also launched many strategies to encourage AI adoption to maintain their competitive advantages because it is expected that adopting AI could increase productivity as an internal driver in various ways (Syverson, 2011).

It is expected that increased AI investment can lead to an increase in firm productivity. Current literature that examined the impact of AI adoption on firm-level productivity provided significant positive results to support the statement. However, techno-pessimists argued that the benefits of AI have been exaggerated because the “Digital economy” is still in the installation phase, infrastructures are not mature yet, and the success largely relies on tangible and intangible complementary assets, which leads to the rise of discussion of modern productivity paradox (Anderton et al., 2023). The opposing viewpoints may be attributed to differences in units of analysis (industries and countries). Therefore, there is still debate whether increased AI adoption leads to significant productivity growth. Previous articles have mainly applied empirical research methods to examine the relationship by using the ordinary least squares (OLS) regression model, which remains the mechanisms unexplained. In addition, a limited number of articles that examine factors that affect the strength or direction of the relationship between AI adoption and firm-level productivity.

The research aims to explore the influence of AI adoption on firms’ productivity within the UK, in particular, to analyse mechanisms through which AI adoption transforms productivity and examine factors that affect the degree to which AI adoption influences productivity. This could provide new micro-level empirical evidence to contribute to existing literature. The research plan uses quantitative research methods and establishes a separate moderator and mediator model to test the research questions. However, there are problems that researchers can expect to encounter:

- Complexity: models that include more of moderators are complicated and there may be industry-specific or firm-specific factors that are hard to quantify; it is challenging to distinguish mediator effects from direct effects.
- Generalizability: results obtained from manufacturing industry datasets may not be generalizable to other contexts, such as service sectors.

Therefore, detailed research design is required. Despite the above problems, the research will deepen current understandings of AI adoption’s impact on productivity and explore the factors under which companies can invest in AI to achieve success, aiding managerial decision-making and informing policies to foster innovation and workforce preparedness.

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Division	: Management Sciences and Marketing (MSM)
Name of Supervisor(s)	: Prof. Fahian Huq, Dr. Chris Smith
Research Title	: Developing Taxonomy of Supply Chain Corruption

While academics have focused on researching anti-corruption strategies, high-level corruption entails the bending of explicit rules and principles for the benefit of closed networks (Fazekas et al., 2023) remains exist. Moreover, institutionalised corruption is being practiced more actively, especially in public procurement, and it becomes a mere avenue for obtaining funds for political purposes (Lassou et al., 2023). One of the causes of this phenomenon is increased discretion to buyers, which can result in repetitive project awards to the same firm (Coviello et al., 2018). Other factors include the existence of the intermediaries who encourage covert supplier collusion (Yang and Babich, 2015), bribery trades that motivate agents to win the undeserving company (Singh, 2017), and uncertainties which provide opportunities for corruption (Neu et al., 2015).

Corporate corruption is one of the major issues facing society today (George et al., 2016), it arises from organisational misconduct that has become normal to institutional factors such as supply chain norms that create grey areas (Skilton and Bernardes, 2022). Despite this, the subject of supply chain corruption appears to be neglected and lacking from the literature (Kim and Wagner, 2021). Bid-rigging is one example of a corrupt practice that affects taxpayers and costs billions of dollars annually (Signor et al., 2023). Despite numerous anti-corruption initiatives, the phenomenon of corruption remains challenging due to its diverse manifestations and potential to occur at different phases of the supply chain. A comprehensive summary of the existing literature is necessary to gain a deeper understanding of supply chain corruption.

The first objective of this research is to increase our understanding by reviewing relevant literature to take a broader look at a variety of topics, such as the causes, actors, forms, and impacts of corruption activities across the global supply chain. Second, this research aims to compare and combine the findings with empirical data obtained from practitioners. Through a multi-stage qualitative study, this research will adopt the taxonomy development method (Nickerson et al., 2013) which consists of two iterative processes of conceptual-to-empirical approach and two empirical-to-conceptual iterations involving supply chain practitioners anonymously via the Prolific, a crowdsourced community of participants. The eligible participants include supply chain managers mainly in the US and the UK who have known of corrupt activities in their supply chain operations.

Philosophically, this research uses an interpretivism perspective which can facilitate a thorough exploration of perceptions, motivations, and contextual influences underlying this phenomenon. This approach will gather qualitative data and create a taxonomy to investigate the social phenomena. The created taxonomy will be the first in the context of supply chains, enhancing the field of supply chain management theory regarding corruption as the unavoidable disruption in global supply chains.

Postgraduate Researcher:	Hugh Coughlan
Division and Programme:	Management Sciences and Marketing (PhD)
Supervisor(s):	George Christodoulakis, Aseem Pahuja
Presentation Title:	Investigating the Importance of Fraud Indicators for Advancing Fraud Risk Intelligence

Financial fraud poses a significant threat, not only to individual financial entities, but also to the integrity and stability of the global economy and its security. It erodes investor confidence and can destabilise markets. Moreover, financial fraud weakens the social fabric, collective ethical standards, and ultimately, the democratic institutions of society as a whole. In 2023, the Global Financial Crime Report by NASDAQ estimated that approximately \$3.1 trillion in illicit funds were channelled through the global financial system, illustrating the extensive scale and complexity of combating financial crime globally (NASDAQ, 2023).

This research aims to investigate the significance of fraud indicators in enhancing fraud risk intelligence within financial institutions. It seeks to assist in the detection, representation, and forecasting of fraud risk. Fraud risk intelligence involves the practice of gathering, analysing, and interpreting information regarding potentially fraudulent activities to inform decision-making and prevent financial losses by implementing risk mitigation strategies.

The influence of 'Cressey's Fraud Triangle Theory' (Cressey, 1953), which identifies the three primary motives behind fraud as incentive, opportunity, and rationalisation, remains a foundational concept in understanding the complexities of financial fraud. This research will affirm the importance of fraud risk indicators and offer solutions beyond the classical model of fraud portrayed in 'Cressey's Fraud Triangle Theory' (Cressey, 1953). It also highlights that the exposure to fraud risk within financial institutions is now greater than ever, owing mainly to the rapid development of digital transformation and services in areas such as supply chain risk, cyber risk, and credit risk. It is crucial for financial institutions to recognise that the cost of lacking a credible and dynamic fraud risk intelligence solution far exceeds the potential regulatory fines, reputational damage, and inherent risk to the institution itself. In discussing the amendments to the Principles for the Sound Management of Operational Risk, the Basel Committee on Banking Supervision (BCBS) states that "further work is necessary to strengthen banks' ability to absorb operational risk-related events, such as pandemics, cyber incidents, technology failures, or natural disasters, which could cause significant operational failures or wide-scale disruptions in financial markets" (BCBS, 2020a, p. 1). This underlines the need for financial institutions to move away from a traditional fraud triangle theory mindset to a broader, more complex model powered by artificial intelligence (AI) solutions to tackle both current and future digital fraud risks.

A key trend observed in this research area is the utilisation of financial data, coupled with technological advances in AI, to provide a more empirical basis for detecting fraud. While the use of financial indicators and supporting frameworks for fraud detection is not a novel concept, the ability to process large volumes of data, alongside increased computational power and advancements in AI, offers a new opportunity to expand the boundaries of fraud modelling. These advancements can go beyond the traditional 'Fraud Triangle' model by incorporating intelligent capabilities for detecting, representing, and forecasting fraud risks.

This research investigates whether AI can create dynamic, custom models enriched with fraud indicators to boost fraud risk intelligence within financial institutions. It highlights their significance in representing, detecting, and predicting fraud risk intelligence, especially within the digital corporate finance landscape. Furthermore, it seeks to identify key areas within the Banking, Financial Services, and Insurance (BFSI) sector that could function as indicators for fraud risk intelligence. Preliminary results indicate that a mix of financial and non-financial indicators from existing fraud research and databases could help in developing a dynamic fraud risk intelligence model. Such a model, enhanced with data from various sources and custom fraud indicators, could achieve significant improvements through AI advancements. As a result, it could facilitate the creation of effective, innovative strategies specifically designed for fraud risk intelligence, to support the fight against financial crime.

References

BCBS (2020a, p.1) Principles for the Sound Management of Operational Risk. [Online]. Available at: <https://www.bis.org/bcbs/publ/d508.pdf> (Accessed: 01 November 2023).

Cressey, D.R. (1953) *Other People's Money: A Study in the Social Psychology of Embezzlement*. Glencoe, IL: Free Press.

NASDAQ (2023) Global Financial Crime Report. [Online]. Available at: <https://www.nasdaq.com/global-financial-crime-report> (Accessed: 01 February 2024).

Modelling and Forecasting of Day-ahead Electricity Prices with Explainable Artificial Intelligence: From Risk Management Perspectives

Jingchuan Ma

The prices of electricity are highly volatile, making stakeholders exposed to price risk in the deregulated electricity market. It is challenging to manage electricity price risk since electricity markets are affected by multiple factors (Shimomura et al., 2024). Under this circumstance, conducting accurate electricity price forecasting (EPF) and identifying the key driving factors of price volatility are imperative from the risk management perspective. As the day-ahead market is the main platform for trading electricity, this research will focus primarily on developing explainable artificial intelligence (XAI) models to predict and analyse day-ahead electricity prices.

Although various machine learning (ML) methods, such as Support Vector Machine (SVM), Random Forest (RF), and Artificial Neural Networks (ANN) have been applied to forecast energy prices, they focus primarily on the accuracy of forecasting results (Lehna et al., 2022). In contrast, few articles discuss the driving factors of electricity prices on the premise of ensuring accurate prediction results. However, stakeholders who are exposed to price risk need to understand which factors contribute to price volatility in addition to predicting price. Explainable artificial intelligence (XAI) can enhance the interpretability of the forecasting results generated by complex machine learning models, which are viewed as black boxes (Machlev et al., 2022).

In order to fill the gap, this research aims to conduct accurate price forecasting while analysing the factors that lead to price volatility and risk. To achieve this goal, this study will conduct three different machine learning methods, Random Forest (RF), Gradient Boosting Decision Trees (GBDT) and Deep Neural Networks (DNN), by adding novel explainable features to accurately forecast day-ahead electricity prices. Furthermore, SHapley Additive exPlanation (SHAP) and Model-agnostic Explanations (LIME), which are the most common two approaches of XAI, will be chosen to analyse the importance of each feature for the forecasting results. This research presents two potential contributions. Novel accurate ML forecasting models will be developed by adding previously unused features. Additionally, advanced XAI approaches will be used to provide explanations for the forecasting results to identify the key drivers of price volatility. The research results will provide effective guidance for stakeholders to manage electricity price risk.

References

- Lehna, M., Scheller, F., & Herwartz, H. (2022). Forecasting day-ahead electricity prices: A comparison of time series and neural network models taking external regressors into account. *Energy Economics*, 106, 105742.
- Machlev, R., Heistrene, L., Perl, M., Levy, K. Y., Belikov, J., Mannor, S., & Levron, Y. (2022). Explainable Artificial Intelligence (XAI) techniques for energy and power systems: Review, challenges and opportunities. *Energy and AI*, 9, 100169.
- Shimomura, M., Keeley, A. R., Matsumoto, K. I., Tanaka, K., & Managi, S. (2024). Beyond the merit order effect: Impact of the rapid expansion of renewable energy on electricity market price. *Renewable and Sustainable Energy Reviews*, 189, 114037.

Amr Mousa

Postgraduate Researcher	: <u>Amr Mousa</u>
Division and Programme	: <u>Management Sciences and Marketing (PhD)</u>
Supervisor(s):	: <u>Prof Richard Allmendinger, Wei Pan and Theodore Papamarkou</u>
Presentation Title	: <u>Advanced Continual Adaptation in Non-Stationary Environments with Meta-Reinforcement Learning</u>

Reinforcement Learning (RL) has gathered significant attention due to its potential to solve complex decision-making problems autonomously. However, the application of RL in non-stationary environments, where the underlying dynamics evolve over time, presents a critical issue that is yet to be fully addressed. This PhD project investigates the adaptation of RL algorithms to non-stationary conditions—a problem that is not only intriguing from a theoretical standpoint but also crucial for the practical deployment of RL in real-world scenarios, such as financial markets, healthcare, robotics, and autonomous vehicles.

Just as humans effortlessly adjust to new circumstances while retaining their past experiences, we are inspired to achieve a similar level of adaptability in RL systems. The challenge lies in teaching these systems to maintain optimal decision-making as they encounter shifting environments, striking a balance between maintaining learned behaviors (stability) and acquiring new knowledge (plasticity). This ability to preserve past learning—avoiding the risk of catastrophic forgetting—is crucial. It ensures that AI systems remain effective and intelligent over the long term, even as they navigate through an unpredictable and ever-changing world.

To address these problems, our literature review reveals that Meta-RL has been identified as a promising approach inspired by the natural learning process of human beings which is ‘learning how to learn’ instead of acquiring task-specific knowledge. Moreover, it aligns with general AI principles, which are essential for developing future adaptive learning systems that facilitate rapid adaptation to new tasks or shifts in environmental dynamics.

The methodology adopted in this research involves a systematic exploration of Meta-RL algorithms, with a focus on advanced techniques such as memory-augmented neural architectures (e.g. recurrent neural networks and transformers) and hybrid models that integrate the strengths of both model-based and model-free learning. This multidisciplinary approach integrates various strategies from neuro- and cognitive science such as brain-inspired neural modulation, pseudo- and generative rehearsal, which are remarkably analogues to the process of human dreaming—a time when our brains consolidate and reinforce our knowledge.

As the project proceeds, several challenges are anticipated, including the adequate trade-off between stability and plasticity, scaling up the proposed algorithms to high-dimensional state spaces, and the computational demands of training such models. Additionally, ensuring that these algorithms can generalize across a diverse set of environments without overfitting to particular tasks is a significant hurdle. Despite these challenges, this work has the potential to revolutionize multiple domains where adaptability is crucial. In healthcare, for example, personalized treatment plans could be continually updated as new patient data becomes available. In finance, trading algorithms could adapt better to market volatility. In autonomous systems, such as self-driving cars, it could lead to enhanced safety and reliability by allowing real-time adaptation to unforeseen traffic conditions.

Conclusively, this research contributes to the theoretical understanding of sustained learning in AI, a critical step toward achieving general AI. The methodologies and solutions anticipated are expected to offer deeper insights into the mechanisms of human cognitive flexibility and lay the groundwork for future AI systems that learn and evolve in a manner currently exclusive to the domain of biological entities. These contributions will be ahead in propelling AI towards a future where it can adapt and evolve efficiently and safely in practical and real-world scenarios.

Yutong Qi

Postgraduate Researcher	:	<u>Yutong Qi</u>
Division and Programme	:	<u>Management Sciences and Marketing (PhD)</u>
Supervisor(s)	:	<u>Prof Dong-Ling Xu, Dr Fan-lin Meng</u>
Presentation Title	:	<u>Multi-objective optimisation of stochastic dynamic vehicle routing problems for heterogeneous vehicles considering carbon transaction</u>

Customers' aspirations for efficient service and the sustainable goal of saving energy pose conflicting challenges for logistics organisations. On the one hand, logistics services such as "one-day delivery" or "half-day delivery" have raised clients' expectations of delivery time. Conventional Vehicle Routing Problems (VRPs) require periodic processing for customer orders, which leads to longer waiting times for early orders(Ojeda Rios et al., 2021). Dynamic processing of stochastic orders resembling taxi hailing services(Hildebrandt et al., 2023) will fulfil customers' satisfaction faster. On the other hand, the burgeoning logistics industry has become a significant energy consumer and carbon emitter. Governments encourage enterprises to reduce greenhouse gas emissions via carbon transaction. Electric vehicles were promoted for their zero emissions in transportation. Nevertheless, electric vehicles face the shortcoming of limited travelling distance due to rechargeable battery design(X. Li et al., 2020). Assuming a fleet of single electric vehicles, placing orders remote from warehouses would be tough to fulfil quickly. Therefore, the significance of this study is in balancing the goal of carbon emission reduction with the requirement of rapid dispatch service. Evolving literature on vehicle routing problems(Boujlil & Lissane Elhaq, 2020) and emerging carbon emission approaches(K. Li et al., 2022) provide the theoretical foundation for the study. In particular, the interplay of stochastic dynamic vehicle routing optimisation problems using hybrid fleet configurations and carbon transaction methods is a new area.

In terms of methodology, this study will introduce a mixed-integer linear programming model with dynamic planning via Markov chains. The objective functions of the model include carbon transaction costs, route costs and a time-window based customer satisfaction penalty function. To navigate through the complex solution space, the research will improve a hybrid meta-heuristic algorithm that combines the advantages of Genetic Algorithm (GA) and Simulated Annealing (SA). Complementary global search capabilities of the genetic algorithm and local optimisation efficiency of the simulated annealing method can provide a robust solution framework(Ilin et al., 2023).

Anticipated challenges are the computational complexity of the model for large-scale data and the sensitivity of the algorithm towards the initial parameters. To address these issues, the study will explore optimisation techniques and sensitivity analyses to ensure model robustness and algorithmic reliability. An arithmetic example will initially validate the accuracy of the model and the computational performance of the algorithm. A practical application to a case study in China to demonstrate the applicability and validity of the model in real-world scenarios.

This research will provide logistics organisations an opportunity in balancing sustainable targets and service performance. And an innovation proposes a comprehensive mathematical model and algorithm that integrates carbon transaction and stochastic dynamic vehicle planning problems.

Keywords: stochastic dynamic vehicle routing problems, carbon transaction, Genetic Algorithm, Simulated Annealing

Energy Poverty Alleviation Policy Design and Evaluation: A Policy-lab Simulation and Quantitative Decision Support Framework

Problem: Energy poverty impacts the quality of life, health, and productivity, posing significant challenges for policymakers in effectively allocating resources to mitigate it. Policy modelling and simulation via Policy lab tools and quantitative decision-making frameworks support the design, “ex-ante” analysis and evaluation of policies, guiding decision-makers by predicting likely outcomes of policy legislative action and allocation of resources.

Why Study: The UK government estimations show that 8.9 million households in England were deemed fuel-poor in 2023 based on 10% cost index, an alarming doubling in size since 2021[1]. The aggregate fuel poverty gap for England in 2023 was estimated at £1.32 billion using the LILEE (Low Income Low Energy Efficiency) index, up by 20% since 2022 (£1.11 billion) in real terms[2]. Despite several long-term plans to tackle the issue and billions of pounds of allocated budget resources, there is scant use of decision frameworks and prediction tools to assess the potential impact of the implementation of these policies.

Literature: The lack of a universal definition or index for energy poverty leads to diverse study approaches. Quantitative studies in this area include i) objective studies considering only monetary aspects, ii) subjective studies conducted based on self-reported surveys, iii) weighted summations to consider different aspects of energy poverty, mostly developed based on [3], iv) studies that consider energy access with more details, and finally v) studies that consider detailed mathematical modelling. Even the last group are focused on only one aspect like the home structure[4]. All these studies focus on the description of the current situation of energy poverty and none of them investigates implications of possible of interventions. Scholarly grounding is limited on “design for policy” [5]. According to [6], policy labs show the causality and value of public interventions, describe change mechanisms, and utilise scientific findings in public policy. Policy labs in the UK mainly work on innovation in the public sector area and more general subjects. Existing models are inadequate for policy lab development, overlooking comprehensive factors and their dynamics [7], highlighting the need for integrating qualitative research to address energy poverty, effectively. Moreover, energy poverty drivers, indicators and indices are used interchangeably in different studies.

Methodology: A five-step framework for designing the energy poverty policy lab is developed. First, clear definitions for drivers, indicators, and indices are provided. Second, drivers and energy poverty index data for the UK will be collected from different sources and divided into training and validation sets. Third, considering training data latent factor analysis and clustering algorithms will be used to identify significant drivers grouped into indicators while considering potential moderating effects. Fourth, functions connecting drivers to indicators and indicators to energy poverty indices are established through machine learning algorithms. Fifth, integrating these functions provides a complete mathematical model with drivers as the input and energy poverty index as the output. Then, validation data sets will be used to evaluate the model's accuracy. The framework and its steps will be operationalized by the design and implementation of a decision support tool helping to analyse and simulate the impact of policies. The main energy policies will be translated into changes in the drivers with the outcomes reflected in indicators and a primary index. Visual comparisons and targeted advice for policy improvements based on critical drivers will be provided.

Challenges: Energy poverty is a multifaceted subject, drawing data and insights from diverse sources which makes it challenging to consolidate them into a unified framework.

Impact: A standardised framework for energy poverty studies facilitates comparability and integration. Also, this mathematical model can be used as a decision support tool for policymakers directly in charge of energy poverty alleviation like the Committee on Fuel Poverty (CFP) at the national level and local authorities.

- [1] “Annual Fuel Poverty Statistics in England (2023 data),” Feb. 2024.
- [2] “Fuel poverty in the UK - House of Commons Library.” Accessed: Mar. 27, 2024. [Online]. Available: <https://commonslibrary.parliament.uk/research-briefings/cbp-8730/>
- [3] P. Nussbaumer, M. Bazilian, and V. Modi, “Measuring energy poverty: Focusing on what matters,” *Renewable and Sustainable Energy Reviews*, vol. 16, no. 1, pp. 231–243, Jan. 2012, doi: 10.1016/J.RSER.2011.07.150.
- [4] A. Pérez-Fargallo, C. Rubio-Bellido, J. A. Pulido-Arcas, and F. Javier Guevara-García, “Fuel Poverty Potential Risk Index in the context of climate change in Chile,” *Energy Policy*, vol. 113, pp. 157–170, Feb. 2018, doi: 10.1016/J.ENPOL.2017.10.054.
- [5] B. Wang, Z. Yuan, X. Liu, Y. Sun, B. Zhang, and Z. Wang, “Electricity price and habits: Which would affect household electricity consumption?,” *Energy Build*, vol. 240, p. 110888, Jun. 2021, doi: 10.1016/J.ENBUILD.2021.110888.
- [6] K. Olejniczak, S. Borkowska-Waszak, A. Domaradzka-Widła, and Y. Park, “Policy labs: the next frontier of policy design and evaluation?,” *Policy Polit*, vol. 48, no. 1, pp. 89–110, Jan. 2020, doi: 10.1332/030557319X15579230420108.
- [7] M. Gayoso Heredia, C. Sánchez-Guevara Sánchez, and F. J. Neila González, “Integrating lived experience: Qualitative methods for addressing energy poverty,” *Renewable and Sustainable Energy Reviews*, vol. 189, p. 113917, Jan. 2024, doi: 10.1016/j.rser.2023.113917.

Wang, Aozhong

Title: Structure and relationship in logistics service supply chain multi-level resilience: A longitudinal study based on logistics service provider perspective

Abstract: Over the past three decades, economic globalisation has transformed the structure of trade (Kano et al., 2020), with economic activity spreading across the globe and resulting in the rise of supply chain complexity and vulnerability. Failure at any point in the supply chain can lead to disruption of the entire supply chain. Many recent disruption events such as the US-China trade war, Covid-19, Russia-Ukraine war, etc. have revealed the importance of supply chain resilience (SCRE). SCRE can be understood as an ability to prepare, recover, adapt and learn from unpredicted disruption. Many scholars have explored SCRE from procurement and operations perspectives, and resilience in logistics has not been as well explored as the other two. Global supply chains and the related complex material flows predominately depend on logistics infrastructure (mainly transportation and warehouse services) provided by logistics service providers (LSPs) (Herold et al., 2021). LSPs play a crucial role in SCRE through their integration and collaboration of logistics activities along global supply chains (Panayides & So, 2005). Also, many scholars consider logistics service supply chain resilience (LSSCRE) from the perspective of logistics network planning, logistics route design, logistics technology, etc., while the structure and relationship between LSPs and other members of the logistics service supply chain (LSSC) such as ports, fleets, government, customs have rarely been explored. Furthermore, supply chain activities have become more dynamic in their ranges over space, time, and in the interrelations between supply chain actors and their external context (Spiegler et al., 2012; Wieland, 2021). Hence, it is essential to embed LSPs in the current external context and to analyse LSSCRE from dynamic, longitudinal and multilevel perspectives. The study will select a Chinese LSP for a single case study, with a timeframe starting from 2019, before the Covid, until 2023, in the post-covid era. This study aims to use panarchy as a theory lens to investigate LSSCRE from organisational level (the internal level of LSP, For example, the structural and relational characteristics between the various departments), supply chain level (the structural and relational characteristics between LSP and other members of LSSC, For example, the relationship between LSP and ports, warehouses, and ship operators), as well as political-economic level (For instances, the structure and relationship characteristic between LSP and government, customs). Meanwhile, Covid is used as the demarcation point to explore the differences and changes of LSSCRE in pre-covid era, covid era and post-covid era from the above three levels, and the resilience strategies in these three time phases are compared and analysed to contribute to the existing SCRE literature. As for possible problems, there may be difficulties in data collection because of the long time span and the fact that some interview questions may involve confidentiality within the company.

Xie, Yunze

The improvement and application of prospect theory

Decision science has been a very important research topic in the field of business and management. Tversky (1979) put forward the prospect theory, as the theoretical foundation of behavioral finance, which explained the individual decision-making behavior from the perspective of psychology. Prior to this, expected utility theory dominated in decision science (Neumann, 1944). However, with the development of experimental economics, many phenomena that expected utility theory could not explain were found in fact. Prospect theory refines expected utility theory by incorporating individual value perception factors into the model, and successfully explains many anomalies which traditional decision theory cannot understand. Therefore, prospect theory is more relevant to realistic decision-making behavior.

Although prospect theory is a very important decision theory in current decision science, there are still many limitations of its research. First, prospect theory is only a descriptive theory, which lacks a unified and standardized expression, and it also increases the uncertainty of decision-making due to individual subjectivity. Second, prospect theory is still imperfect due to the incomplete description for the characteristics of decision makers, which leads to there are still some paradoxes that cannot be explained. Although prospect theory can provide an appropriate description of behavior in experimental settings, it is still problematic to apply it in economic settings outside the laboratory (Barberis, 2013). By comparing with expected utility theory, the most advantage of prospect theory is to consider the psychological characteristics of decision makers. Therefore, this research focus on the analysis of individual characteristics to improve value function, weight function, and reference point which are the most important components of prospect theory.

Prospect theory is a very effective decision-making theory for consumers, considering that it can help consumers to sort through the extensive information in the market and make decisions in line with consumers' expectations. And the former feedback on product usage attracts a lot of attention from consumers because it can provide important reference. Therefore, this research focus on the online shopping and use the improved prospect theory to analyze the impact of product reviews on consumers. Specifically, after capturing textual characteristics from online reviews, prospect theory will be used to analyze their perceived value to design appropriate shopping strategies which match consumers' psychological characteristics. This application can verify whether the improved prospect theory can better describe decision-making behavior and make decisions for consumers. This research can provide reference for future research on improving prospect theory and application in consumer market.

Barberis and Nicholas, C. (2013) 'Thirty Years of Prospect Theory in Economics: A Review and Assessment.', *Journal of Economic Perspectives*.

Neumann, J. Von and Morgenstern, O. (1944) *The Theory of Games and Economic Behaviour*. Princeton University Press.

Tversky, K. A. (1979) 'Prospect Theory: An Analysis of Decision under Risk', *Econometrica*, 47(2), pp. 263–291.

Zhang, Yaofu

Proposed title: Motivating Sustainable Customer Behaviours through Strategic Management of Customer Experience Dimensions

Background: Mainstream marketing activities that seek to create customer needs rather than merely satisfying them, are considered to be drivers of negative environmental impacts, which threaten the progress towards the UN's Sustainable Development Goals. While a significant volume of research has investigated how to promote sustainable customer behaviors, it has been too focused on identifying customers' behavioral, attitudinal, and social influence factors and designing corresponding sustainability actions that can be conducted by organizations without fully considering the impact of these actions on other aspects of customer interests, particularly customer experience (CX). This oversight has potentially led to customer resistance where CX is negatively impacted and could undermine the effectiveness of these actions.

Purpose of the research: This PhD study will explore what elements of a managed CX motivate customers towards sustainable behaviors while simultaneously maintaining or improving the CX. Specifically, this study will focus on identifying the potential relationships between the CX dimensions (such as Affective, Cognitive, Physical, Relational, Sensorial and Symbolic) and the customer perceived psychological factors (including Social influence, Feelings and cognition, Individual self, Habit formation and Tangibility) that drive sustainable customer behaviors and which can be leveraged within a CX.

Research context: Due to the generation of substantial plastic waste and emissions, the food service industry is often considered detrimental to the environment. In particular, this study will investigate businesses focusing predominantly on *non-personal food preparation*: food delivery services, and/or food takeaway services, and/or dine-in services, and/or pre-prepared meals for home heating. The latter include the supply of 'Ready-to-cook' foods which require only simple heating or minimal preparation.

Research problems: 1. What are the most salient CX dimensions perceived by customers in this research context? 2. What customer perceived psychological factors can be identified, associated with these prioritized CX dimensions, which encourage customers towards sustainable behaviours? 3. How might CX managers leverage customers' psychological factors and drive sustainable customer behaviours? 4. What sustainable customer behaviours result from leveraging these identified psychological factors to manage CX in this research context?

Methodology: This study will employ a mixed methods approach. To gain deeper insights into customer experience, qualitative research methods such as 'in-depth interviews' and 'focus groups' will be employed to identify salient CX dimensions and suggest service design approaches for effective CX management actions. In addition, an online questionnaire survey will be conducted to identify the potential relationships among identified variables and construct a structural equation model (SEM).

Contributions: This research provides insights into which CX dimensions are perceived as the most salient by customers in the non-personal food preparation context and their potential connections to psychological factors affecting sustainable customer behaviours, offering guidelines for managers tasked with both service design and environmental protection. Moreover, this research offers implications and serves as a reference for future studies with similar research objectives in other service sectors.

Deciphering the AI Impact: A Multilevel Analysis of Artificial Intelligence on Employee Behaviour

Background: AI is viewed as the era's most significant general-purpose technology, which garnered considerable attention from organisations, and it is characterised as the capability of a system to accurately interpret external data, learn from this data, and then apply the acquired knowledge to accomplish specific objectives and tasks through adaptable adjustment (Kaplan & Haenlein, 2019). Its integration into the hospitality industry is streamlining hotel operations from concierge to room service, which changed the traditional employment (Li, et al., 2019), while AI abilities would pose undeniable employment risks for hotel workers.

The employment literature still grapples with determining the complex and multiple influences of AI on the quality of work and employment. For example, AI inspires optimism with its promise to enhance decision-making and innovation but raises issues around data privacy and diminishing human roles (Braganza, et al., 2021). In particular, existing studies mainly focus on one research subject, such as employees or organisations, rather than multiple participants. Besides, there's a lack of consistency in the theoretical understanding of the relationship between AI and employees. Theoretical approaches to AI's impact on employees remain inconsistent, and reviews lack empirical application summaries. Although employing diverse theories could enrich the understanding of human behaviour complexities (Price, et al., 2015), most research favours singular theoretical models. Additionally, increasing studies on AI and humans are emerging, but an updated review of the theories and models that have been used needs to be included. This study aims to bridge these gaps, constructing and testing a model to elucidate AI's layered impact on employee behaviour and address theoretical inconsistencies.

Methods: The research will be conducted in four stages. The first stage involves a systematic literature review following PRISMA guidelines to identify theoretical gaps. Next, the results will be synthesised into a new framework and refined through the Delphi method. The third phase involves quantitative testing in China, including pilot studies for fine-tuning methodologies. The fourth stage uses statistical analysis (like SEM) to confirm the theory's validity.

Challenges: The research anticipates hurdles, including the swift progression of AI technology, the statistical complexities of multilevel theory testing, and potential delays in achieving Delphi method consensus. These will be addressed through continuous literature updates, the application of advanced statistical methods, and meticulous Delphi panel management.

Contributions: By offering an in-depth perspective of AI's impact from the vantage point of employees, the research promises to yield actionable insights for AI developers, encouraging the creation of more user-centric AI technologies. It also aims to catalyse interdisciplinary collaboration and provide strategic insights into AI's role in organisational structures, bridging the gap between the different disciplines such as psychology, sociology, and business.

References:

- Braganza, A., Chen, W., Canhoto, A. & Sap, S., 2021. Productive employment and decent work: The impact of AI adoption on psychological contracts, job engagement and employee trust. *Journal of business research*, Volume 131, pp. 485-494.
- Kaplan, A. & Haenlein, M., 2019. Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business horizons*, 62(1), pp. 15-25.
- Li, J., Bonn, M. & Ye, B., 2019. Hotel employee's artificial intelligence and robotics awareness and its impact on turnover intention: The moderating roles of perceived organizational support and competitive psychological climate. *Tourism Management*, Volume 73, pp. 172-181.
- Price, P., Jhangiani, R. & Chiang, I., 2015. Phenomena and Theories. In: *Research Methods in Psychology*. s.l.:BCCampus.

Citizens' participation in the development of localised and sustainable innovation ecosystems.

Name: Oluwabusayo Durojaiye

Solutions proposed for addressing global societal challenges such as climate change often demonstrate inefficiencies, setbacks, or failure upon implementation in diverse contexts and scales. Consequently, there is a growing necessity to consider alternative perspectives and approaches in order to develop adaptive strategies capable of effectively addressing challenges within complex and context-specific scenarios (Cohen-Shacham et al., 2016).

Midway through the UN Global Sustainable Development Goals (SDG) 2030 mark, the latest Global Sustainable Development Report indicates that just two of the 17 objectives set for 2030 are on track and emphasises the pressing need for accelerated transformations through more comprehensive education, research, and innovation development (United Nations, 2023). Concurrently, a range of studies have generated extensive theoretical bases and concepts that argue for a shift from conventional norms to practical operationalisation of place-based innovation approaches that empower young people as changemakers in collaboration with other stakeholders including educators, professionals, organisations, civil societies and policy-makers (Drayton, 2006; Sitas et al., 2022). These contribute to the growing demand for sustainable education and technology which play crucial roles in driving globalisation (Basantes-Andrade et al., 2020), and SDG translations to local contexts in place-based approaches (Tan et al., 2019).

Therefore, through two contextual case studies from Nigeria and the United Kingdom, this research will utilise Actor-Network Theory (ANT) in an ethnographic style of qualitative investigation to explore the potential of collaborations between young people, experts, and communities to co-create and implement innovative solutions to global problems within local contexts. It also seeks to examine the effectiveness of design-thinking in adaptive education and training models, and the assessment of the impacts of these adaptive approaches for sustainable societal development relative to global indexes. The use of ANT helps to observe these heterogeneous interrelationships of people, entities, and environments through a distinctive approach to effectively capture these interplays in a comparative analysis of groups of participants collaborating in project assemblages within Nigeria, reflecting the Global South, and the UK in the Western context.

This methodological approach, characterised as a participatory study conducted over an extended period, may present potential challenges of interruptions or premature termination of observatory projects. Consequently, it will seek multiple observatory assemblages as contingencies and, under an optimistic scenario, will facilitate additional comparative analyses across the two case studies.

By attaining a more in-depth understanding of the development of adapted ecosystems for regional or localised sustainable advancements, the findings of this study will be a bridge for research and practice by contributing to the shift from theoretical co-creation concepts to more practical, viable applications. It will further enable a pertinent advancement in strategies for the relevant engagement of young people alongside other stakeholders in organisational growth and policy-making processes aimed at fostering sustainable societal development. **References:**

Basantes-Andrade, A., et al. (2020). 'Technology, Sustainability and Educational Innovation (TSIE)'.

Cohen-Shacham, E., et al. (2016). *Nature-based Solutions to address global societal challenges*.

Drayton, W. (2006). 'Everyone a Changemaker: Social Entrepreneurship's Ultimate Goal' *Innovations*:

Technology, Governance, Globalization, 1 pp. 80-96 <https://doi.org/10.1162/itgg.2006.1.1.80>.

Sitas, N., et al. (2022). 'Youth visions in a changing climate: Emerging lessons from using immersive and arts-based methods for strengthening community-engaged research with urban youth' *Gateways: International Journal of Community Research and Engagement*.

Tan, D., et al. (2019). 'Systems approaches for localising the SDGs: Co-production of place-based case studies' *Globalization and Health*, 15 p. 85 <https://doi.org/10.1186/s12992-019-0527-1>.

United Nations (2023). *Global Sustainable Development Report 2023: Times of crisis, times of change: science*

for accelerating transformations to sustainable development. New York: Department of Economic and Social Affairs.

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Navigating the complex landscape of global business, multinational enterprises (MNEs) frequently encounter significant challenges, particularly in identifying and mitigating risks (Dang et al., 2020). The early 21st century has been characterized as an age of global uncertainty, as numerous firms are facing increasing socio-political risks, ranging from uncontrollable external events to direct challenges from social and political stakeholders (Sun et al., 2024). MNEs operating in emerging markets, particularly in Africa, are especially vulnerable to heightened socio-political risks, owing to political instability, weak formal institutional environment, and inadequate public governance in these countries. Uncertainty not only escalates economic and transaction costs, but also threatens corporate survival, competitiveness, and overall firm performance (Hillman and Hitt, 1999; North 1990). In this context, nonmarket strategy (NMS), defined as ‘a firm’s concerted pattern of actions to improve its performance by managing the institutional or societal context of economic competition’ (Mellahi et al., 2016, pp. 144), emerges as a critical tool for MNEs to reduce their vulnerability to uncertainty and risk (De Villa et al., 2019).

Our study is guided by an overarching question: *How do MNEs employ NMS to navigate uncertainties in volatile and uncertain African countries?* This broad question is broken down into three sub-questions, each addressed in separate chapters of our study. Chapter 1 lays the foundation by providing a comprehensive framework on MNEs, NMSs, and the operations of Chinese multinationals in uncertain emerging markets. Chapter 2 conducts a literature review exploring the interconnections between socio-political risks confronted by MNEs, their corresponding NMS, and the outcomes on firm performance. Chapters 4 and 5 concentrate on the socio-political strategies of MNEs in emerging markets, drawing on primary data from a survey among Chinese MNEs in Africa (as reported by the China-Africa Business Council (2023), to date, there are more than 620 Chinese companies that have invested in 25 Chinese-funded economic and trade zones in Africa, with a cumulative investment of \$7.35 billion) and secondary country-level data published by international organizations. This abstract focuses on Chapter 3, which examines the nature and evolution of MNEs’ corporate socio-political ties and the impact on socio-political risk reduction and performance enhancement in uncertain African regions.

Chapter 3 The efficacy of MNEs’ Corporate Socio-Political Ties in reducing socio-political risks and enhancing performance in volatile and uncertain African countries

Previous research has explored the role of corporate political ties (CPTs) in MNEs as a nonmarket strategy to navigate risks and enhance firm performance in volatile African countries (e.g., Liedong, Rajwani and Mellahi, 2017). Moreover, MNEs may also proactively establish ties with other influential and locally knowledgeable secondary stakeholders, including local communities, media outlets, and NGOs (Dorobantu, Kaul, and Zelner, 2017), to manage socio-political risks. Despite the growing interest, research on the impact of these ties of MNEs on mitigating their exposure to socio-political risk is still in its early stage. To address this research gap, our research broadens the concept of CPTs to “corporate socio-political ties” (CSPTs), defining it as the boundary spanning personal and institutional linkage between firms and local secondary stakeholders. This study derives insights from institutional and resource-dependence theory to empirically examine *the efficacy of MNEs’ various CSPTs in reducing the exposure to socio-political risk and enhancing firm performance in high-risk host countries.*

Given the scarcity of archival data in emerging economies, particularly in Africa, this study employs a survey-based approach complemented by secondary data to test its hypotheses (Liedong, Rajwani and Mellahi, 2017). Data collection targets senior managers of Chinese MNEs operating in the Sub-Saharan African agricultural sector. Driven by the Belt and Road initiatives in 2013, China’s FDI in the agricultural sector, has shown a consistent upward trend over the last decade. According to the Ministry of Commerce of the People's Republic of China (2022), by 2021, the OFDI stock in agriculture has reached \$18.82 billion, marking a 3.8-fold increase from 2012.

Our research makes several contributions to NMS research in international business and strategy literature. It broadens the understanding of corporate ties beyond political connections to include other key local stakeholders, explores the impact of different types of CSPTs on socio-political risk mitigation and firm performance enhancement. Additionally, while previous studies have examined CSPTs usage by MNEs in various Sub-Saharan industries such as pharmaceuticals, electronics and manufacturing, the agricultural sector – a sector where food security is critically linked to socio-political stability and heavily reliant on state support – remains largely anecdotal. Thus, our study provides a novel and compelling research context. Regarding the anticipated challenges of our study, the foremost concern is the expected low survey response rate. To tackle this issue, our study plans to maximize the response rate through assurance of anonymity, offers to share results upon completion and employing a professional survey company.

Patriarchy, Women's Lifecourse and Career Choices in China: Xiangyu Sheng

Patriarchy and its implications for the social and working lives of women throughout the globe continues to be an open empirical question. Patriarchy has historically manifested in a deep-rooted gendered division of labour (Dousin, Collins and Kler, 2022). Early studies of patriarchy from an employment perspective have focused on its impact on women's work trajectories, in particular, differential treatment and outcomes between men and women within organizations and institutional settings have alluded to the centrality of recognition (Batton and Wright, 2019; Anderson and Tomaskovic-Devey, 1995). The centrality of recognition means it is widely recognized that the available resource varies by gender in the workplace. However, a less studied problem is how patriarchy shapes women's subjective perceptions and decision-making in the lifecourse, and the resulting impact on their employment trajectories; for instance, the role of patriarchy in shaping women's choices of educational and professional paths or when dealing with tensions between career and personal aspirations at a structural, societal and institutional levels.

This project brings together the individual, subjective and structural dimension to understand how patriarchy interplays within them to shape women's lifecourse decisions, employment, personal outcomes and overall experiences in society and the labour market. This proposal brings an interdisciplinary approach that combines theoretical insights from sociology of work and organizations, gender and intersectionality, and human resource management; Though it is difficult to find the entry point of the original theoretical basis that will break through at this stage. The qualitative research will adopt interpretivism as a philosophical position and will innovatively apply biographical, semi-structured interview. The innovative data collection method allows biographical self-analysis in a relatively templated interview model, which not only provides participants with narrative directions but also allows them to freely recall personal stories and trajectory. Thus, the data collection method facilitates to collect targeted data to explore the mutual shaping of lifecourse and employment domains under the context of patriarchy. Specifically, the data will be collected from 40 women who work in the financial industry in China between 25-45 years of age. This financial sector will be chosen because the competitiveness of financial industry intensifies contradiction between patriarchy and women's trajectory. The age period selection largely ensures that participants have finished education and entered the labour market. The setting for the research is China; its relatively recent developments in the economic, policy and demographic domains have gradually sharpened tensions between men and women's aspirations and employment outcomes (Walker and Millar, 2020). The research contributes to figure out how employment and lifecourse interplay between each other with the interaction of patriarchy to deepen theoretical understanding from process, dynamic and outcomes dimensions so that promoting gender equality in China.

Key Words: Patriarchy, Women Trajectory, Career Choice, Lifecourse.

Reference

Anderson, C. D. and Tomaskovic-Devey, D. (1995). 'Patriarchal pressures: An exploration of organizational processes that exacerbate and erode gender earnings inequality', *Work and Occupations*, 22(3), pp. 328-356.

Batton, C. and Wright, E. M. (2019). 'Patriarchy and the structure of employment in criminal justice: Differences in the experiences of men and women working in the legal profession, corrections, and law enforcement', *Feminist Criminology*, 14(3), pp. 287-306.

Dousin, O., Collins, N., and Kler, B.K. (2022). 'The experience of work-life balance for women doctors and nurses in Malaysia', *Asia Pacific Journal of Human Resources*, 60(2), pp. 362-380.

Walker, R. and Millar, J. (2020). 'Left behind? The status of women in contemporary China', *Social inclusion*, 8(2), pp. 1-9.

Recharge to be Proactive Throughout the Workday: A Daily Diary Study on On-job Recovery

Activities and Employee Proactivity

Fanyi Wang

Employee proactivity, defined as employees' 'self-initiated and future-oriented actions to change and improve situations' (Parker et al., 2010), is crucial for organizational effectiveness and individual career development (Cai et al., 2019). On the other hand, proactive behaviors are resource-intensive, and an over-pursuit of proactivity by employees could lead to counterproductive consequences such as work stress, emotional exhaustion, and even employee withdrawal (Pingel et al., 2019). Recovery activities play a vital role in replenishing employees' depleted resources through four core recovery experiences: psychological detachment, relaxation, control, and mastery (Sonnentag & Fritz, 2007). Engaging in recovery activities is essential for preserving employees' wellbeing and sustaining their proactivity (Ouyang et al., 2019). However, existing literature has predominantly focused on the role of off-job recovery in employee proactivity, leaving a significant gap in examining the role of on-job recovery activities, such as lunch breaks and micro-break activities (Kim et al., 2017).

Grounded in the effort-recovery model (Meijman & Mulder, 1998) and conservation of resources theory (Hobfoll, 1989), the research will be conducted in two stages. Firstly, it will investigate the influential mechanisms through which on-job recovery activities contribute to employee proactivity at the individual level. Secondly, this research will explore how on-job recovery activities impact employee proactivity at the team level. Considering that interpersonal interactions and social experiences occur among employees during on-job recovery activities (Bosch et al., 2017), this research will conduct an in-depth study of the collective nature of the on-job recovery experience.

Adopting a within-person approach, this study will utilize a daily diary study with the experience sampling method. The type and level of participants' engagement in on-job recovery activities, along with their proactivity, will be collected and measured on consecutive workdays. This method allows for capturing daily variations in levels of on-job recovery activities and their subsequent impact on participants' proactivity levels. Multilevel path analysis will be applied for data analysis. A theoretical model will be developed to reveal the influential paths of on-job recovery activities on employee proactivity, as well as their boundary conditions.

Through a resource-based approach, this study aims to empirically examine the effectiveness of on-job recovery activities on employee proactivity at both individual and team level. With a specific focus on the collective impact of on-job recovery activities on team proactivity, this study will contribute significantly to the proactivity and recovery literature by enriching the understanding of the collective nature of on-job recovery. By identifying the types and effectiveness of on-job recovery activities on employees' proactivity, this research will provide practical implications for organizations to develop effective on-job recovery strategies, such as work design, to foster a supportive working environment that optimizes employee proactivity for organizational development. This research will also offer insights for individuals and teams regarding recovery practices to sustain their proactivity and maintain their wellbeing.