# The adjusted gender pay gap:
# a critical appraisal of standard decomposition techniques

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## Introduction

Interest at the EC level in a measure of the gender pay gap has increased in recent months. A revised list of 'structural indicators' (designed to follow up progress on employment and other issues following the Lisbon Special European Council in March 2000) includes the gender pay gap as an additional indicator.[1] Its inclusion reflects new political priorities, in particular the request at the Stockholm European Council to develop indicators 'to ensure that there are no discriminatory pay differentials between men and women' (cited in COM(2001) 619: 6). The precise measure has yet to be decided upon and depends on the outcome of further work on statistical methods that control for gender differences in sector, occupation, education, experience and age (op. cit.). At the same time, preparatory work on indicators of quality in work includes an unadjusted measure of the gender pay gap as a key indicator on gender equality, but this time supplemented by an adjusted measure of the pay gap as a context indicator.

Policy interest in 'adjusted' measures of gender pay equity is not new. Goldin (1990) reports its use in the late 1980s by the US government in its official reporting of male and female earnings differences, as well as by the University of Connecticut when it adopted a policy of eliminating the gender pay gap. The general aim of adjusting the gender pay gap is to control for a range of personal characteristics which may differ between men and women and which may therefore explain some of the difference in average pay between men and women. This may be important in comparing the gender pay gap across European member states as men and women in some countries may share similar levels of education, years of work experience and type of training, whereas in others there may be large gender differences in these characteristics. However, a selection of personal characteristics is not the only factor

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[1] The revised list of structural indicators in the area of employment for 2002 include: employment rate (total and by gender); employment rate of older workers; gender pay gap; tax-rate on low wage earners; life-long learning (adult participation in education and training); accidents at work (quality of work). Other indicators identified as in need of development in the area of employment are vacancies, quality of work, marginal (and average) effective tax rate and childcare facilities (COM(2001) 619).

that shapes the wage structures of men and women. Countries may also differ in the degree to which men and women are rewarded differently for equal characteristics. In some countries, gender may be a critical variable in explaining variations in the wage for a given level of education or training, whereas in other countries it may not be so important. Moreover, the country-specific employment system may also play an important role. In some countries years of work experience may be an important explanatory factor in understanding an individual's wage whereas in others it may play a very minor role. It follows that in the former group of countries gender differences in years of work experience are likely to be critical in explaining the gender wage gap whereas this would not be the case in the latter.

Given the range of potential influences on a country's male and female wage structure, it would seem practical to develop and apply a statistical technique which allows policy-makers to identify the relative importance of different factors that contribute to the gender pay gap. One such technique, the Oaxaca decomposition, identifies the proportion of the observable gender pay gap that is attributable to personal characteristics and the proportion attributable to 'labour market discrimination'. Advocates of this technique claim that it enables policy-makers to develop a more targeted approach to eliminating the gender pay gap. However, one potential problem is that statistical techniques such as these have have had to make a number of simplifying assumptions about the way labour markets operate in order to disentangle the independent effects of various factors on the wage structure. In particular, it is typically assumed there is a degree of independence between gender differences in personal characteristics and gender differences in rewards to these characteristics. Moreover, where decomposition techniques have been applied to cross-national comparisons of the gender pay gap, it is assumed that the degree of statistical error is of a similar type for each country when in fact diversity in the way labour markets operate exposes severe limitations to a statistical approach to decomposing the gender pay gap. While standard decomposition approaches seek to provide a simple overview of the factors shaping the gender pay gap in a particular country, in fact they may obscure more than they reveal because they are unable to incorporate the complexity of institutional and other societal-specific factors in the shaping of the wage structure.

This paper examines these issues. It begins with a brief introduction to the main opposing approaches to explaining gender wage inequality. It then sets out 'a beginners' guide' to the Oaxaca-Blinder decomposition approach and also offers a contrast with the more recently developed Juhn-Murphy-Pierce approach. The third section provides a review of some of the empirical results and policy recommendations from a selection of studies that have used some form of 'adjusted' gender pay gap approach. The final section sets out some of the major weaknesses of the Oaxaca-Blinder approach to assessing the gender pay gap and argues for an alternative approach that is better able to address cross-national differences in the institutions and rules that govern labour markets and shape a country's wage structure.

## 1. Explaining gender pay inequality

Generally speaking, there are two empirical approaches to explaining gender pay inequality. A first approach begins with the observation that the unadjusted pay gap does not compare like with like. The characteristics of men and women in the labour market differ with respect to the length of work experience, the level of education and skills, occupational status and sector of employment. Given that each of these characteristics has some association with the level of earnings, it is assumed appropriate to adjust the pay data so as to distinguish what proportion of the overall pay gap is due to differences in individual characteristics and what proportion is due to sex discrimination within the labour market.

While apparently straightforward, the approach relies on a number of assumptions. We outline these here, but subject them to critical examination below once we have reviewed the standard econometric technique. The first assumption is that individual characteristics of work experience, skill, occupation and so on, are the result of free choices made by individual men and women (at least under the orthodox version of the framework of neoclassical economics, an issue we return to below). For example, gender differences in how long to participate in the labour market reflect the greater household responsibilities of women – a condition that is assumed to lie outside the scope of labour market policy. Equally, women may be expected to

invest less in education because of intended discontinuities in labour market participation – again, not an issue considered to be associated with employer policies and practices or other areas of labour market policy. The second assumption is that these individual characteristics can be taken as approximate measures of productivity and that productivity equates with pay. Different levels of education, for example, are assumed to correlate with differences in productivity, and therefore with the level of pay. Overall, it is claimed that the benefits of this approach are threefold: it offers clarity, by identifying the pay differential between male and female workers after controlling for differences in individual characteristics; it identifies what fraction of the gap is due to differences in productivity and what fraction is due to labour market discrimination; it isolates the issue of labour market discrimination and thereby facilitates a clear policy focus.

A second approach to explaining gender pay inequality may usefully be termed the 'comparative institutional approach'. This approach begins with the observation that gender pay inequality is the result of entrenched institutional norms, labour market policy and employer practice which shape, in a way that also reflects structural conditions of the labour market and broader conditions of the particular society, labour market opportunities for different groups of workers and the relative value of occupations in society. Because this approach encompasses a wider array of societal factors, research typically calls for a reassessment of gender relations in many areas of policy-making in an effort to close the gender pay gap. For example, rather than assume that the occupational characteristics of a male or female employee are the result of free individual choice, studies adopting this approach question the range of employment opportunities open to women and investigate societal differences in the relative wage associated with female-dominated occupations. As such, any difference in occupational characteristics between men and women is not simply an issue of individual choice, nor is it a reflection of differences in productivity. Rather, occupational differences lie at the heart of the overall gender pay gap and are as likely to be caused by labour market discrimination as they are by a process of free decision-making.

## 2. Measuring 'labour market discrimination'

Virtually all empirical studies of wage discrimination between men and women use a formal statistical technique first devised by Oaxaca (1973), building on Becker's (1957) well-known theory of labour market discrimination (see, also, Blinder 1973). In this approach, discrimination is defined as the difference between the observed gender pay ratio and the gender pay ratio that would prevail if men and women were paid according to the same criteria. The observed gender pay ratio is known from the available data. The problem is how to estimate a pay ratio assuming an absence of discrimination. Becker was interested in discrimination insofar as he wanted to explain why an individual's wage did not equate with their marginal productivity. The conventional concept of discrimination is thus very much concerned with the extent to which an employer takes into account 'non-productive characteristics' (such as gender) of an employee in determining his or her wage. The decomposition approach of Oaxaca develops this concept of discrimination, but, importantly, within a human capital model that assumes an individual employee has a certain number of 'productive' characteristics (such as level of education, years of work experience and so on) that can be used as approximations of his or her marginal productivity (since marginal productivity is difficult, if not impossible, to measure). At the heart of the approach, therefore, is an assumption that certain individual characteristics can be identified as associated with a person's productive capability and that this, in turn, is associated with the wage earned.

In attempting to explain part of the gender pay gap, this approach attempts to control for differences in characteristics between men and women. For example, if we imagine that pay data only identify one characteristic – length of work experience – then the observed gender pay gap is likely to be a reflection of the following factors: differences in length of work experience between men and women; differences in reward for each year of experience to men and women; and an 'unexplained' or 'residual' difference in pay. If men and women are rewarded identically for each year of experience, then the gender pay gap is decomposed into two components; a first 'explained' component is due to differences in the average length of work experience between men and women and a second 'unexplained' or 'residual' component is due to unobservable characteristics (or, more technically, a difference in the intercepts).

The more real world case is where men and women have different characteristics and are rewarded differentially for this characteristic. In this case, the explained component of the gender pay gap is due to differences in the level of work experience and the residual component is due to both unobservable differences and the difference in reward for each year of experience.

More formally (following Mincer's 1974 human capital reduced-form equation), it is usual to specify a wage equation that re lates the logarithm of earnings as a function of individual characteristics:

$$\ln w_i = b_0 + b_1 ED + b_2 EXP + b_3 EXP^2 + b_4 Z$$

> where, ED is education, EXP is post-school work experience
> and Z represents other productivity-related variables;
> $b_i$ represent the retu rns on these characteristics

Or, more generally, this can be written as two separate wage equations, one for women and one for men, where X is a vector of personal characteristics:

$$\ln w_f = a_f + Sb_f X_f$$

$$\ln w_m = a_m + Sb_m X_m$$

Oaxaca decomposed the logarithmic gender wage gap into quantifiable productivity and discrimination components. Since the world of no discrimination could be assumed to be one where the wage structure faced by males also applies to females, or where the wage structure faced by females also applies to males, two estimations are derived:

$$\ln w_m - \ln w_f = Sb_m(X_m - X_f) + [(a_m - a_f) + SX_f(b_m - b_f)]$$

$$\ln w_m - \ln w_f = Sb_f(X_m - X_f) + [(a_m - a_f) + SX_m(b_m - b_f)]$$

In each equation the first term on the right hand side is the explained component, that is, the difference in male and female characteristics evaluated using either the reward to male characteristics or the reward to female characteristics. The second term is the unexplained component (interpreted as 'wage discrimination') and includes a difference due to unobservable factors that influence productivity and a difference due to differential reward for equal characteristics. In Oaxaca's (1973) original application of this technique, separate estimates are obtained using both the male and the female weighting procedure to establish a range of possible values. The two weighting procedures only give identical results if men and women receive the same reward for equal characteristics. Alternatively, Neumark (1988) suggests using a neutral weighting procedure that involves deriving a weighting coefficient from a pooled regression of males and females (see, also, Oaxaca and Ransom 1994). For studies that adopt this general approach the estimate for 'wage discrimination' is typically interpreted as the extent to which the labour market rewards equal characteristics between men and women with a different value. We provide illustrations of this below.

The statistical procedures have advanced since the early 1970s studies. In particular, early applications of the Oaxaca approach are said to suffer from problems of sample selection bias (Heckman 1979; see, also, Bloom and Killingsworth 1982). In many countries, labour market opportunities combined with welfare state policies may mean that women with lower levels of human capital are more likely to opt out of labour market participation. If this is the case, then women who participate may not be representative of the female population. Since, this approach is, in principle, interested in the wages that the market potentially offers to the whole population of men and women then regression estimation on the subsample of participants produces biased estimates. The so-called Heckman correction involves modeling the probability of employment among men and women using a range of variables, such as household demographics and nonwage sources of household income, and including this as an additional regressor in the wage equation. The idea is that this adds information on unobserved characteristics related to participation behaviour and thus corrects the problem of estimation bias (Zabalza and Tzannatos 1985).

The main alternative technique to the Oaxaca-Blinder (1973) decomposition is the Juhn-Murphy-Pierce (1991) decomposition.[2] This approach minimizes the problem of sample selection bias by avoiding the need to make separate estimations of wage equations for female workers (Juhn et al. 1991, 1993). Moreover, in the application to cross-national comparisons of the gender pay gap developed by Blau and Kahn (1992, 1997) (see, also, Gupta et al. 2001), this method allows for changes in the overall wage distribution to affect the gender pay gap. As such, the Juhn-Murphy-Pierce approach has the advantage of enabling identification of four sources of contributing factors to the overall gender pay gap: gender differences in productivity characteristics; gender differences in the prices of observed productivity characteristics; cross-national differences in relative wage positions of men and women; and gender differences in the prices of unobservable productivity characteristics. More formally (following Blau and Kahn 1992), a male wage equation can be expressed as follows for a male worker i and country j:

$$Y_{ij} = X_{ij}B_j + s_j ?_{ij}$$

> Where $Y_{ij}$ is the log of wages, $X_{ij}$ is a vector of explanatory variables, $B_j$ is a vector of coefficients, $s_j$ is the residual standard deviation of wages for country j and $?_{ij}$ is a standardized residual.

The logarithm of the pay gap for country j is:

$$D_j = Y_{mj} - Y_{fj} = dX_jB_j + s_j d?_j$$

> Where the d prefix refers to the average male-female difference for the variable immediately following; the final term of this expression corresponds to the 'unexplained' component found in Oaxaca-type decompositions.

The next step sets out the innovative step in this approach, that is, to provide a decomposition of the pay gap between any two countries, j and k:

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[2] See Gupta, Oaxaca and Smith (1998) for a positive test of the equivalence of these two decomposition techniques.

$$D_j - D_k = (dX_j - dX_k)B_k + dX_j(B_j - B_k) + (d?_j - d?_k)s_k + d?_j(s_j - s_k)$$

> Where the first term estimates the contribution of intercountry differences in observed characteristics to the gender pay gap, the second term estimates the impact of intercountry differences in returns to observed characteristics, the third term measures the effect of intercountry differences in the relative wage positions of men and women and the fourth term reflects intercountry differences in residual inequality.

In the above equation, it is the third and fourth terms which are the innovation. The third term allows for the following kind of situation. If women's average wage in one country is at the $40^{th}$ percentile of the male wage distribution, but is only at the $20^{th}$ percentile in a second country, then this variable picks up gender differences in unobservable characteristics, as well as country differences in labour market discrimination against women. The fourth term picks up inter-country differences in the wage penalty of women earning below male average wages after controlling for observable characteristics; in other words, the overall dispersion of wages are controlled for. Overall, gender-specific factors are reflected in the first and third terms, whereas the effect of a country's labour market structure is picked up in the second and fourth factors.

## 3. Empirical examples of the adjusted gender pay gap approach

There has been a proliferation of studies that use either the Oaxaca-Blinder, or Juhn-Murphy-Pierce approach to decomposing the gender pay gap. These are not limited to studies of the US and European countries. A review of the main academic journals for developing countries demonstrates a similar fascination (see, for example, Appleton et al. 1999; Horton 1996; Psacharopoulos and Tzannatos 1992; Seguino 1997). Indeed, a recent report from the World Bank provides a summary of results from studies carried out for 19 developed countries and 41 developing countries (World Bank 2002: appendix 3). Given the sheer volume of work carried out, it is

perhaps no surprise that the results are filtering through to the world of policy-making. This section provides a brief review of some of the more well known and the more interesting studies – limited to developed countries. The purpose of the review is to highlight the main findings and to illustrate the way these have been orientated to policy issues regarding gender pay equity.

It is perhaps appropriate to begin with a review of the findings from the classic studies of Oaxaca (1973) and Blinder (1973). Oaxaca draws on US wage data from 1967 ('Survey of Economic Opportunity'). Before carrying out the decomposition, Oaxaca estimates separate wage regressions for white males, white females, black males and black females using twelve variables to control for alleged productivity differences (see results in Table 1). Most variables are self-explanatory. However, the data do not allow a direct measure of work experience, so a proxy is estimated by subtracting the number of years of schooling (plus six) from the age of the individual and adding a control for the number of children in the female wage equation to make up for missing information on employment interruptions for childraising (op. cit.: 697-698). Overall, the estimates (expressed as an average of the male and female reduced form wage equations, see above) show that discrimination accounts for 58% of the gender pay gap for whites and 56% for blacks (op. cit.: Table 3). In this full 12-variable regression, the two most powerful control variables are the industry and occupation variables. If the control variables are restricted to 'personal characteristics' only (9 variables, excluding occupation, industry and class of worker) then the discrimination component increases substantially to 78% for whites and 95% for blacks (op. cit.: Table 4). In other words, gender differences in personal characteristics, such as education, experience, etc., only explain around 22% of the gender pay gap for whites and 5% for blacks. Personal characteristics with most explanatory power include part-time work status and marital status, so that controlling for gender differences in these variables significantly reduces the adjusted pay gap.[3] It is no accident that Oaxaca differentiates the two sets of results. He argues that the controls for occupation:

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[3] For both men and women, part-time work is associated with lower wages (an estimated coefficient of −0.19 for men and −0.04 for women in the respective wage equations) so the larger share of women in part-time work compared to that among men pulls down women's average wage. Conversely, for both men and women marriage is associated with a positive wage coefficient (+0.18 for men and

. . . eliminate some of the effects of occupational barriers as sources of discrimination. As a result, we are likely to underestimate the effects of discrimination (op. cit.: 699).

An important lesson from this much-cited work, therefore, is the need for two regressions that distinguish between the effects of 'personal' and more general characteristics on the gender pay gap. Nevertheless, this does not resolve the question of which variables ought to be defined as 'personal characteristics'. In Oaxaca's (1973) decomposition, part-time work is one of the personal characteristics with most explanatory power, but it could simply be picking up occupational differences given the clustering of part-time work in a small number of occupations.

Differences by race throw out further interesting results in this study. For blacks, the education variable actually widens the pay gap, because black females have around one more year of schooling than black males. The only control variable that acts in a similar direction among whites is the variable that controls for health problems, although its effect is negligible. Also, controlling for children has little effect on the black wage equations, but is significant for white women, suggesting that black females do not stay out of the labour force as long as white females to raise children or, as Oaxaca speculates, that the skills acquired by black women are low and therefore skill depreciation while inactive has little effect on wages (we return to this contentious issue below). Overall, however, Oaxaca is clear about the contribution of this study to an understanding of gender pay equity. In the conclusion he states:

> We are in agreement with other researchers that unequal pay for equal work does not account for very much of the male-female wage differential. Rather it is the concentration of women in lower paying jobs that produces such large differentials. Our results suggest that a substantial proportion of the male-female wage differential is attributable to the effects of discrimination (op. cit.: 708).

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+0.09 for women) so controlling for the lower share of married women in work compared to that of married men explains a significant portion of the total gender pay gap (op. cit.: Table 1).

**Table 1. Findings from selected studies using the Oaxaca-Blinder approach**

| | Country | Control variables | Key explanatory variables (in descending order) | % of GPG explained by differences in characteristics | % of GPG attributed to discrimination |
|---|---|---|---|---|---|
| Oaxaca (1973) | US | 12: Education, experience, number of children, class of worker, occupation (10), industry (16), health problems, part-time, migration, marital status, size of urban area, region | Industry<br>Occupation<br>Marital status<br>Part-time<br>Children | 42% (whites)<br>44% (blacks)<br>[average of two estimates] | 58% (whites)<br>56% (blacks)<br>[average of two estimates] |
| Blinder (1973) | US | 12: Age, region, education, training, occupation (8), union, veteran status, health, local labour market, mobility, length of time on job | Occupation<br>Length of time on job<br>Union membership | 34% | 66% |
| Asplund et al. (1993)[1] | Denmark Finland Norway Sweden | 12: Experience, education, tenure, part-time, cohabitation, temporary contract, immigrant, health, province, no. of children, occupation (6), sector (7) | DK: Sector, occupation, experience<br>FI: Sector<br>NO: Sector, occupation<br>SW: Sector, occupation, part-time | DK: 28%<br>FI: 10%<br>NO: 34%<br>SW: 49% | DK: 72%<br>FI: 90%<br>NO: 66%<br>SW: 51% |
| Langford (1995) | Australia | 9: School, potential experience, tertiary education field, marital status, children, country of birth, occupation (8), industry (12), public/private | Industry<br>Tertiary education field<br>Potential experience | 51% | 49% |
| Le Grand | Sweden | 21: Education, experience, seniority, | Positional grade | 57% | 43% |

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|---|---|---|---|---|---|
| (1991)[1] | | immigrant, big city, married, children, housework, career interruption, positional grade, union, public sector, occupational segregation (female share), physical work, autonomy, working time inconvenience, work monotony, piece -work, commuting time, part-time, hectic work | Occupational segregation Experience | | |
| Plasman et al. (2001) | Belgium | 11: Education, work experience, years of service in company, occupation (ISCO 2-digit), paid working hours, type of contract, unsocial hours premium, economic/financial control at company, paid overtime, sector (NACE 2-digit), company size | Sector Years of service Occupation | 48% | 52% |

Notes: 1. These studies refer to the gender pay gap as the ratio of male average pay to female average pay.

Blinder (1973) developed (apparently simultaneously) a similar decomposition technique to Oaxaca, distinguishing between the portion of the gender pay gap attributable to 'differing endowments' (or characteristics) and that attributable to 'differing coefficients' (or rewards to characteristics), with the portion attributable to discrimination estimated as the sum of the latter portion and a portion attributable to unexplained factors (op. cit.: 439). The study is also based on US data for 1967, although in this case from the Michigan-based 'Panel Study of Income Dynamics'. Table 1 summarises the results in a manner that conforms with the approach taken by Oaxaca. However, Blinder is careful to decompose the discrimination component into a part attributable to differences in rewards to similar characteristics and an unknown 'shift coefficient'. This shows that by far the most important factor explaining the gender pay gap is differences in reward to age, reflecting the much flatter age-wage profile among women compared to men. Men are also at a clear advantage with respect to education and local labour market conditions, enjoying much higher returns to these characteristics than their female comparators. For all three variables there is hardly any difference in the endowments. One curious result is that while gender differences in occupation act to the disadvantage of female earnings, differences in returns to similar occupations contribute a wage advantage to women over men (op. cit.: Table 3). Taking the two effects together shows, surprisingly, that women gain overall from controlling for the occupation variable. Nevertheless, as Blinder notes, the age variable probably picks up some of the occupation effect, in particular the failure of women to move up the occupational ladder within any of the broad occupational groupings (op. cit.: 449). This result clearly shows the difficulties of separating out independent effects of one variable from another on the overall wage structure – again, an issue we return to below.

Contemporary applications of the Oaxaca-Blinder technique are numerous and apply to a range of areas of policy interest. Asplund et al. (1993) apply the technique to national wage data for four Nordic countries and address issues related to equal pay legislation and the degree of centralization of wage bargaining. This study finds that Finland has a narrower gender pay gap than Denmark, Norway and Sweden largely because men and women share similar characteristics; differences in Finland account for just 10 per cent of the wage gap compared to between 28% and 49% in the other three countries. Part of the reason for this, the authors argue, is that there

is a low incidence of part-time work in Finland, female labour force participation has been high for a long time thus reducing the share of new entrants and the level of occupational segregation is relatively low. Sector differences play the most significant role but even this is relatively small due, the authors argue, to the narrow wage differential between public and private sectors (op. cit.: 16-17). In the other three countries, sectoral and occupational differences between men and women are significant explanatory variables. Also of interest is the finding that gender differences in part-time status account for a substantial portion of the explained gap in Sweden, but this finding is actually reversed in Denmark, Finland and Norway, with part-time status responsible for a wage advantage for women over male comparators (op. cit.: Table 7); the authors provide no comment on this particular finding. Overall, they argue that the low incidence of discrimination in Sweden is due to the relatively centralized bargaining structure and that equal pay legislation in Denmark and Norway have been insufficient to eliminate the wage gap.

In an application of the technique to wage data for Australia, Langford (1995) draws on the ABS Income and Distribution Survey for 1989-1990, which covers male and female full-time workers only. The study finds that 51 per cent of the gender pay gap would be eliminated if male and female workers had similar characteristics (using Neumark's no-discrimination structure). Industry differences account for more than half of the explained component of the gap, but these are partially offset by gender differences in occupation and the public-private employment mix. The variable 'tertiary education field' includes nine dummies representing different areas (such as social sciences, science and engineering, commerce, etc.) and accounts for around 40 per cent of the explained component of the gap; Langford shows that it is women's underinvestment in physical trades and sciences that severely acts to their disadvantage. The explanatory power of potential experience is due, Langford suggests, to the dominance of younger women in the Australian labour market. Interestingly, demographic variables (marital status, number of children and country of birth) play very little role. Additional decompositions for separate samples of workers with children and workers without children show that gender differences in characteristics explain a far higher proportion of the gender pay gap among workers with children than those without children (48% and 20% of the gap, respectively); this supports the case for better childcare and maternity leave provision to reduce the

gender pay gap. However, because the pay gap among workers with children is wider, Langford also shows that 'discrimination' accounts for a very similar size of the gender pay gap for the two groups of workers (10 points of the 19 percentage point gap for workers with children and 9 of the 11 point gap among those without children; op. cit.: 73), although these findings may be a result of excluding data on part-time workers for whom problems of measuring labour market experience are likely to be greater. A further decomposition for public sector workers and for private sector workers shows that employer discrimination is higher in the private sector, contributing 10 percentage points to the gender pay gap, compared to 7 percentage points in the public sector. Langford wonders whether this is evidence of better implementation of Equal Pay legislation in the public sector, or the result of trade union initiatives. He also argues that these results certainly conflict with neoclassical models of discrimination, which hypothesize that monopolies bring higher discrimination. In conclusion, Langford states:

> Therefore, the lower discrimination [in the public sector] must be the result of institutional factors. . . . the results bring further support to the hypothesis that enterprise bargaining will not benefit women as the private sector appears to possess higher levels of discrimination. The difference though between them is perhaps not as large as expected reflecting the government's commitment to restrained wage outcomes and public sector cutbacks. It would appear that the enacted legislation has had some impact (op. cit.: 75, 77).

For Sweden, Le Grand (1991) draws on the 1991 Level of Living Survey to investigate the effectiveness of solidarity wage bargaining in securing equal treatment of men and women in the Swedish labour market. The hypothesis is that if solidarity wage bargaining was powerful in promoting equal pay for equal job types then controlling for job characteristics ought to generate an adjusted pay gap of zero. The results show that variables related to job segregation (especially positional grade and occupational segregation, measured as female share in the occupation) have most explanatory power, accounting for around three quarters of the explained gender pay gap. Overall, Le Grand shows that if men and women had the same positional grade and if there were no occupational segregation then the unadjusted gender pay gap would decrease by around 40 per cent. Other variables play a relatively insignificant role, so that the adjusted pay gap still amounts to 8%

compared to an unadjusted gap of 20%. What this means, Le Grand argues, is that the component attributed to 'discrimination' is larger than one might have expected.

> These results are not in accordance with the principle of solidarity wage policy with equal pay for the same type of jobs, as formulated by the trade union movement in Sweden. Gender is an independent and strong determinant of earnings inequality in the Swedish labour market. Despite these negative results, however, it should be remembered that solidarity wage policy, by narrowing the wage dispersion, has contributed to small male-female wage differentials compared to many other countries (op. cit.: 273).

There are two further empirical findings of note. The first relates to the inclusion of a range of variables that measure working conditions (the degree of autonomy, inconvenience of working hours, and so on). Le Grand shows that the pay difference between men and women has very little to do with Adam Smith's theory of 'compensating differentials', since gender differences in working conditions explain very little of the gender pay gap. The second finding is that in the original specification, Le Grand did not include industry or occupational variables. Further tests were carried out with an expanded wage model with 26 industry dummies but this only reduced the adjusted pay gap by 0.5 per cent (op. cit.: 272). It is likely that the small effect of the industry variable is due to these effects been picked up in other variables such as working conditions and positional grade (normal skill demands and supervisory position).

As part of work undertaken by the Belgian presidency for the European Council, a study by Plasman et al. (2001) argues that application of the Oaxaca-Blinder technique to decomposing the gender pay gap is both appropriate and feasible as a means of developing targeted policy action to reduce the gender pay gap. The study uses the European Structure of Earnings Survey since this provides a large sample size (and therefore provides relatively reliable information) and includes a high differentiation of occupations and sectors of activity (although the absence of public sector data is clearly a major limitation). The application to the case of Belgium is undertaken as an illustration of what might be achieved through further work on other countries using the same data source. The presentation of findings in the study is unfortunately limited. It appears that the most important explanatory variables are

sector of activity, years of service in the organization and occupational activity. Correction of gender differences in these three variables alone would reduce the gender pay gap by almost eight percentage points (from 25.4% to 17.6%) as they explain around two thirds of the explained component of the gender pay gap (op. cit.: Table 2). Gender differences in the three human capital variables (education, previous work experience before current job and years of service in current organization) together only explain 14 per cent of the total gender pay gap. Or, if human capital characteristics were equivalent between male and female workers, the gender pay gap would narrow from 25.4% to 21.9%. No findings are reported which attempt to disentangle what part of 'discrimination' (the remaining adjusted pay gap) is due to differences in returns for similar characteristics (and for which characteristics such differences are narrow or wide) and what part is due to unobservable characteristics that impact on the wage structure. Despite the limited nature of the results reported (which presumably reflects the policy-nature of the paper), the authors are confident of the positive contribution of such work to evaluating and informing policy; they provide examples of how this might operate in practice:

> If it appears that differences in occupation contribute significantly to wage inequalities, measures contributing to a better balance between men and women in different occupations, or measures such as a review of job classifications, will be appropriate. If the effect of seniority or experience is significant, the pertinence of career break systems could be challenged. However, if the differences in the remuneration of identical characteristics are significant, the question why, for instance, the same professional experience is rewarded differently in men and women should be investigated. Consequently, this breakdown allows a better follow-up of the evolution of the elements that constitute the wage inequalities between countries and can suggest areas for policy actions (op. cit.: 44).

A number of studies employ the rather more innovative Juhn-Murphy-Pierce method for decomposing the gender pay gap. Interest in this approach stems from the claim that gender inequity in pay is due to three factors: differences in productivity-related characteristics, differences in reward to workers with equal characteristics and cross-national differences in the overall shape of the wage structure. Development of this

statistical approach to decomposing the gender pay gap appears to have been pioneered by Blau and Kahn (1992, 1997),[4] although it is clear that the conceptual work of institutionalist economists has had a major influence in highlighting the importance of cross-national differences in country wage structures for an understanding of the gender pay gap (Bettio 1988, Høgsnes 1994, Rowthorn 1992, Rubery 1991, Rubery and Fagan 1994, Whitehouse 1992). We use the term wage structure to refer to the overall shape of the wage distribution, the degree of dispersion between the low paid and the high paid, as well as the concentration of workers at different points of the wage distribution.

Blau and Kahn (1992) use the approach to identify the factors that explain cross-national differences in the gender pay gap using the US as the comparator. They draw on the International Social Survey Programme (ISSP) as a source of wage data, supplemented by additional data for four of the ten countries covered. They find that country differences in wage structure are important in explaining international differences in the gender pay gap (op. cit.). Comparison of the impact of gender-specific factors (gender differences in characteristics and the relative position of women in the male wage distribution) show that US women fare well compared to other countries: only Hungary and Sweden had relatively more favourable levels of productivity characteristics and only Australia and Italy displayed more favourable gender treatment effects in the wage structure (op. cit.: Table 7). But the US level of wage inequality (as revealed through the returns to observed characteristics and the wage penalty associated with women's position in the wage structure) widens the US gender pay gap compared to all the other nine countries. Indeed, this effect accounts for all, or more (since it may be offset by other factors), of the difference in gender pay gaps with six of the nine countries (the exceptions being Italy, Switzerland and the UK) (op. cit.: Table 7). It is worth noting, however, that what is stylistically referred to throughout the paper as the effect of a country's wage distribution also includes the level of discrimination; as such the independent effect of wage distribution may be overstated (op. cit.). In conclusion, Blau and Kahn argue that an understanding of women's relative position in the US labour market needs to be

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[4] Other studies test the similarity between this method and the traditional Oaxaca-Blinder approach, once a pooled wage regression (rather than male wage equation) is utilised (Gupta et al. 2001).

reorientated to an understanding of changes in the overall wage structure, rather than solely factors that shape the supply and demand for skills:

> Our research suggests that to understand changes in the gender pay gap fully, it would also be fruitful to examine the impact of changes in wage structure. . . . In the face of rising inequality, women's relative skills and treatment have to improve merely for the pay gap to remain constant; still larger gains are necessary for it to be reduced (op. cit.: 32).

In a more recent comparative study using the same data set, Blau and Kahn (2001) test for the effects of both overall wage compression and female labour force supply and find that more compressed wage structures and lower female net supply are both associated with a narrower gender pay gap.

In the final study reviewed here, the Juhn-Murphy-Pierce approach is applied to analysis of ECHP data for 8 countries, plus additional data for Hungary (Rice 1999). Because of the direct relevance of this study, the results of the first and second stage decompositions are show here in Tables 2 and 3 below. Rice finds that gender differences in measured characteristics (human capital and job characteristics) account for only a small proportion of the observed gender pay gap. Gender differences in human capital characteristics account for just 2% of the observed gap in Spain and just 4% in France; the most they account for are 21% in Germany and 25% in the UK. Combined with job characteristics, these figures rise significantly (to 17% in Spain, 39% in France and up to 45% in Denmark), suggesting, as Rice puts it,

> . . . that relative to their human capital, females on average suffer from a 'poorer' (ie. lower paying) job distribution in terms of occupation, industry and firm size than their male counterparts. Controlling for levels of human capital, women are less likely than men to be employed in those occupations and industries associated with large positive rents (Rice 1999: 25).

The final three columns in Table 2 provide summary statistics on each country's wage structure, after controlling for measured human capital and job characteristics; in other words, these statistics provide some indication of the extent to which women face unequal treatment in the labour market either because they receive lower

returns to observable characteristics or women are regarded as having lower productivity due to characteristics that are unobservable. The penultimate column shows that in all eight countries, half of all women are ranked at best below the 34th percentile of the male wage distribution after controlling for individual characteristics. The measure of wage inequality given by the standard deviation shows that the wage penalty of this unequal treatment is markedly higher in Germany, the UK and Spain than in Denmark.

**Table 2. Juhn-Murphy-Pierce decomposition of the gender pay gap using ECHP**

| | *Differential in log (adjusted) earnings (at sample mean)* | *Difference in measured characteristics evaluated at male prices (at sample mean)* | *Standard deviation of male residual wage distribution* | *Percentile ranking in male residual wage distribution* | |
|---|---|---|---|---|---|
| | | | | *Female median* | *Female mean* |
| Denmark | 0.1352 (100%) | 0.0612 (45%) | 0.2610 | 33.38 | 39.87 |
| France | 0.2035 (100%) | 0.0784 (39%) | 0.3740 | 34.05 | 38.83 |
| Germany | 0.3499 (100%) | 0.0589 (17%) | 0.4915 | 18.91 | 29.70 |
| Greece | 0.2183 (100%) | 0.0895 (41%) | 0.3619 | 33.52 | 39.05 |
| Italy | 0.1692 (100%) | 0.0095 (6%) | 0.3255 | 23.57 | 33.42 |
| Portugal | 0.1718 (100%) | 0.0468 (27%) | 0.3783 | 34.08 | 40.06 |
| Spain | 0.2033 (100%) | 0.0355 (17%) | 0.3955 | 29.67 | 37.17 |
| UK | 0.2718 (100%) | 0.0967 (36%) | 0.3967 | 28.20 | 35.97 |

Source: Rice 1999: Table 6.

The Rice (1999) study also applies the Juhn-Murphy-Pierce decomposition to an analysis of inter-country differences in the gender pay gap with Denmark chosen as the reference country since it has the narrowest gap among the seven countries selected. The findings show that differences in observed characteristics do not explain much of the difference in the relative size of each country's gender pay gap compared with Denmark (at most 35% of the difference between France and Denmark is explained by this variable). Nevertheless, the range of explanatory power is striking. In the southern European economies it is notable that the effect of observed characteristics is negative reflecting the relatively high levels of education of female workers compared to male workers in these countries. The major finding, however, is that for all countries the larger gender pay gap compared to that found in Denmark is primarily explained by the relative position of women in the residual wage distribution and the wage penalty associated with this position. In all countries, the average woman is ranked lower than is the case in Denmark, and this combines with higher wage inequality (after controlling for individual characteristics); these two effects have greater explanatory power than the effects associated with observable characteristics (Rice 1999: 29-30).[5] In conclusion, like Blau and Kahn, Rice stresses the need to consider both gender-specific factors and a country's wage structure in recommending policy action to close the gender pay gap. Moreover, she highlights the differential impact of these two factors at the top-end and the bottom-end of the labour market in different countries:

> Lower paid women in Denmark fare better relative to male workers than their counterparts elsewhere in Europe because they receive more equal treatment as indicated by their higher ranking in the residual wage distribution. However, the picture appears rather different for those in the upper tail of the earnings distribution. Here we find relatively small differences across the economies in the ranking of female workers in the residual wage distribution. Among this group, differences in observable productivity characteristics play a much

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[5] Rice carries out further decompositions away from the sample mean to test whether her findings are representative of the sample as a whole. She finds that limiting the sample to workers in the lower quartiles of the wage distribution a large part of the explanation lies in the unequal treatment of women measured by their placement in the male wage distribution. Among higher paid workers (the upper quartile) gender differences in observable characteristics carry most weight in explaining the difference with Denmark.

greater role in determining cross-country differences in the gender earnings. Higher paid women in the southern European economies, Portugal, Italy and Spain, fare considerably better in this respect relative to women in Germany, the UK and even Denmark. This is due in part to relatively high levels of human capital, particularly general education, but of greater significance is the lower level of occupational and industrial segregation of female employment in these countries when compared to the countries of northern Europe (Rice 1999: 32-33).

**Table 3. Juhn-Murphy-Pierce decomposition of inter-country differences in the gender pay gap using ECHP (reference country Denmark)**

| | | Gender-specific effects | | Wage structure effects | |
|---|---|---|---|---|---|
| | *Relative gender gap* | *Attributable to measured character-istics* | *Attributable to unobserved productivity* | *Attributable to relative prices of measured characteristics* | *Attributable to unobserved prices* |
| Germany | 0.2147 | 0.0556 | 0.0954 | -0.0579 | 0.1216 |
| UK | 0.1366 | 0.0176 | 0.0379 | 0.0179 | 0.0631 |
| Greece | 0.0831 | -0.0233 | 0.0145 | 0.0516 | 0.0403 |
| Spain | 0.0681 | -0.0085 | 0.0248 | -0.0172 | 0.0690 |
| France | 0.0683 | 0.0242 | 0.0126 | -0.0070 | 0.0384 |
| Portugal | 0.0366 | -0.0170 | 0.0074 | 0.0026 | 0.0436 |
| Italy | 0.0340 | -0.0213 | 0.0707 | -0.0304 | 0.0149 |

Source: Rice (1999: Table 7).

## 4. Problems with the Oaxaca-Blinder decomposition approach

The Oaxaca-Blinder decomposition offers an apparently straightforward method for informing policy on how to close the gender pay gap by identifying the importance of a range of factors in different countries in explaining the average pay gap between male and female workers. For example, in some countries it may be differences in years of work experience that is the main explanatory factor, with the implication that

policy targeted at expanding childcare provision and paternity leave might eliminate the gender difference in years of work and therefore significantly close the observed gender pay gap. In other countries, it may be sex segregation by sector that accounts for a major part of the observed gender pay gap, with the implication that policy action to equate the male-female share of individual sectors would be the most effective way of establishing gender pay equity. However, despite its apparent simplicity and policy focus, the Oaxaca-Blinder decomposition relies on a number of assumptions and, in the way particular statistical techniques are deployed, this adds a certain ambiguity to the results generated and lends complexity rather than simplicity to the interpretation of these results.

The problems are not insignificant. Indeed they arise as a direct consequence of the core objective of the Oaxaca-Blinder decomposition to separate out an explained portion of the gender pay gap and an unexplained portion attributable to discrimination. Again, it is worth emphasizing that the Oaxaca-Blinder decomposition approach developed out of Becker's (1957) theory of discrimination (Blau and Ferber 1987). This states that wage discrimination is the pay difference between two groups that is not accounted for by productivity differences. However, statistical estimation of discrimination is no easy matter, a point not lost in the early studies of Oaxaca and Blinder (for a general critique, see Butler 1982). The challenge for the decomposition approach is thus twofold: to identify all the individual characteristics that can be said to have an impact on productivity; and to develop a technique which separates out the independent effects of productivity and discrimination on the gender differential in pay. It is in the struggle to meet this challenge that a number of inter-related problems arise.

### *Choice and definition of control variables*
The first problem is that because the neoclassical economic model assumes pay is equated with productivity, it is necessary to include as many individual characteristics related to productivity as possible in the specification of the wage equations. However, sources of wage data are imperfect in this regard. The problem is referred to as one of 'unobservable productivity characteristics'. If male workers, on average, are more highly qualified than female workers with regard to omitted variables, then the value of discrimination will be overestimated. Indeed, it is well-

known that a key development in the decomposition approach has involved the progressive inclusion of more and more variables in the wage equations, expanding the vector of productivity-related characteristics. With the addition of more variables, so the adjusted pay gap associated with discrimination has diminished (Gunderson 1989, Humphries 1995). As we can see from the above Table 1, the selection of control variables tends to incorporate standard variables, such as education and job experience, but there also appears to be a degree of subjectivity in the selection (such as the use of immigrant status, union membership or company size variables). Oaxaca in his classic 1973 study was clear on this issue:

> It is clear that the magnitude of the estimated effects of discrimination crucially depends upon the choice of control variables for the wage regressions. A researcher's choice of control variables implicitly reveals his or her attitude towards what constitutes discrimination in the labour market (op. cit.: 699).

In practice, choice of control variables is likely to be constrained by their availability in the chosen source of data. However, where the researcher is keen to include a variable because of a known association with earnings, often proxy measures are incorporated instead. The best example of use of imperfect measures is for the variable work experience. Few data sets include reliable information on years in employment as well as years in the current organization. Many studies thus rely on a proxy variable for potential experience that subtracts years of total education and five or so years of pre-schooling from the age of each individual (see, for example, Langford 1995, Oaxaca 1973). In both these studies, the potential bias of this proxy variable (since women are more likely to have intermittent labour force participation than men) is controlled for by including a children status variable in the female wage equation to reflect the cost of lost experience due to childcare (assuming depreciation of skills during the period of absence); the major problem with this technique is the potential for problems of correlation between the two control variables, number of children and potential experience (Oaxaca 1973: 698).

### *Feedback effects*

The second problem is that although the statistical technique appears to separate out an 'explained' from an 'unexplained' component of the gender pay gap, there are good reasons to believe that the distinction is in fact rather more blurred. This is

referred to as the 'feedback effect' problem in the literature. The assumption of the model is that controlling for gender differences in characteristics (education, experience, occupation and so on) means that one can produce an estimate of how similar workers would potentially be treated in the labour market and claim that any remaining pay difference is attributable to discrimination. But labour market discrimination may also shape observable productivity differences (Bergmann 1989, Humphries 1995). For example, employers may discriminate against women directly in blocking their access to training programmes. Moreover, once we consider that the choices that individuals make concerning education, participation and working time are in fact endogenous, it is clear that women's perceptions of labour market sex discrimination may adversely affect decisions to invest in education and training. Taken together, these feedback effects mean that labour market discrimination (or the estimate of the adjusted gender pay gap) is likely to be underestimated in the Oaxaca-Blinder decomposition approach.

How much of a problem is this for conventional applications of the Oaxaca technique designed to inform policy? Of course, it is entirely possible for the researcher to claim that the identification of an 'explained' portion of the gender pay gap is only designed to guide policy to the particular areas associated with gender pay inequality, whether this concerns inequality in education, training or job tenure. The researcher may in fact be indifferent as to whether gender differences in personal characteristics are interpreted as reflecting free individual choice or as involving some element of labour market discrimination through feedback effects. The problem with this is that the explanatory power promised by the model is much diminished. The policy-maker may now know, for example, that gender differences in the level of workplace training are an important factor in explaining the gender pay gap, but the causes of this are still unclear. Is labour market intervention required to reduce discriminatory employer practices and open up more training places for women, or are the differences the result of the different household responsibilities of men and women with female workers more likely to underinvest in training because of lower attachment to the labour market? The former policy approach may be preferred by those researchers attempting to use the model in a way that encourages more positive labour market intervention. The latter fits with the neoclassical assumptions

of the original specification of labour market choice and discrimination in the works of Becker.

There is a long-running debate between these two opposing camps. On the neoclassical side, Mincer and Polachek (1974) argue that it is optimum for women to invest less in education than men since women specialize in household production and the rearing of children and therefore envisage labour force participation as discontinuous. Since time spent out of waged work constitutes a depreciation of human capital, women choose to enter occupations where the loss in wages due to absence is minimal, resulting in a crowding of women in jobs that require low levels of education and training and pay low wages (op. cit.; see, also Becker 1993, Fuchs 1989). Against this position, England (1982) demonstrates that if men and women are assumed to wish to maximize wage earnings then in fact it makes more sense for women to enter higher paid occupations before childbirth; moreover, if the decision does involve a balancing of expected returns to human capital to the respective depreciation rate then it is not clear that this implies a choice of low investment in human capital (see, also, Beller 1982). The direction of causality is also questioned by a series of case studies in the US (including the feminisation of bank teller positions and clerical work) that identifies a negative causal relationship between female entry and declining occupational earnings (Reskin and Roos 1990). Unfortunately, despite the sophisticated statistical insights of the Oaxaca approach, the results as conventionally presented do not provide sufficient justification for either approach.[6] In other words, some of the major questions underpinning debates in active labour market policy remain unresolved.

These problems of policy interpretation were noted from the outset. In the conclusion to his study, Oaxaca tells us:

> Another difficulty in the residual approach is that it does not take into account the effects of the feedback from labour market discrimination on the male-female differences in the selected individual characteristics. The differences could reflect the adaptation of women to the biases of the labour market; yet

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[6] On balance, given the strong assumptions of the model, it is more likely that the results can be justified as compartmentalizing the gender pay gap into one component resulting from free rational choice and another resulting from discrimination – that is, discrimination is assumed not to affect human capital choices (Butler 1982).

under the residual approach all differences in the characteristics contribute to a reduction of the wage differential attributable to discrimination. The problem becomes one of how much of the observed differences in individual characteristics would exist in the absence of discrimination. These very difficult problems have not been dealt with in this study, but they are clearly important in terms of policy prescriptions for narrowing the male-female wage differential (1973: 708).

***Occupation and sector as control variables***

The problems already discussed are neatly illustrated by consideration of the issues raised by the inclusion (or not) of occupation and sector as control variables. In almost all studies, inclusion of these variables adds considerably to the explanatory power of the model, generating a much reduced adjusted pay gap. A glance at Table 1 above reveals that one or both of these variables are among the most important control variables in all studies reviewed. The reason for this is not only because occupational variables correlate with wage differentials, but also occupational categories may also correlate with a host of unobserved variables that impact on the wage level. This is illustrated in the study by Le Grand (see above) where eight variables characterising working conditions were used instead of occupation and when a decomposition was carried out with occupation as an additional control variable it was found to have very little explanatory power. In other words, the working conditions variables (such as job monotony, autonomy, etc.) are likely to be unobserved productivity-related variables in other models, but picked up by the occupation control variable. Also, we saw in Oaxaca's study that the part-time work variable had relatively strong explanatory power, but, again, this may have been strongly associated with occupational categories. These ambiguities in the statistical results suggest that it is perhaps more important to focus on the inter-relationships between occupation, working conditions and part-time work, for example, and the way these shape gender wage differentials.

It has long been known that the more detailed the classification (of occupations or industry sectors) the greater is the explanatory power of this variable. This demonstrates that sex segregation (by occupation or industry) plays an important role in shaping the gender pay gap. However, use of detailed classifications as a

control variable may factor out discrimination in promotion practices and obstacles to advancing up occupational categories (such as into managerial categories, for example). Several reviews of the approach argue that correcting the gender pay gap for differences in occupational activity using detailed occupational classifications will produce an underestimation of discrimination (or of the 'adjusted' pay gap) (Cain 1986, Chiplin 1979). For these reasons most studies prefer to use relatively broad classifications of around 6 to 12 categories (see Table 1 above).

More generally, it is worth noting that in his (1973) study, Oaxaca was concerned that by controlling for occupational differences between men and women 'some of the effects of occupational barriers as sources of discrimination' would be eliminated leading to an underestimation of discrimination (p. cit.: 699). Hence, the study refers to estimates from two separate decompositions; the first decomposition involves personal characteristics only and the second involves personal and job characteristics. At best, therefore, the two estimates may be thought of as setting lower and upper bounds, respectively, to the extent of discrimination (or as maximum and minimum levels to the adjusted gender pay gap).[7]

### Controlling for societal-specific effects

Given the interest of the European Commission in developing a harmonized indicator on gender pay inequality for all member states, it is necessary to assess the extent to which a standard decomposition approach can successfully highlight cross-national differences in factors that contribute to the gender pay gap. The issue of cross-national comparison raises a number of problems; some are addressed with the development of the Juhn-Murphy-Pierce model, but many remain.

As we described above, for a single country, decomposition of the gender pay gap identifies the following factors as contributing to the gender pay gap: gender differences in the industry, or occupational distribution; pay differences within the same occupation (and/or industry) that are accounted for by differences in productivity and those attributed to discrimination; and, in some studies, the

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[7] One innovative study treats the occupation variable as endogenous, rather than as a 'productivity-related' characteristic, in order to better capture the barriers women face when attempting to enter male-dominated occupations (Kidd and Shannon 1996).

valuation attached to female-dominated compared to male-dominated jobs. As such, the results feed directly in to the three conventional policy options: equal opportunities policies; equal pay for the same work; and equal pay for work of equal value (Rubery 1991). However, cross-national studies demonstrate that other factors are also important in shaping gender pay differentials; in particular, differences in the gender pay gap among countries also reflect differences in employment structures and wage systems (Bettio 1988, Rowthorn 1992, Rubery and Fagan 1994, Whitehouse 1992). Employment structures reflect differences in the composition of industries and occupations in the economy, along with differences in the share of self-employment, part-time employment, temporary employment, and so on. Wage systems vary among countries along three dimensions: the width of pay differentials between jobs; the ranking of jobs by pay; and the principles of pay determination (Rubery 1991). Only the first of these dimensions is captured in the concept of wage structure developed in the Juhn-Murphy-Pierce approach. It is beyond the scope of the present study to consider in detail how each of these factors shape the gender pay gap in particular countries; this is the objective of a future research report. However, reference to some examples illustrates the way societal differences in employment structures and wage systems may undermine the usefulness of a universalistic decomposition approach.

Gender difference in occupation is typically a strong explanatory variable in decompositions of the gender pay gap. But when we are told that, controlling for other factors, occupational differences explain 50 per cent of the observed pay gap in country A, but just 20 per cent of the gap in country B, what does this tell us? Does it tell us that country A has a worse record on equal opportunities than country B and therefore needs to reduce sex segregation within occupations? This depends on the particular country. In Germany, for example, it is the skill and qualification of the worker, rather than the job title, that determines pay within an occupation (Marsden 2000). Hence, even after controlling for gender differences in age, education, employment contract, and so on, application of the model to Germany may mis-represent the role of occupational differences simply because of the absence of controls for skill and qualification. Also, differences in pay between occupations may be more important in many countries, so that the extent to which the gender share of occupations matters depends on where they stand within the

overall wage structure. In some respects this is picked up in the work that develops the Juhn-Murphy-Pierce model by introducing variables that control for wage dispersion (see above). This controls for the fact that women's employment at different points of the wage distribution is associated with a particular wage penalty, or wage premium, and this differs substantially between countries. However, what happens when a female-dominated occupation moves up the ranking in a country because the pay of a male-dominated occupation has fallen relative to the average? How does the statistical approach disentangle the effects of wage dispersion and occupational sex segregation when the outcome is a narrowing of the gender pay gap through the leveling down of men's pay?

One important difference in industry composition between countries is the share of public sector employment. The results from a Oaxaca-Blinder decomposition focus on the extent to which the gender pay gap would be reduced if men and women were equally represented in the public and private sectors. However, a more pressing problem may concern the relative pay differential between the public and private sectors. Also of interest is the trend in the size of the female share in public sector employment as, at least in the case of the UK, this has been found to be positively associated with women's average pay relative to men (Grimshaw 2000). We saw above that some single-country decomposition analyses do estimate separate wage equations for the public sector and for the private sector - with the finding, for example, that the more regulated pay grading system in the Australian public sector explains the lower incidence of labour market discrimination (Langford 1995). However, a cross-national comparison requires an approach that recognises a diversity of models of public sector employment and the way these interact with the overall gender pay gap: does the public sector provide for integrated pay settlements among manual and non manual workers?; is the public-private sector pay differential similar for all occupational groups (ranging from low to high skill)?; does the public sector provide an important source of employment for all employment forms (part-time, full-time, low skill, high skill)?

There are also potential problems regarding identification of 'personal characteristics' for the purposes of cross-national comparisons. First, as we argued above there may be problems classifying variables as personal or job-related. Oaxaca takes part-time

status to be a personal characteristic rather than a job-related variable while it reflects both factors, especially in countries with a high incidence of part-time work. Also, Blinder demonstrates the overlap between the age and the occupation variables, although again this correlation is likely to be contingent on the use of seniority-related pay principles in particular countries. Second, it may be problematic to adjust the gender pay gap for differences in education when education has such a wide-ranging interaction with the wage system and employment structure across European countries. While the decomposition approach emphasizes the way gender differences in acquisition of education contribute to the gender pay gap, there are equally important issues regarding cross-national differences in returns to education and in the gender gap in returns to education. For example, controlling for education may lead to a large adjustment in the gender pay gap in countries where there is very little difference in the educational levels of men and women, but where the reward to education is very high. Conversely, controlling for education may explain very little of the gender pay gap in countries where there is very little reward to education despite large differences in education levels between men and women. The focus of the decomposition approach, on the one hand, on the difference in levels of education among men and women and, on the other, the gender gap in reward to education may therefore not be appropriate to cross-national analysis because of additional differences in the way education is rewarded between countries.

## Conclusion

This paper has considered the merits and limitations of the conventional statistical methods to decompose the gender pay gap. The Oaxaca-Blinder approach attributes one part of the gap to gender differences in personal and job characteristics and another part to labour market discrimination, made up of differences in wages paid to men and women with similar characteristics and other factors that are omitted from the statistical model. The advantage of this approach is the apparent ease with which the results translate into policy options. Where gender differences in occupation explain a large portion of the gender pay gap, the country may need to focus on equal opportunities policies to reduce levels of sex segregation. Where the

number of children widens the gap, the country may need to expand access to childcare facilities or to strengthen parental leave arrangements.

Despite its apparent simplicity, however, the approach does not answer fundamental policy questions and, moreover, does not appear suitable for cross-national analysis of the gender pay gap. Because the key finding of the approach is the 'adjusted' level of the gender pay gap, there is the obvious danger that this might be used by some policy-makers to argue that the issue of gender pay equity is not so urgent. Moreover, the adjusted figure presents a particular perspective on how to interpret differences across countries by distinguishing the role of personal and job characteristics, on the one hand, and labour market discrimination, on the other. There is a major problem in separating out these components since information about labour market discrimination may shape the personal and job characteristics of men and women (so-called 'feedback effects'). Also, the approach does not answer the question as to whether policy attention ought to focus on eliminating the adjusted pay gap by addressing labour market discrimination, or to focus on those factors that are identified as contributing to the gender pay gap, such as differences in occupation, education, and so on. The former approach is assisted by a decomposition that includes as many variables as possible since this will increase the explainable portion of the gap and reduce the amount attributed to discrimination. Moreover, the results of the decomposition approach says very little about the way different countries attach different values to education, age, experience, skill, qualifications, job title and employment contracts in the principles of wage determination. Nor is it clear how changes in the overall distribution of wages and the ranking of female-dominated and male-dominated occupations shape the gender pay gap. Wider differences in employment structure, comprising of differences in industry composition, the public-private employment mix and the importance of self-employment, part-time work and temporary work, add to the complexity of cross-national analysis.

In conclusion, this paper finds a number of conceptual problems with the decomposition approach and identifies practical difficulties in applying this to a cross-national assessment of an 'adjusted pay gap' that can usefully inform policy-makers. Future work will explore the merits of a comparative institutional approach for

explaining country differences in the gender pay gap. This will assess the complex interaction of labour market institutions with the employment structure and wage system of each member state of the European Union. The aim is to develop practical policy insights to close the gender pay gap that reflect a richer understanding of the way a country's gender pay gap is shaped by factors specific to that society.

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