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ABSTRACT

The Gender Wage Gap in Developed Countries*

Despite the increased attachment of women to the labour force in nearly all developed countries, a stubborn gender pay gap remains. This chapter provides a review of the economics literature on the gender wage gap, with an emphasis on developed countries. We begin with an overview of the trends in the gender differences in wages and employment rates. We then review methods used to decompose the gender wage gap and the results from such decompositions. We discuss how trends and differences in the gender wage gap across countries can be understood in light of non-random selection and human capital differences. We then review the evidence on demand-side factors used to explain the existing gender wage gap and then discuss occupational segregation. The chapter concludes with suggestions for further research.

JEL Classification: J16, J24, J31, J71

Keywords: wages, gender wage gap, labor force participation, discrimination, developed countries

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1 Introduction

This chapter surveys the literature on the gender wage gap in developed countries. The overarching goals are to provide an overview of the gender wage gap, to examine the extent to which wages by gender are converging, and to summarize the research on the causes of the wage gap and its evolution. Given the enormous literature on the gender wage gap, this survey chapter will not provide an overview of all possible areas of interest. Blau and Kahn (forthcoming) provide a recent survey of U.S. trends. Existing surveys across a wider range of countries include Arulampalam et al. (2007) on glass ceilings, Kunze (2008) on the identification of the key parameters in the human capital–wage regression model, Booth (2009) on competition issues, and most recently, Olivetti and Petrongolo (2016) on the impact of industry structure.

A starting point for analysing the gender pay gap is a competitive labour market model that relates the accumulation of human capital to labour income. The estimation of logarithmic wage regressions using microeconomic data and the application of some type of decomposition analysis building on the Oaxaca–Blinder method (Oaxaca, 1973; Blinder, 1973) have been the main empirical workhorses used to understand the gender wage gap and its evolution. In most countries, the observed gender wage gap has declined since the 1970s, women's labour force participation rates have increased, and women have steadily increased their levels of education, now even overtaking men in several countries. However, while progress toward gender equality in earnings is widely observed, there is considerable variation in the observed trends across countries and over time.

This chapter is structured as follows. The next section provides an overview of the raw data on the gender wage gap and employment rates in developed countries during the period 1970 to 2015 using OECD data. The following section describes the main decomposition approaches used to explain the gender wage gap and summarizes the main findings of applications of these methods. The next sections review the evidence on how trends and cross-country differences can be understood in light of non-random selection into work and summarize the evidence on the impact of human capital on the gender

wage gap, particularly differences in the levels and returns to work experience. The last two sections review more demand-side factors impacting the gender wage gap, including discrimination, competition and recruitment, job search and mobility across firms, and studies of selected professional occupations. The concluding section offers suggestions for future research.

2 International trends in the gender wage gap and employment

To provide a description of gender differences, we assemble an unbalanced panel of a selection of developed countries (including some so-called transition countries) over the period 1970 to 2015 from the OECD database. We use the hourly wage as a measure of productivity-related pay and the median gender gap in full-time equivalent hourly wages in percentage terms as the measure of pay differentials. To evaluate the trends in female labour supply, we use the employment rate for the female population aged 15 years and over. Of course, this may understate female labour supply in countries with either high levels of unemployment or large amounts of informal or non-registered low-wage work. The data set contains long time series for Sweden, Japan, the United States, the United Kingdom, Finland, and Australia, starting in the 1970s. For most other countries, the available times series only begin in the late 1980s or early 1990s.

2.1 The gender pay gap

Table 1 here

Table 1 summarizes the time trends in the median full-time equivalent gender wage gap in percentage terms for these countries. For exposition purposes, we report the gap for only selected years[1], but to obtain a more accurate picture, we can also estimate the

[1] 2010 is the last year in Table 1 since this is the last year for which for all countries the numbers are available.

rate of convergence using the following simple linear trend regression on the complete panel:

$$(\overline{w^M} - \overline{w^F})/\overline{w^M} \quad = \alpha + \delta Trend + u \tag{1}$$

where the left-hand side variable is the median gender wage gap. This simple regression, estimated by ordinary least squares on annual data, provides a δ coefficient of -0.51, that is, a decrease of 0.5 percentage points in the median gender wage gap per year. When country fixed effects are included in the regression, the average rate of convergence is slightly smaller at -0.39.[2]

Figure 1 plots the raw median gender wage gaps using the complete time series for eight sample countries, Australia, France, Germany, Italy, Japan, Sweden, United Kingdom and the United States over the time period from 1970 to 2015. We note that one group of countries, comprising the United Kingdom, the United States, and Japan, had quite a large gender wage gap (40–50 percent) in the early 1970s, followed by significant declines since then. The post-unification data for Germany seems to follow a similar trend. In contrast, Australia, Italy, France, and Sweden all had relatively small gender wage gaps in the 1970s (about 20 percent), followed by a much flatter downward trend. Note that throughout the period, Italy had a stable trend, with its smallest raw gender wage gap occurring after the mid-1980s.

Figure 1 here

For these eight countries, the estimated coefficient of convergence is -0.47. For those countries in the sample that started with a relatively large gender wage gap (United Kingdom, the United States, and Japan), the rate of convergence is -0.58, compared with -0.14 for the remaining countries (Australia, Germany, Italy, France, and Sweden). This comparison reveals considerable heterogeneity in the rate of convergence. It also suggests that much of the overall convergence in this sample of countries is driven by the United Kingdom, the United States, and Japan.

[2]This estimate corresponds with that of Olivetti and Petrongolo (2016) who reported that the average female-to-male earnings ratio increased by approximately 0.4 percentage points per year between 1970 and 2010 among industrialized countries.

The time series of the remaining developed countries included in Table 1 also suggest that there is overall no increase in the gender wage gap across time, but once again we observe considerable heterogeneity in the rate of convergence. For example, the Scandinavian countries (Norway, Denmark, and Sweden) have a gender wage gap always less than 20 percent over the entire period, with little change in the gender wage gap over time. The German-speaking countries (Germany, Austria, and Switzerland) have a larger gender gap that has decreased at a very similar rate to the United States since the 1990s. The Southern European countries (Spain and Italy) have a remarkably small gender wage gap. For transition economies, such as the Czech Republic and Estonia, we also observe a large gender wage gap but with diverse patterns of change.

2.2 Trends in employment rates

Since the 1970s, the entrance of women into the labour market has increased dramatically. Figure 2 presents time series starting in the 1960s on male and female employment rates. Panel A shows the typical pattern that men generally work and that male employment rates have remained high in the OECD countries; here we show trends for a selection of six countries. Panels B, C, and D show the corresponding trends for women in the selection of OECD countries, Mediterranean countries, and transition countries, respectively. Panel B shows a strong and gradual increase in women's employment rates; in these countries employment rates increased from 40 to 50 percent in the 1970s, and to 60 to 75 percent in the 2010s. Italy is a conspicuous outlier. Nonetheless, there continues to be considerable cross-region heterogeneity. For example, female employment rates are quite high in Scandinavia (see Sweden in Panel B) and considerably lower in Mediterranean countries (Panel C). In transition countries female employment rates remain low in some, but with noticeable increases since 2010.

Figure 2 here

3 The decomposition of the gender wage gap

The comparison of observed average wages between men and women may yield a biased measure of the gender pay gap if men and women differ in terms of characteristics that are important for productivity and wage formation in the labour market. If women have smaller endowments of these characteristics than men, it could explain at least part of their relatively lower wages. Measures of human capital, especially education and years of work experience, are the most-studied productivity factors that often differ by gender.

Most of the gender wage gap literature takes the Mincerian human capital earnings function (Mincer, 1974) as a starting point to examine the relationship between earnings, schooling, and skill accumulation.[3] Building on these estimated wage regressions, the raw gender wage gap is then decomposed into a part that can be explained by differences in mean endowments between men and women and a second or residual part that reflects gender differences in the price of market skills. In the following, we first review the decomposition approaches most commonly applied, including the Oaxaca–Blinder (hereafter OB) decomposition (Oaxaca, 1973; Blinder, 1973) and the Juhn–Murphy–Pierce (hereafter JMP) decomposition (Juhn, Murphy and Pierce, 1991), and a summary of the main findings.

3.1 The Oaxaca–Blinder decomposition

A simple model of wage determination that nests most past specifications in the gender wage gap literature is:

$$lnW_g = X_g' b_g + \epsilon_g, \tag{2}$$

which is estimated by ordinary least squares. Subscript i indexing individuals is suppressed and subscript g indexes gender (male and female). The dependent variable is the logarithmic hourly wage, lnW_i. The vector of variables, X_i, includes individual character-

[3] For an overview and discussion of the Mincer earnings equation, see Chiswick (2003), Lemieux (2006) and Heckman et al. (2006).

istics related to human capital acquisition. The error term, ϵ_i, captures other unobserved characteristics, assumed uncorrelated with the observed variables X_i.

After estimating the parameter vectors, β_M and β_F, from separate wage regressions for men and women corresponding to equation (2), we can write the predicted mean wage for males at male prices as:

$$\overline{lnW_M} = \overline{X'_M}\beta_M, \tag{3}$$

and the predicted mean wage for females at female prices as:

$$\overline{lnW_F} = \overline{X'_F}\beta_F. \tag{4}$$

As a counterfactual, the average wage for females if they were remunerated exactly equally to men with respect to all characteristics included in X can be expressed as:

$$\overline{lnW^*{}_F} = \overline{X'_F}\beta_M. \tag{5}$$

Using equations (3), (4), and (5) we can then derive the OB decomposition of the difference in the mean log wages for men and women by subtracting (4) from (3), and expanding the equation by adding and subtracting the expression in (5). After rearranging terms, we obtain:

$$\overline{lnW}_M - \overline{lnW}_F = (\overline{lnW}_M - \overline{lnW^*}_F) + (\overline{lnW^*}_F - \overline{lnW}_F) \tag{6}$$

or

$$\overline{lnW}_M - \overline{lnW}_F = (\overline{X}'_M\beta_M - \overline{X}'_F\beta_M) + (\overline{X}'_F\beta_M - \overline{X}'_F\beta_F) \tag{7}$$

The decomposition of the overall gender wage gap can then be rearranged as follows:

$$\underbrace{(\overline{lnW}_M - \overline{lnW}_F)}_{raw\ wage\ gap} = \underbrace{(\bar{X}_M - \bar{X}_F)\beta_M}_{explained\ part} + \underbrace{\bar{X}_F(\beta_M - \beta_F)}_{unexplained\ part} \tag{8}$$

which is the OB decomposition. The decomposition shows that the difference in mean logarithmic wages can be decomposed into a component explained by differences in characteristics, $(\bar{X}_M - \bar{X}_F)$, weighted by a price vector, β_M, and an unexplained (or residual) component arising from differences in prices weighted by the mean characteristics of women, $\bar{X}_F$.[4]

[4]In this version, the male price vector serves as the competitive price.

The virtue of this decomposition is that it not only allows for an aggregate quantitative accounting of how much of the gender wage gap is explained by differences in relevant labor market skills, but also pinpoints the specific sources of the gap, for example, gender differences in either amounts of education or years of work experience or in their returns (prices). There are, however, several well-known challenges in interpreting the residual wage gap along with the decomposition overall. First, it is challenging to estimate the returns to each factor consistently because of possible correlation of the explanatory variables and the error term due to omitted variables. Second, the observed characteristics have to be measured accurately in order to calculate the explained part in the decomposition in equation (8); accurate measures of years of work experience are notoriously difficult to obtain in most data sets, which typically include only information on age and years of education.[5] Third, the explained part may be overstated as it relates to productivity-related characteristics if discriminatory behaviour affects the values of X. For example, gender differences in educational attainment may reflect discrimination in the education system and occupational outcomes for women may not only reflect individual choices, but also demand-side factors such as barriers to entry or employment discrimination. Therefore, taking account of differences in occupation or other such variables may inappropriately explain part of the wage differences observed.

Furthermore, it is difficult to give the unexplained part as measured by the residual a clear interpretation. It is well understood that it does not necessarily measure the extent of unjustified wage differences in the sense of discrimination in the labour market. This is because with omitted variables in the earnings equation, the residual may be too large or too small; the actual impact on the OB decomposition will depend on the strength of the correlation between the omitted variables and the included variables for men and women. Further, as the residual consists of differences in the estimated coefficients for the two groups of workers (males and females), any bias in the estimated coefficients will then affect the size of the unexplained portion of wages.[6]

[5]Women have historically exhibited intermittent labor force participation. Thus, using potential experience (e.g. age-schooling-six) is particularly unlikely to be an accurate measure of their work experience.

[6]For a discussion, see Kunze (2008).

A main achievement of the empirical literature is that due to the availability of new richer datasets, some individual characteristics can now be measured more precisely, reducing measurement error problems, and the set of characteristics that are controlled for can be expanded, reducing omitted variable problems. For example, using publicly-recorded tax registry data can be used to improve the measure of work experience by measuring actual years of work experience instead of potential experience, thereby reducing measurement error potentially affecting survey data.[7]

Overall, the results for a large range of countries show that differences in years of education and actual work experience explain a relatively large part (but less than half) of the raw gender wage gap. Inclusion of not only additional productivity-related factors such as tenure, occupation, industry, and union status, but also demographics, such as marital status, children, and race, further increase the explanatory part. This has been shown for a large sample of countries including the OECD countries in Weichselbaumer and Winter-Ebmer (2005). Arulampalam et al. (2007) showed this using the European Community Household Panel (ECHP) as well as Blau and Kahn (2016) for the United States.

In light of the question of gender wage gap convergence, it is interesting to compare the results of the OB decomposition across time. Blau and Kahn (2016) demonstrate that, for the United States, the explanatory contribution of gender differences in years of work experience and education has declined. This is consistent with the observation that women worked more continuously during the 1990s and 2000s than in previous decades in the United States, and hence women have become more similar to men in the workforce in terms of cumulative work experience. As regards education, the effect even reverses, because women have actually overtaken men in years of education in recent years; the overall wage gap would have been even larger in the absence of this advantage. Additionally, a large part of the gender wage gap is still the result of gender differences in occupation and

[7]Examples for studies that use actual work experience generated from survey data are Ondrich et al. (2003), Kim and Polachek (1994). Examples of studies using registry data are Kunze (2005) and Weber and Zulehner (2014).

industry. Goldin (2014) shows that approximately one-third of the gender wage gap is accounted for by a very large set of occupational controls. This reflects the fact that men and women continue to work in quite different jobs.[8] Unfortunately, we have not seen a corresponding decomposition across this time span for other countries in the literature, and can only speculate that since the trends in employment and education are similar in Europe, possibly with some delay, these findings may be generalizable. However, we would first like to consider the quantitative importance of each of the factors over a larger number of countries.

3.2 The decomposition of changes in the gender wage gap

Observed changes in the gender wage gap may not only be related to changes in differences in gender-specific factors but also to changes in economy-wide wage inequality. For example, returns to education have been increasing steadily in many developed economies (Autor, Katz, and Kearney, 2008) and this could independently affect the gender gap. The Juhn-Murphy-Pierce (1991) decomposition measures the size of each of these components. This extension is interesting, as notably the United States, but also other European countries, such as Germany (Dustmann et al., 2009) and the United Kingdom (Machin, 1996), experienced considerable increases in wage inequality. For example, increases in wage inequality at the top affect the mean gender wage gap more as men are more likely to be in the upper part of the wage distribution.

To derive the Juhn-Murphy-Pierce decomposition, let the individual-specific effect vary over time, and hence rewrite equation (2) as follows:

$$lnW_{it}^{M} = X_{it}^{M} b_{t}^{M} + s_{t}^{M} \theta_{it}^{M},$$

where i indexes individuals and t the time period. θ captures unobserved skills and is defined as the standardized residual, $\theta_{it}^{M} = \epsilon_{it}^{M} / s_{t}^{M}$, where $s_{t}^{M} = \sqrt{Var(\epsilon_{it}^{M})}$.[9] Under the assumption that prices derived from the male sample wage regression (β_{t}^{M}) are equivalent

[8] For further discussion of occupational segregation and women's earnings, see Pan and Cortes, this volume.

[9] Note that following Juhn et al. (1991), we do not assume that the residuals are normally distributed.

to competitive prices and that there is no discrimination ($\beta_t^M = \beta_t^F$) we can write the male–female wage differential in period t at the mean as:

$$\Delta\overline{lnW}_t = \Delta\bar{X}_t\beta_t^M + \sigma_t^M\Delta\bar{\theta}_t.$$

The impact of gender and wage structure-specific components on the change in the mean wage differential between periods t and s can then be estimated using the following decomposition.

$$\underbrace{(\Delta\overline{lnW}_t - \Delta\overline{lnW}_s)}_{change\ in\ raw\ wage\ gap} \tag{9}$$
$$= \underbrace{(\Delta\bar{X}_t - \Delta\bar{X}_s)\beta_t^M}_{observed\ X's\ effect} + \underbrace{\Delta\bar{X}_s(\beta_t^M - \beta_s^M)}_{observed\ prices\ effect} + \underbrace{(\Delta\bar{\theta}_t - \Delta\bar{\theta}_s)\sigma_t^M}_{gap\ effect} + \underbrace{\Delta\bar{\theta}_s(\sigma_t^M - \sigma_s^M)}_{unobserved\ prices\ effect}$$

The first two terms are simply a two-period version of the OB decomposition. The first component in equation (11), $(\Delta\bar{X}_t - \Delta\bar{X}_s)\beta_t^M$, measures the impact of the change in differences in observed human capital endowments between men and women. For example, women are working more continuously today than in the past, which leads to a relative increase in their years of work experience. This declining gender gap in experience contributes to the recent reduction in the gender wage gap. The second term, $\Delta\bar{X}_s(\beta_t^M - \beta_s^M)$, measures the effect of the changing male prices on the observed labour market characteristics. For example, an increase in the return to experience for men will lead to an increase in the unexplained portion of the gender pay gap, given the relatively lower work experience level of women. This is because any disadvantage women have in terms of the years of work experience will be weighted relatively heavier when the return for men is higher.

The third term, $(\Delta\bar{\theta}_t - \Delta\bar{\theta}_s)\sigma_t^M$ (the gap effect), captures changes in the relative positions of men and women, that is, whether women rank higher or lower in the male wage residual distribution after controlling for observed (human capital) characteristics and holding the degree of inequality in the male wage distribution constant. In other words, it reflects changes in the levels of the unobservable variables. The final term, $\Delta\bar{\theta}_s(\sigma_t^M - \sigma_s^M)$, is the unobserved price effect, which measures the impact of a change in inequality on the change in the male–female wage differential, assuming that females maintain the same

position in the residual wage distribution of men. This can be interpreted as reflecting changes in the returns to unobservable skills.[10] A general conceptual problem in the decomposition is that it relies on changes in the distribution of male wage residuals or some other reference point, and the observed wage structure based on prices derived from the male sample regression. As first shown by Fortin and Lemieux (1998), these results may be sensitive to the distribution of the residuals. For example, if discrimination lowers women's position in the male distribution of wage residuals, then if discrimination has declined over time, as is likely, the smaller the penalty to being below average in the distribution, the smaller the pay gap. Collecting the components of the decomposition, the overall wage structure effect is composed of the "observed prices effect" and the "unobserved prices effect," while the gender-specific effect is the sum of the "observed X's effect" and the "gap effect."

Given that both the variance of the wage residuals and the distribution of the predicted wage residuals depend on estimates of the parameters of the controls, the contribution of the gap effect and the unobserved price effect to the explanation of the gap may be estimated with bias. Blau and Kahn (1997) also note that non-random sample selection into work may complicate interpretation of the decomposition. They argue that the use of the male sample regression estimates ameliorates the problem, which nevertheless ignores unobserved heterogeneity problems.

The JMP decomposition has been estimated for various countries and particularly for periods with increasing wage inequality. During the 1980s, wage inequality increased in the United States because of increases in the market rewards to skills and increases in employment in high-wage male-dominated sectors (Blau and Kahn, 1997). Blau and Kahn (1997) conclude that in the United States, women were "swimming upstream" during this period, in the sense that women increased their stock of human capital, or gender-specific factors, sufficiently in order to more than offset the price effects so that overall the gender wage gap was falling. They show using the JMP decomposition that

[10]Note that this only holds under the assumption that s^M does not change over time because of measurement or pricing error or a change in the number of unobserved characteristics.

the changes in gender-specific factors outweighed the wage structure effects, resulting in a decrease in the gender wage gap.

In contrast, Kidd and Shannon (1996) show that when comparing 1981 and 1989, Australian women did not swim upstream against the tide of wage inequality. Edin and Richardson (2002) present a different picture for Sweden during the late 1970s until the early 1990s that was characterized by increases in wage compression and a decline in the gender wage gap during the 1970s and 1980s that then stabilized. They do not find any strong wage structure effects. Despite not observing a decline in the gender wage gap in Denmark during the 1980s and 1990s, Gupta et al. (2006) show that, rather than swimming upstream as in the United States, Danish women were in fact floating downstream: they were catching up with men in terms of the accumulation of human capital, but the returns to human capital were declining, particularly among highly paid women.

4 Selection and Women's Labor Force Participation

This section investigates whether and how non-random selection into work explains the gender wage gap and whether it explains part of the convergence trend in the gender wage gap. Traditionally, most men work full time and continuously throughout their lives. For women, the employment picture is much more varied across countries and over time, as well as within countries. This introduces the potential problem that the observed gender wage gap estimates over time or across countries may be biased because of non-random selection of women into work and, thus, into the wage samples used to compute the gender wage gap. For instance, traditionally it was common for women to work unpaid or only to do paid work until they married. More recently, non-random selection into employment potentially begins shortly after women have given birth at which time they decide whether and when to return to work, and, if they return to work, whether to work full-time or part-time.

The time series of observed gender wage gaps presented previously suggest consider-

able gender convergence since the 1970s. However, as can be inferred from the differences in the employment rates by country, the estimates compare a relatively lower proportion of employed women to employed men in 1970 than in the 2000s. Hence, the question arises whether the composition of working women in 1970 is different from that in 2000 in ways that might affect wage comparisons. When comparing the gender wage gap across countries, it is important to take these differences into account. For example, we showed earlier in this chapter that Italy has a relatively low gender wage gap, much lower than, for example, the United States or the United Kingdom. At the same time, female employment rates in Italy are much lower than those in either country.

O'Neill (1985) showed that this kind of process was at work from the 1950s through early 1970s in the United States, a time period when the gender earnings ratio was relatively constant at approximately 60 percent. In the 1950s, women's labor force participation was not only low, but highly selective. Working women were far more educated than women as a whole and they had work continuity that was relatively similar to men. By the 1970s, women's labor force participation was much less selective in terms of education and also work experience. The constancy of the wage ratio despite these changes suggests that in terms of the OB decomposition, the explained portion of the wage gap increased, while the unexplained portion decreased.

Blau and Kahn (2006) show that part of the observed decrease in the gender wage gap in the United States between 1979 and 1998 was because of the positive selection of women into employment. They show, for example, that the gender wage gap substantially increased when they include imputed earnings for those without observed wages. This suggests that the gains in women's relative wages were overstated during the 1980s. It also suggests that selection may explain part of the slowdown in convergence between male and female wages in the 1990s, as women's labor force participation became less selective. Mulligan and Rubinstein (2008) provide evidence of negative selection into work during the early 1970s that changed to positive selection in the mid-1980s, and Jacobsen, Khamis and Yuksel (2015) found positive selection also during the 2000s; both studies are based on a Heckman selection model (Heckman, 1974) using information on marital status as

exclusion restrictions.

Given the increase in female labour force participation overall, non-random selection into work after childbirth may become increasingly important in understanding future gender wage gap convergence. If there is positive selection into work after childbirth, then this may overstate the gender convergence in wages. In Denmark, a country with internationally high female employment rates, Nielsen et al. (2004) show that, in 1997, being a mother and having a lower expected wage rate during maternity leave in the private sector significantly increased a woman's probability of being employed in the public sector. Hence, while women overall remained at work, they generally worked in lower-paid jobs, which could explain the relatively larger gender wage gap in Denmark. Pal et al. (2016) have shown for the United States that the family gap decreased over time and has even more recently turned positive, which may partly be because of the increased return rates of mothers, and hence, a decrease in the negative selection effect. Several other observed productivity-related characteristics may also explain the decline in post-childbirth wages, including loss of work experience and tenure. Part of the decrease in wages after motherhood is related to decreases in the hours of work, as, for example, shown in Fernandez-Kranz et al. (2013) for Spain.

The analysis of wage effects around childbirth is complicated because the decision to return to work after childbirth, as well as the length of work interruptions, is endogenous. In this literature, parental leave reforms (mostly in Europe and Canada) have been used as a source of exogenous variation, in order to model the return to work decision.[11] This literature finds that ordinary least squares estimates substantially over-estimate the wage losses related to work interruptions because of unobserved heterogeneity and selection (Ejrnæs and Kunze, 2013; Schoenberg et al., 2014). In Germany during the 1980s and 1990s, for example, non-random selection into full-time work had a negative effect on wage growth around childbirth. Hence, it is those women with the largest wage losses who return to work after childbirth (Ejrnæs and Kunze, 2013).

[11]See Blau and Winkler, this volume for more discussion of pregnancy, childbearing and workforce interruptions. Rossin-Slater, this volume, discusses maternity leave policies in more detail

Other factors may explain why the gender wage gap varies across countries.[12] One noteworthy pattern is that countries with low wage inequality tend to have lower gender wage gaps. This is invariably so in countries where the premiums paid to highly-educated workers are relatively small and the proportion of men among the highly educated is relatively high, such that the gender wage gap becomes relatively narrow. Differences in the wage structure do explain an important portion of the international variation in gender wage gaps (OECD, 2002; Blau and Kahn, 1992). However, the inequality-adjusted wage gap in Southern Europe remains substantially smaller than elsewhere in Europe and the United States. Olivetti and Petrongolo (2008) show that the gender wage gap in Southern Europe is actually much larger after correction for selection, and even as large as in the United Kingdom and the United States. For other European countries, a similar correction only leads to a moderate increase in the gender wage gap. Overall, Olivetti and Petrongolo (2008) conclude that positive selection into employment is most common in these countries.

5 Human Capital and the Gender Wage Gap

The relative increase in the human capital of women over time has also contributed to the observed convergence in the wages of males and females, with the relative increase in work experience contributing more than the increase in education (Blau and Kahn, 2016). Overall, women are more likely than men to work part time, even though the incidence of part-time work varies considerably across countries. Studies for the United Kingdom suggest different hourly pay in full- and part-time jobs for women and that a main part of the pay differential can be explained by differences in individual characteristics (Manning and Petrongolo, 2008). However, part-time jobs are often very different from full-time jobs. In part-time work, less work experience obviously accumulates over a year than in a comparable full-time job. Hence, part-time work is likely to negatively affect future progression on the career ladder in line with the human capital model (Kunze, 2015). Studies

[12]For a discussion, see Olivetti and Petrongolo (2008).

using British data have highlighted that part-time work also leads to a downgrading of career in terms of occupation (Manning and Petrongolo, 2008; Connolly and Gregory, 2008).

An early theoretical argument used to explain gender differences in wage profiles builds on the extended human capital model in Polachek (1981), where the rate of atrophy of human capital during periods of non-work is occupation-specific. The underlying assumption is that women have a comparative advantage outside the labour market and expect to spend fewer years in the labor market than men. The model then predicts that women will enter occupations with low investment in on-the-job training and hence higher initial wages, but with relatively low returns to years of work experience. Men, by contrast, are more likely to enter occupations with relatively high training content, but lower entry wages, since employees bear part of the cost of training at the start of the career. These jobs provide subsequently steeper wage profiles, given the returns to the greater investment in training. However, the prediction of a wage advantage for women at entry into work finds little empirical support, which casts doubts on this theory (Light and Ureta, 1995; Loprest, 1992; Kunze, 2005). Nonetheless, Polachek (1981) and Görlich et al. (2008) more generally confirm the hypothesis. Consistent with empirical findings in most countries, the model generates an increasing gender wage gap across time and occupational segregation by gender.

More in line with the extant empirical findings are models emphasizing firm-specific training and firm-based allocation mechanisms into jobs. Two such models are the firm job-rationing model in Kuhn (1993) and the job-matching model in Barron et al (1993). Both of these models predict tenure-wage profiles where men have a wage advantage from first entry. Wages are then higher for men, as they are in jobs with more on-the-job training due to their stronger labour force attachment. Starting wages for men are also higher than for women because expected profits are paid up front in an effort to prevent job-shopping (Barron et al., 1993). These models also predict gender-segregated labour markets.

The existing research seems to agree that male and female wages at first entry into the

labour market are similar, and that differences between the two evolve primarily through the early career (Bertrand et al., 2010; Manning and Swaffield, 2008)). Nevertheless, some studies contradict these findings. For example, Napari (2009) found a gender wage gap of almost 10 percent at first entry among white-collar workers in Finland. Fitzenberger and Kunze (2005) and Kunze (2005) show that men with apprenticeship training in Germany are paid 10 to 20 percent more at entry, even though this gap has declined across cohorts. For the United States, Buffington et al (2016) found among graduate students in STEM fields that men earn 31 percent higher wages one year after graduation.[13] Bertrand et al. (2010) follow a sample of MBAs in the financial and corporate sector in the United States and find that men and women's earnings at entry differed by 11 percent. The gap increases to almost 50 percent after 9 years and more than 80 percent ten or more years after graduation. Similarly, Napari (2009) and Manning and Swaffield (2008) find substantial differentials in wage growth during the early career, leading to an increase in the gender wage gap. It is noteworthy that these studies show that gender differences in wages arise even before women have children (Napari, 2009, Kunze, 2005).

This body of research suggests several explanations for these findings. Those studies that find gender differences in entry wages suggest that pre-labour market factors, such as field of study or experience (Bertrand et al., 2010, Buffington et al., 2016), as well as occupation (Fitzenberger and Kunze, 2005) are important determinants of entry wage differences. It seems crucial to understand even small differences at entry into a first job, as wage increases negotiated between employees and employers thereafter are often based on the entry level wage. In addition, individual fixed factors at entry as mentioned above may translate into large differences in wage returns throughout the entire career.

It is clear that part of the gender wage gap is related to labour market adjustments around the period when women have children. International studies consistently find that women with children are paid less than women without children, which is the so-called "family gap" (Waldfogel, 1998; Davies and Pierre, 2005). A potential explanation is that women interrupt work after childbirth, which leads to wage losses through human capital

[13]Ginther and Kahn, this volume, provide more detail on women in STEM careers

depreciation and detachment from work. A significant negative effect of leave related to childbirth is found for the United States (Andersen et al., 2002; Waldfogel, 1998), the United Kingdom (Joshi et al., 1999; Viitanen, 2014), and Canada (Phipps et al., 2001). There is no effect for Denmark (Gupta and Smith, 2002; Nielsen et al., 2004) and Sweden (Albrecht et al., 1999). For West Germany, relatively large losses of 10 to 20 percent related to parental leave have been reported for female full-time workers (Ejrnæs and Kunze, 2013; Ondrich et al., 2003; Schönberg et al., 2014; Beblo et al., 2009; Görlich et al., 2009). Empirical findings on rebound effects in terms of wage growth during the post-childbirth period tend to suggest effects, both large (Buligescu et al., 2009) and small (Ejrnæs and Kunze, 2013). Postponement of childbirth leads to relative increases in wages because the returns to experience are relatively high before entry into motherhood (Miller, 2011).

Most of the studies on the wage effects of leave from work as related to childbirth have focused on mothers. From this evidence, we can only infer that the gender wage gap will increase post-birth. We know much less about the wage effects of having children on fathers' earnings and of paternity leave. The take-up of paternity leave has only recently become more common in some European countries, with Norway in 1993 and Sweden in 1995, becoming the first countries to earmark part of the parental leave period for fathers. Albrecht et al. (1999) show for Sweden a relatively large and negative wage effect for fathers, which they explain with signaling. As it was uncommon at the time for fathers to take any parental leave, it could be that taking leave was a strong signal of low career commitment. Take-up rates of paternity leave increased during the 1990s in Sweden. Angelov et al. (2016) investigated the gender wage gap in Sweden within parent couples. They find that the gender gap within parent couples in hourly wages increased by 10 percentage points from before childbirth until 10 years after. This is explained by the reduction of hours of work post-childbirth, which leads to a gradual relative depreciation of human capital.

6 Labour demand factors

One of the persistent questions in labour economics is whether the difference in wages between men and women reflects observed or unobserved differences in productivity, that is, supply-side factors, or demand-side factors such as discrimination. In addition, job mobility may play a role in the gender wage gap. We address these two issues in this section.

6.1 Discriminatory behaviour and firms

One explanation for the gender wage gap is that women face taste-based workplace discrimination (Becker, 1971), which causes the discriminated-against group (here, women) to have short-run equilibrium wage rates that are just low enough to compensate for the employer's distaste. Becker shows that in long-run equilibrium with free entry and exit the discriminatory wage difference will tend to be eliminated, because discriminating firms will face higher wages for equally-skilled workers and, hence, have lower profits. Whether or not the conditions for this surprising result are actually met in practice is an empirical question.

A testable hypothesis from this literature is how market structure (competitive vs monopolistic) affects taste-based discrimination. The empirical literature unanimously supports the hypothesis that taste-based discrimination is less evident in environments that are more competitive (Black and Strahan, 2001; Weichselbaumer and Winter-Ebmer, 2005; Weber and Zulehner, 2014). Black and Strahan (2001) provide direct evidence of discriminatory behaviour by use of a quasi-random experiment of the removal of regulations at the regional level in the United States banking sector that decreased rents. The hypothesis is also supported by Weber and Zulehner (2014), who show that the survival probability for start-up firms in Austria is lower for discriminatory firms. Weber and Zulehner (2014) exploit employer–employee matched data for all industries and measure prejudice against women at the firm level by the share of female employees within a firm relative to the industry average. They show evidence of learning among large start-ups

that begin with a relatively low share of female employees, but then catch up.

Not all discrimination is taste-based. Models of statistical discrimination show that when there is asymmetric information such that employers are uncertain regarding worker productivity or quit probability, profit-maximizing employers may discriminate against women based on actual or perceived average group differences (Phelps, 1972; Aigner and Cain, 1977). Gayle and Golan (2012) show that statistical discrimination played an important role in the United States during the period from 1968 to 1997 as well as in the decline of the gender wage gap.[14] They rule out a taste basedr discrimination by testing for gender differences in individual specific fixed effects. By contrast, in another study on data for the United States Flabbi (2010) presents evidence in favour of the presence of taste for discrimination. Flabbi (2010) applies a search model with bargaining, matching and taste for discrimination. The results reveal that there is a significant proportion of discriminatory employers in the labour market, and the proportion declined all through the 1980s and 1990s A closer look at the trend in gender wage gap in the United States shows though that the gap declined through the 1980s but stayed quite stable most of the 1990s. The decline of taste for discrimination seems therefore not to explain the trend in gender wage gap, and instead non-random selection may play an important role.

Correspondence and audit studies have provided convincing evidence concerning whether firms discriminate at the recruitment stage against women and especially against women with children. In a correspondence study, fictitious resumes that are identical except for the applicant's gender or motherhood status are sent to employers for real job openings. The evidence suggests that significant discrimination against women exists, especially in high-status and male-dominated professions. One study dealing with the French financial sector finds evidence of discrimination against young women aged 25 years in high-skilled administration and commercial jobs (Petit, 2007). In another study for the United States, mothers were perceived less favourably than non-mothers during recruitment, but no dif-

[14]They use a dynamic general equilibrium model of labour supply, occupational sorting, and human capital accumulation in which the gender wage gap and discrimination arise endogenously. Their model captures statistical discrimination linked to the future probability of work interruptions.

ferences between fathers and non-fathers were found (Correll et al., 2007).

6.2 Gender differences in job search and job mobility

Gender differences in job search and job mobility may be another contributory factor to the gender wage gap. More generally, mobility during the early career is an important source of wage growth (von Wachter and Bender, 2006). The basic theoretical arguments that have been offered to explain why women may search longer for a new job and receive lower wages operate through two main channels: differences in productivity and differences in employer discrimination. Black (1995) shows that if there are discriminatory employers, women will receive lower wages than men, although the effect of this on the duration of search is ambiguous. The equilibrium search model in Bowlus and Eckstein (2002) allows for both productivity differences between men and women as well as the composition of prejudiced and unprejudiced employers. They show that women remain unemployed longer, even if equally productive as men. Wages are lower for women in equilibrium because, given the presence of some prejudiced firms, all firms exert monopsony power and offer all women lower wages.

However, German evidence suggests that young women change jobs less frequently than men, while young women experience smaller gains in wages when they switch jobs (Fitzenberger and Kunze, 2005). Unfortunately, these findings are difficult to interpret because job movers represent a select sample of workers, where the selection is often based on worker characteristics that are unobservable to the econometrician but are correlated with outcomes (for a discussion, see e.g., von Wachter and Bender (2006)).

Displaced workers have been used in this literature as a quasi-experiment, because in this situation, job search occurs for arguably exogenous reasons. Simple comparisons of mean durations of displacement suggest that women take longer than men to find a new job after displacement (Abbring et al., 2002; Kletzer and Fairlie, 2003; Hu and Taber, 2011; Kunze and Troske, 2012, 2015). Disaggregation by age groups reveals that these differences are driven by differential behaviour by women in their prime childbearing years.

These differential outcomes remain even after controlling for differences in human capital and unobserved heterogeneity. Kunze and Troske (2015) show correlational evidence for the United States that fertility decisions have a significant impact on labour market mobility.

Studies yield mixed results on the gender differences in post-displacement wage outcomes.[15] Consequently, there is no agreement on the mechanism generating differential outcomes. Little is also known about whether job search processes differ between men and women.

Finally, some evidence suggests that an important explanation of the gender wage gap is that women are sorted into less well-paid jobs. Some studies based on employer-employee matched data find that the gender wage gap becomes smaller after firm fixed effects are accounted for, both in general (Meng, 2004; Meng and Meurs, 2004) and when focusing on large firms (Heinze and Wolf, 2010). Firms also differ in their wage policies. Meng (2004), for example, shows that the gender wage gap is smaller in firms exposed to strong market competition, which have less firm-level wage bargaining. There thus appears to be a strong interaction with the centralization of the wage bargaining system. Another way to think of the role of the firm is that there is a sorting and an individual bargaining effect. If women sort into low-wage firms, this will explain part of the gender wage gap. In addition, women may be less likely to bargain over their wages or they receive poorer wage offers from employers. In Portugal, Card et al. (2016) detail evidence for the importance of both channels. Their findings highlight the role of frictional labour markets and the rents that accrue at the firm level (Manning, 2011). A series of related studies investigate the importance of the role of the gender composition of the managers of the firm for wage determination and the gender wage gap. Evidence from employer–employee matched data for Sweden and Portugal finds that a relatively large proportion of women among managers tends to narrow the gender wage gap within the firm (Cardoso

[15]Tate and Yang (2015) found that women's wage losses are much larger than men's, whereas Hu and Taber (2011) found no losses, Kunze and Troske (2012) only small differential wage losses, and Kletzer and Fairlie (2003) the opposite.

and Winter-Ebmer, 2010; Hensvik, 2014).[16]

7 Occupational Segregation

Gender segregation with respect to occupations is highly persistent, but the degree of segregation is declining, as shown with international data in Blau et al. (2014). Decomposition studies reveal that occupational segregation contributes considerably to male-female wage differentials. Women are systematically working in relatively low-paid occupations and men in more highly-paid occupations; this may reflect genuine job barriers or differences in preferences by gender for different kinds of jobs.[17] A policy recommendation that follows is to provide incentives to women to go into typically male, but highly productive and highly paid occupations, such as technical occupations, engineering, and STEM fields more generally. Goldin (2014) makes a different point by highlighting that in the United States, within-occupation wage differentials actually account for a larger proportion of the gender wage gap than between-occupation wage differentials. Using a very detailed occupational classification, she finds that no more than one-third of the wage gap between college-educated full-time workers is related to the difference in their occupational distributions. This finding suggests taking a closer look at how wages are determined within occupation groups.

Large losses in earnings related to reduced hours of work and parental leave have traditionally been viewed in a human capital model framework, interpreting wage losses in terms of the depreciation of human capital or relatively slower accumulation of human capital through part-time work. This may result in wage losses, lower wage growth, along with diminished promotion probabilities, i.e. career progression. As an alternative, Goldin (2014) frames these results in a labour economics framework in terms of compensating wage differentials (Rosen, 1986). As an example, law is a profession where there may be a high penalty to working shorter hours, not because of the relatively small amount

[16]Kato and Kodama, this volume, provide an extensive discussion of firm's practices regarding how work is done, with a focus on the effect of such practices on women's earnings.

[17]See Pan and Cortes, this volume, for discussion regarding occupational segregation

of human capital acquired or the depreciation of their human capital stock during time out of work, but because losses may be capturing high transaction costs. This could be because of the inability to smoothly hand work over to other employees or the preferences of clients for just the one contact person. Part-time work may then delay work or make it more costly. Of course, there could be other explanations, such as signaling or statistical discrimination in terms of the (career) type of worker or whether one is diverging from male norms (Bertrand et al., 2010).

Goldin (2014) argues that in high-skilled professional occupations non-linear contracts put women at a disadvantage. Men are more likely than women to work long hours, and in some professions, these hours are disproportionately rewarded, a situation she refers to as a non-linear wage-hours schedule. A related argument is put forward in Cha and Weeden (2014) who show an "overwork" effect whereby the relatively higher wages of men can be explained by their longer hours of work (they are more likely to work more than 50 hours a week) and their increased propensity to work in professional and managerial jobs. The overwork effect increases the total gender wage gap by an estimated 10 percent and partly offsets the effects of decreasing the gender wage gap through any increases in education and other human capital characteristics. Flabbi and Moro (2012) build a search model in which the demand for work flexibility by women leads to a similar effect as compensating wage differentials.

Studies focusing on specific professions also seem fruitful in revealing mechanisms that could explain the gender wage gap. In an analysis of the legal profession, Azmat and Ferrer (2016) show that part of the gender gap in earnings is explained by the poorer performance of women, where performance is measured using detailed individual data on billed hours and client revenue. They show that women bill fewer hours and acquire less client revenue than men. In addition, they find that female lawyers from the start have lower career aspirations and this is also an important determinant of performance. The other important factor that negatively affects performance for women is having children. Men and women differ in their area of specialization, time spent networking, and time they spend working at weekends. However, even though these factors explain performance,

they do not explain the gender gap in performance. This study alerts us to the fact that if we expect performance-related pay to become more important in certain professions or more generally, we could expect that the gender wage gap will increase in the future.

8 Concluding remarks

In this survey, we reviewed the economics literature on the gender wage gap in developed countries. In particular, we focused on the evidence for the convergence in the gender wage gap over time and across countries and the extent to which two primary factors, non-random selection into work and human capital as a supply-side factor, explain part of this pattern of change. We then turned to a review of the research on demand-side factors, as related to firms and occupations, and the extent to which these also explain part of the gender wage differential we continue to observe today.

The statistical data demonstrate considerable heterogeneity across developed countries in the convergence of the wages of men and women. While we know from the literature many factors that are driving the gender wage gap, we still lack quantitatively hard facts about what factors are most important beyond the classic supply-side factors. Gender differences in human capital have fallen in importance as women's human capital investments more closely align with those of men. Given this trend, it seems almost disappointing that differences in wages remain quite large. We know that parental status matters much more and that within-occupation differences matter more than any between-occupation differences. More recent research has identified several factors related to the workplace, in terms of both firm and occupation characteristics, that are also driving gender wage differences. This literature has so far only partly addressed the trends in the gender wage gap and the unexplained gap. Notably, the quantitative impact of specific explanatory factors also seems to vary considerably across countries and time. This may indicate a potential contribution and need for (replication) studies that test existing economic explanations across a wide range of countries and periods. Policy design of efficient equality policies hinges on generalizable and quantitative evidence.

The interesting question that arises is what to expect for the future. Will the gender wage gap decline in the near future or increase? It seems that one core question is and remains 'Can women have it all?' The decades from the 1960s to the 1990s were periods where in many European countries diverse sets of policies were introduced with the intention of assisting mothers to combine family and work, and of protecting women against labour market discrimination. Research can contribute to answering questions as to what extent such policies have worked in favour of reducing the gender wage gap. Areas that remain highly relevant relate to the career paths of men and women in firms and why women do not perform as well as men on the career ladder.

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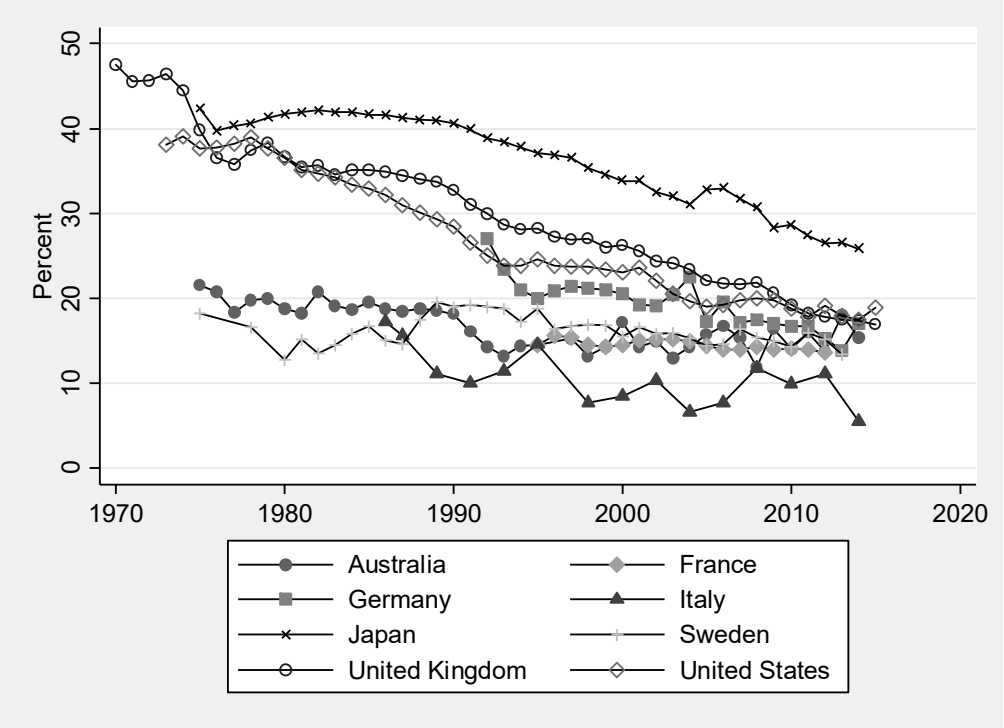
Table 1: Median Gender Gap in Per Cent, by Country, 1975-2010

Country	1975	1985	1995	2000	2010
Australia	21.6	19.6	14.5	17.2	14.0
Austria	.	.	.	23.1	19.2
Belgium	.	.	.	13.6	7.0
Canada	.	.	.	23.9	19.0
Chile	.	.	.	.	9.1[a]
Czech Republic	.	.	18.3[b]	16.9[c]	15.8
Denmark	.	.	.	.	8.9
Estonia	.	.	.	24.0[d]	26.6
Finland	.	.	22.4	20.4	18.9
France	.	.	14.6	14.6	14.1
Germany	.	.	20.0	20.5	16.8
Greece	.	.	.	.	12.2
Hungary	.	.	15.8	14.1	6.4
Iceland	.	.	.	.	14.3
Ireland	.	.	.	19.7	12.8
Israel	.	.	.	.	20.7
Italy	.	.	14.6	8.5	9.9
Japan	42.4	41.7	37.1	33.9	28.7
Latvia	.	.	.	.	13.3
Lithuania	.	.	.	.	7.0
Luxembourg	.	.	.	.	5.0
Mexico	.	.	.	.	11.6
Netherlands	.	.	.	.	18.6
New Zealand	.	.	13.7	7.2	7.0
Norway	.	.	.	10.2	8.1
Poland	.	.	20.1[c]	14.3	7.2
Portugal	.	.	.	.	13.5
Slovak Republic	.	.	.	20.3	14.9
Slovenia	.	.	.	.	11.6
Spain	.	.	.	.	6.6
Sweden	18.3	16.7	18.8	15.5	14.3
Switzerland	.	.	.	23.8	20.1
Turkey	.	.	.	.	20.1
United Kingdom	39.9	35.1	28.2	26.3	19.2
United States	37.6	33.0	24.6	23.1	18.8

Note: Entries are the median gender wage gap in full-time equivalent hourly wages. Data are downloaded from OECD data base http://stats.oecd.org/Index.aspx?QueryId=64160. [a]2009, [b]1996, [c]2001, [d]2002

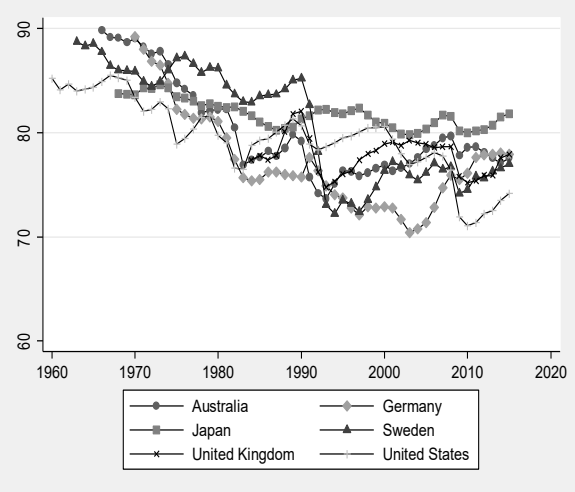
Figure 1: The median gender wage gap in per cent, selected OECD countries with long time series



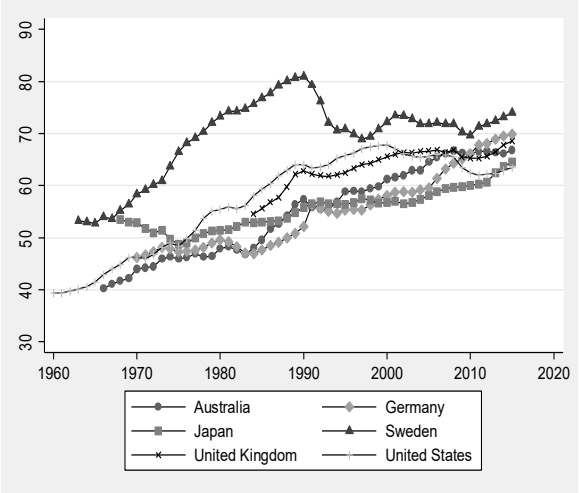
Note: Data are downloaded from OECD data base. Employment rates are based on the definitions of the respective country labour force surveys.

Figure 2: Employment rates in selected countries, by gender

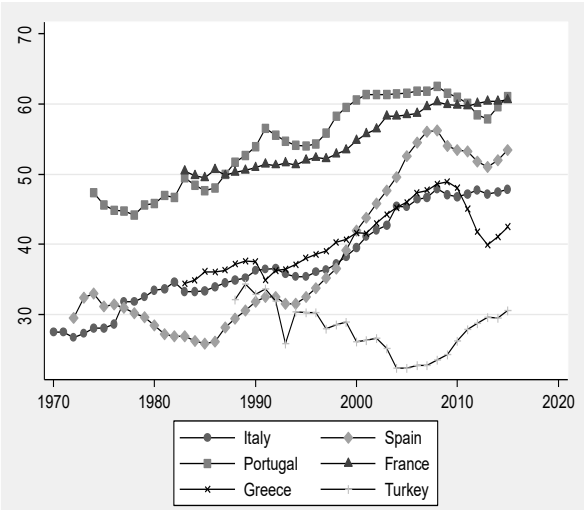
Panel A: Selected OECD countries, men



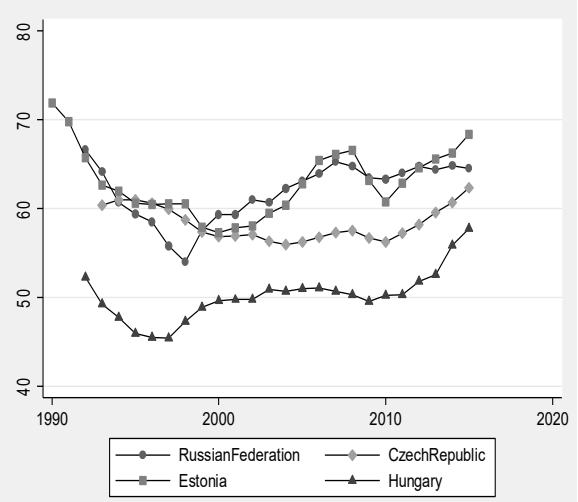
Panel B: Selected OECD countries, women



Panel C: Mediterranean countries, women



Panel D: Transition countries, women



Note: Data are extracted from the OECD database. Employment rates are measured among the resident population aged 15 years and over living in private households or collective households. The specific details of the definitions of employment rates within each country are based on the respective country labour force surveys.