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The Gender Pay Gap Across Countries: A Human Capital Approach

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The Gender Pay Gap Across Countries: A Human Capital Approach

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Abstract

The gender wage gap varies across countries. For example, among OECD nations women in Australia, Belgium, Italy and Sweden earn 80% as much as males, whereas in Austria, Canada and Japan women earn about 60%. Current studies examining cross-country differences focus on the impact of labor market institutions such as minimum wage laws and nationwide collective bargaining. However, these studies neglect labor market institutions that affect women's lifetime work behavior -- a factor crucially important in gender wage gap studies that employ individual data. This paper explicitly concentrates on labor market institutions that are related to female lifetime work that affect the gender wage gap across countries. Using ISSP (International Social Survey Programme), LIS (Luxembourg Income Study) and OECD wage data for 35 countries covering 1970-2002, we show that the gender pay gap is positively associated with the fertility rate (treated exogenously and endogenously with religion as the instrument), positively associated with the husband-wife age gap at first marriage, and positively related to the top marginal tax rate, all factors which negatively affect women's lifetime labor force participation. In addition, we show that collective bargaining, as found in previous studies, is negatively associated with the gender pay gap.

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I. Introduction

The fact that women earn less than men is a consistent widely observed phenomenon. Explaining this pay gap has attracted much attention, not just because the gender wage gap is intrinsically interesting, but also because discriminatory wage practices could lead to an inefficient resource allocation. As such, the gender wage gap has been studied throughout the last several decades using many datasets, various estimation methods, and numerous employee subgroups (Weichselbaumer & Winter-Ebmer, 2003). Despite the large number of studies, scholars still debate the underlying causes of the gender wage gap.

Most studies concentrate on data within a specific country. One typical approach is to ascertain how much of a gender wage differential remains after adjusting for an individual's productivity enhancing characteristics, such as but not limited to schooling, experience, occupation and industry. Using this approach most research finds a sizable "unexplained" gender wage gap. However, many argue this approach may be biased because it omits important, albeit unobservable, variables such as long-term career motivation. Excluding pertinent variables could lead to an omitted-variable bias and result in erroneous estimates of the earnings profile slopes that depict how individual characteristics are rewarded. As a result, techniques to decompose earnings disparities between legitimate human capital differences and discrimination may be inaccurate because they rely on imprecisely estimated earnings profiles.

In part to get at these omitted variables, a second approach incorporates unobserved heterogeneity. These studies that account for unobservables adopt fixed-effect techniques to adjust for individual specific constants in a wage regression. Here the underlying assumption is that unobserved variables such as an individual's motivation raises earnings a fixed amount throughout the person's lifecycle. First-difference or mean-deviation estimation techniques "nets out" such unobserved variables so that one can obtain unbiased wage-function parameters to compute reliable male and female wages. One problem is fixed-effect estimation assumes unobservable variables affect wage levels but have no effect on the *rate* earnings rise throughout one's lifecycle. But unobservable variables often influence the *rate* at which one's earnings rise, and not just one's earnings *level*. Modifying fixed-effects models to incorporate individual specific earnings function slopes can account for individual differences in earnings growth, but the technique cannot isolate whether flatter earnings gradients arise because of less on-the-job human capital investments or greater on-the-job discrimination in promotion opportunities. So one is back to the same problem of trying to distinguish between discrimination and rewards for human capital investments.

Another approach is to make use of international data. To date, relatively little attention has been paid to comparative studies across countries.[1] But interestingly, there are striking international variations in the gender pay gap (Blau and Kahn, 1996a, 1996b, 2002). Countries like Australia, Belgium, Czech Republic, Hungary, Italy, Poland and Sweden exhibit a gender pay gap around 20% over 1970-2000 based on OECD data.[2] Other countries such as Austria, Canada, South Korea, and Japan maintain gender pay gaps as large as 40-50%. When examined across time, the gender pay gap declines significantly in the United Kingdom, the United States, and France, starting out around 50% and ending up at about 25%. For France it declines from about 35% to 10% over 1970-2000. For other countries, such as Belgium, Luxembourg, Spain, Sweden and Switzerland the gap has been relatively constant. During this time period demographic and institutional factors that may help explain how women's relative labor market success varies across countries. If so, one can use these international differences to better understand the gender wage gap, at least to the extent at least some of these demographic differences are exogenous and affect the labor market perhaps through incentives to invest in human capital. As such, given the considerable international variation in the gender wage gap, it is possible that much can be learned by exploring gender wage differences *comparatively* across countries.

Previous comparative studies mostly focus on wage setting institutions (Blau and Kahn, 2003; Weichselbaumer and Winter-Ebmer, 2002). In particular, Weichselbaumer and Winter-Ebmer (2003) do a meta-analysis comparing 363 studies that collectively examine gender wage differences for 67 particular countries. As a meta-analysis, that study analyzes secondary data. Blau and Kahn (2003) utilize micro-data from the International Social Survey Programme (ISSP) for 22 countries over the 1985–94 period. They find that countries with a more compressed male wage structure (a narrower male earnings distribution) are associated with a lower gender pay gap. Also, they find that greater collective bargaining coverage is negatively related to the gender pay gap.

One important demographic factor is the family wage gap: Male-female wage differences are relatively small (usually less than 10%) for single (especially never married) men and women, but considerably larger (roughly 40%) for married men and women (Blau and Kahn, 1992), and even greater for those men and women with children (Harkness and Waldfogel, 2003), especially children spaced widely apart (Polachek, 1975a). To explain this pattern Becker (1985) resorts to division of labor in the home. Division of labor in the home implies married men expect to work more years (and with greater effort) over their lifetime than married women. As a result married men purchase more human capital than married women (especially those married women with children), and thus married men have higher wages. Single

[1] Among the very few researchers studying international differences of the gender pay gap, Blau & Kahn have conducted most of the studies on this subject.

[2] The gender pay gap is measured at the 50th percentile of wage distribution, using raw wage data for the sample of full-time workers. Also, see appendix 1 for details on country names and available years for each country.

(especially never married childless) men and women earn roughly similar wages and exhibit roughly comparable lifetime work histories.

Proving that household division of labor is an important factor instigating the gender wage gap is particularly complicated. Division of labor increases incentives for husbands to invest in *marketable* human capital while it increases incentives for wives to invest in less remunerable home activities. The problem is actual human capital investments are not directly observable. Most data contain years of school, some contain actual work experience (only up to the time the data were collected), but few are detailed enough to contain the particular subjects studied in school, types of on-the-job training, or subjective variables such as the quality of schooling (sometimes measured by courses studied or college major, if available) or motivation. Yet these latter more subtle factors are important determinants of human capital investment but are rarely available when explaining the gender wage gap (Weinberger and Kuhn, 2005).

Without directly observing these more subtle human capital variables, one must rely on alternative approaches to measure human capital. One method entails estimating *future* work expectations rather than relying only on a person's *observed* past and present work history. Current and past employment translate directly to human capital accumulation (Mincer 1974), but *future* work expectation are important because they alter human capital investments at school and on the job early in one's work life (Polachek, 1975b and Weiss and Gronau, 1981). *Expecting* to drop out of the labor force (perhaps to bear and raise children) reduces lifetime work, which decreases potential rewards from human capital. As a result the benefits of human capital investment are smaller. In contrast, those who expect to work long hours, and those who foresee the greatest number of years at work, have the highest expected returns. Thus, one's incentive to invest in training is directly proportional to the time one *expects* to work over one's lifetime. Because estimating future work behavior is imprecise, most studies neglect future work expectations and concentrate solely on *observable* current and past labor market experience.[3] Similarly, predicting human capital stock is difficult, so that only a handful of studies adopt this approach, and only for particular countries (Polachek, 1975b; Goldin and Polachek, 1987; and Kao, et al., 1994).

Given the difficulty in incorporating expected labor force participation over the lifetime, it makes sense to validate the implications of the division of labor in the home in some other way. One possibility is to explore whether the theory's predictions regarding lifetime work and wages are upheld in data. Within a number of specific countries (e.g. Germany, UK, US, and Austria) there is a direct link between lifetime work and earnings, as illustrated by the relationship between the gender wage gap and martial status, already mentioned (Blau and Kahn, 1992). But another approach is to test whether the theory's inferences hold *between* countries. This can

[3] Some studies even neglect past work by using Mincer's age-education-six potential experience measure.

be done by examining whether cross-country *differences* in institutional variables that affect lifetime labor force participation (but by themselves do not directly determine wages per se) are related to cross-country differences in the gender wage gap.

In this paper, we introduce three innovations. First we expand the information used by incorporating a greater number of years of ISSP data (1985-2002). Second we introduce new data obtained from the Luxembourg Income Study (LIS) as well as the OECD. Third, we concentrate on hypotheses emanating from the division of labor within the home. In particular, we explore whether differences in women's incentive for labor force participation can account for variations in the gender pay gap across countries and over time. More specifically, because women (especially married women) were historically, and still are more likely than men to specialize in household activities, they may exert less effort than otherwise because of a greater preoccupation with household responsibilities. If such is the case, women's incentive for lifetime work (both in terms of work time and work effort) may be an important determinant of female wages relative to men. For this reason, we expect women who reside in countries with fewer incentives for work to have lower wages relative to men, and vice versa for women residing in countries with greater work incentives. Variables such as the fertility rate, the age gap between husband and wife at their first marriage, the top marginal income tax rate, and female relative educational attainment -- all which affect women's incentive for labor force participation relative to men's -- may be important.

This paper proceeds as follows: Section Two is devoted to reviewing comparative international studies on the gender pay gap. Stylized facts are given in Section Three. Section Four describes why examining women's incentives for labor force participation are important. Various gender pay gap measures are compared in Section Five. Section Six provides descriptions of a few competing wage datasets. Research designs and empirical results appear in Section Seven. The final section contains concluding remarks and indicates possible directions for future research.

II. Brief Background Literature

Donald Treiman and Patricia Roos (1983) are the first to investigate gender pay differences within a cross-national framework. They run standard $\log_e$-linear wage regressions for full-time workers aged 20-64 in each of nine industrialized countries. They decompose wage differences in each country parceling out the gap between education, potential experience and occupation, and find significant "unexplained" differences in each country. Rachel Rosenfeld and Arne Kalleberg (1990) adopt a similar approach, but concentrate on only four countries (United States, Canada, Norway and Sweden). Using slightly more refined demographic variables (e.g., number of children instead of simply marital status) and concentrating on two sets of countries with different labor market structures (Scandinavian countries with more

centralized wage determination and North American countries with decentralized wage systems), they also find significant unexplained wage differences in each country. However, both these studies confine their analysis to decomposing wage differences *within* each country rather than comparing differences *across* countries.

Blau and Kahn were the first to compare gender pay gap differences systematically across countries. In a series of papers (1992, 1995, 1996b, 2003) they focus on cross-country variations in market returns to skills -- both measured and unmeasured. They find that the gender pay gap tends to be higher in countries with a larger overall wage inequality because generally female workers are more likely to be located at the bottom of the wage distributions. To show this, Blau and Kahn (1996b) adopt the Juhn, Murphy and Pierce (1993) methodology to decompose the inter-country differences in the gender wage gap into a number of components reflecting gender differences in worker attributes and what they call "wage structure" (1992:538). They reaffirm this result in a later study stating "more compressed wage structures … are associated with a lower gender pay gap (2003:138-9)."[4]

To get at wage structure Blau and Kahn model earnings (Y_{ij}) for males and females (i=m,f) in each country j to be proportional to observable individual attributes, X_{ij}, (where the factor of proportionality B_j represents market rewards for individual attributes applied equally to both males and females) plus a residual. The residual is broken up into two components: a country-specific standard deviation of wage (σ_j) and a standardized (mean zero and variance one) residual for each gender and country (θ_{ij}). The male-female earnings gap within a particular country is

$$Y_{mj} - Y_{fj} = (\Delta X_j)B_j + \sigma_j \theta_j \qquad (1)$$

and the gender earnings gap difference between countries *j* and *k* is

$$Y_{mj} - Y_{fj} - (Y_{mk} - Y_{fk}) = (\Delta X_j - \Delta X_k)B_k + \Delta X_j(B_j - B_k) + (\Delta\theta_j - \Delta\theta_k)\sigma_k + \Delta\theta_j(\sigma_j - \sigma_k) \qquad (2)$$

The latter two terms reflect earnings structure differences. The first of these depicts cross-country differences in the relative residual wage positions for men and women. This term is often taken to measure discrimination because it reflects differences in male and female positions in a country's wage distribution holding constant individual earnings function attributes. However, this term can also reflect the effect of unmeasured individual characteristics. It can result from biases arising from the

[4] Because a country's wage setting institution determines wage structure, they also concentrate on particular labor market institutions. In particular, they find that collective bargaining coverage is significantly negatively related to the gender pay gap (2003:106)

implicit assumption of a gender-neutral reward structure. (More on this shortly.) The second depicts inter-country differences in residual earnings inequality.

According to the literature, there are at least two problems with this type decomposition: First, this decomposition can lead to erroneous conclusions if the standard deviation and percentile ranks are dependent (Suen, 1997). As such, one can attribute gender wage differences to a country's wage structure when indeed it can occur because male earnings are becoming more dispersed. This is not unreasonable, given that many countries are now exhibiting widening male wage distributions. Second, this decomposition (as well as the Blinder-Oaxaca decomposition which will be discussed later) can lead to erroneous conclusions because it assumes a common earnings function (B_j) for *both* men and women, when different remuneration structures may be warranted (Yun, 2007). This is especially true if measured female and male characteristics have a different meaning for men and women. For example, being married may imply *steeper* wage gradients for men because division of labor in the home causes them to specialize in market human capital investment, whereas being married may yield *flatter* wage gradients for women because division of labor could imply specialization in household human capital rather than marketable human capital (Polachek, 1975a).

Because of these potential biases which preclude one from distinguishing between discrimination and wage structure, it makes sense to identify particular country institutions, and test directly their effect on the gender wage gap. Blau and Kahn do this by exploring the role of a particular wage setting scheme: collective bargaining. They find collective bargaining to be negatively associated with the gender pay gap, which stands to reason because collective bargaining tends to set high wage floors thereby equalizing earnings. But collective bargaining is just one institutional attribute.[5]

Weichselbaumer and Winter-Ebmer (2003) adopt a different approach. Their meta-analysis pools the results of 363 papers from which they obtain 1532 data points on 67 countries. From these data they regress the wage gap on a host of variables (including characteristics pertaining to each study's author, e.g. whether the study's author was female). Through their comparative study, they find that ratification of international conventions supporting equal treatment of male and female workers has a negative and significant effect on the gender pay gap. At the same time, countries with greater economic competition measured by the Economic Freedom Index display lower gender pay gaps based on Becker (1957)'s argument that in the long run, competitive markets eliminate gender discrimination when firms try to minimize their costs.

[5] Blau and Kahn test for other institutional factors (UI duration and replacement rates, an index of protective regulation for permanent and temporary workers, an index of gender occupational segregation, and a measure of relative female labor supply) but these turn out to be statistically insignificant in their analysis (2003, Table 8, p. 136).

Neither of these sets of studies concentrates on the implications of the expected lifetime labor force participation model. This model was originally developed by Ben-Porath (1967) and later modified so it could be applied to account for how interrupted lifetime work links expected lifetime labor force participation to one's incentive to acquire marketable training. In turn, this training, acquired in school and on the job, determines earnings potential. Thus according to this approach expected lifetime work history is the important motivating ingredient in one's ability to eventually achieve high earnings. As will be illustrated, this model is consistent with each of the stylized facts governing the gender wage gap.

Concentrating on factors related to expected lifetime labor force participation is even more important because it sheds new light on another labor economics paradox. When examined over time, one important finding is that the gender pay gap is narrowing in spite of the growing overall wage inequality. (This narrowing is unexpected because, as discussed above, Blau and Kahn (2003) show that wider wage inequality leads to a *greater* gender pay gap.) This paper offers an explanation. We claim the diminishing gender pay gap is a result of women's increased incentive to participate over their lifetime in the labor market during the past decades. Higher expected participation leads to larger female rates of return to education, steeper female earnings profiles, greater female wage dispersion, higher female wages relative to males, and smaller overall gender wage differences. As it turns out, our empirical evidence shows a wider male wage dispersion *is* associated with a larger gender wage gap, but its effect is mitigated when the female wage dispersion increases.

III. The Stylized Facts

The U.S. male-female wage ratio is now about 78%, but an intriguing pattern emerges when examining this gender wage gap for different marital status groups. For *single* men and women the wage gap is generally less than 10%, implying single women on average earn over 90% of what men earn. But *married* women earn *far* less than married men. Here the wage ratio is typically in the 60% to 70% range implying a 30-40% wage gap. Further deconstruction illustrates that children play a major role in the gender wage gap. Married women with children earn less than married women without children (Harkmess and Waldfogel, 2003). Married women who space their births widely apart receive even lower wages (Polachek, 1975a). Opposite patterns regarding marital status and family hold for men. Married men with children earn more, and spacing children at wide intervals is associated with even higher husband earnings (Polachek, 1975b). Thus the wage gap varies by marital status, children, and spacing of children. As it turns out, these demographic variables are more important predictors of the gender wage gap than any other explanatory factors.

There is now more than ample evidence of these family effects. Numerous studies corroborate this so-called "motherhood" penalty" For example, Korenman and Neumark (1992) find that cross-sectional ordinary least squares and first-difference estimates understate the negative effect of children on wages. Waldfogel (1998) shows that having children lowers a women's pay by about 10%, after controlling for age, education, experience, race, ethnicity and marital status. Budig and England (2001) find about a 7% wage penalty per child. Using the National Longitudinal Survey Panel, Baum (2002: 2) confirms the finding that "interrupting work to give birth has a negative effect on wages" but that "this negative effect is at least partially eliminated when [controlling for] whether the mother returns to work at her pre-childbirth job." Berger et al. (2003: 309) find evidence that "the forces towards specialization become stronger as the number of children increase, so that the spouse specializing in childcare [has] some combination of lower wages, hours worked and fringe benefits." Similarly, looking at British data Joshi, Paci, and Waldfogel (1999: 543) show "women who broke their employment at childbirth were subsequently paid less pay than childless women [whereas] mothers who maintained their employment continuously were as well paid as childless women." Using the European Household Panel Survey, the German Socio-Economic Panel, and the British Household Panel, Davies and Pierre (2005) show a family wage gap for 11 European nations. Finally, Paull (2006) makes similar inferences.

Male and female age-earnings profiles also differ from each other over the lifecycle. Male profiles are higher and generally steeper. Not only do males earn more, men also experience a more rapid earnings growth than women. But whereas male earnings profiles tend to be concave (rising steeply early in one's work career and then tapering off), women's earnings functions are often non-monotonic. Female earnings rise moderately early in the career, then the earnings profiles flatten out or decline during the child-rearing period, and finally earnings rise often at a rate equal or exceeding men's (Polachek, 1975b and Mincer and Ofek, 1982). Thus, the gender earnings gap is relatively small when men and women begin to work just after graduating from school. The gender earnings gap widens in mid-life during child-bearing periods, but the earnings gap decreases somewhat when women return to the labor market at older ages. While originally observed using cross-section analysis, these same results hold true using a cohort-based analysis following age groups across the 1960-2000 U.S. Decennial Censuses. For example, Weinberger and Kuhn (2005) find the 43% wage gap for 23-32 year olds in 1959 rises to 57% in 1969 when they are 33-42, and eventually falls to 46% when they are 53-62 years old in 1989. This same gender wage gap pattern is replicated for other cohorts.

Finally, married women's labor force participation rose dramatically from 4.6% in 1890 to 61.0% in 2003. This rapid rise in female labor force participation probably constitutes the single most noteworthy labor market trend in the United States over the last century. Women are now over fifteen times more likely to be in the labor force than 100 years ago. At the same time, men's labor force participation declined

moderately from 84.3% in 1890 to 73.5% in 2003.[6] Concomitant with these two labor force participation trends, the female-to-male wage ratio rose (albeit more erratically) from 34% in 1890 to about 76% in 2003, and 78% today.[7]

IV. Household Division of Labor, Women's Lifetime Labor Force Participation and the Gender Wage Gap

A distinct feature of women's labor force participation is intermittent periods of work and non-work over the lifetime. Never-married white women 30-44 years old in 1967 worked 14.5 years out of a possible 16 years. In contrast, married-spouse-present women only worked 6.4 out of about 16.8 years (Mincer and Polachek, 1974). Although somewhat less stark, these same patterns emerge in more recent data. Using the 1980 Panel Study of Income Dynamics Data (PSID) Carole Miller (1993) found that married women average 10.04 years out of the labor force. Similarly, using a panel of 2659 individuals from the 1976-1987 PSID data, Polachek and Kim (1994) found that women averaged 9.62 years out of the labor force relative to men's 2.22 years. Similarly using the National Longitudinal Survey Spivey (2005: 124) found that in 1994 only 57% of women worked more than 70% of the time after the start of their careers, whereas the comparable figure for men is 79%. Data for foreign countries are comparable. For example, using Canadian data, Simpson (2000) found that in 1993 married women with children averaged 7.6 years (or 36.4% of their work years) out of the labor force, whereas single women spent 1.5 (or 12.9%) of their work years out of the labor force. For men, this figure is 0.9 years (or 8.1%). Data within narrow professions yield similar results. Catalyst (2003) finds that only 29% of women MBA graduates worked full time continuously since graduation compared to 69% for men, and similarly only 35% of women law graduates worked continuously since graduation compared to 61% for men. Clearly lifetime labor force participation differs by gender and marital status.

Division of labor in the home is one explanation why men work throughout their life while even nowadays women (especially married women) often drop out to bear and raise children. Whereas this division of labor may come about because of "efficient" allocation in the home, it can also result because of a wife's inferior bargaining power within a marriage (Ott, 1995), high marginal tax rates on wives' earnings (Kumar, 2005), the unavailability of day care centers (Kreyenfeld and Hank, 2000), or simply cultural norms (Coltrane, 2000). But whatever the reason, less time in the workforce over one's lifetime decreases one's incentive to invest in marketable human capital. In turn, smaller human capital investment decreases one's wage. This can be exacerbated because even while at work division of labor may cause women to work less intensely thereby undertaking less on-the-job training (Becker, 1985).

[6] The 1890 data are from Historical Statistics of the United States from Colonial Times Until 1970, Series D 49-62, p. 133. The data from 2003 are from the 2004-5 Statistical Abstract of the US, Table 570 (p. 371) for males and Table 578 (p. 376) for females.

[7] The 1830 figure is based on Claudia Goldin (1990), pp 60-61; and the 2003 figure is based on June O'Neill and Dave O'Neill (2006).

One way to explain these patterns is to model households as efficient economic units that maximize the discounted value of production throughout the course of their marriage subject to human capital accumulation and asset constraints (Polachek, 1975a JHR).[8] Proceeding this way implies households

$$Max \int_0^T e^{-\rho t} Z_t dt = \int_0^T e^{-\rho t} f(X_t, T_{M_t}, T_{F_t}) dt \qquad (3)$$

where Z_t is household production in year t produced by a household production function $f(X_t, T_{M_t}, T_{F_t})$ (for convenience assumed invariant to change over the marriage), and where X_t equals market goods consumed in period t, and T_{M_t} and T_{F_t} are respectively husband's and wife's time spent in home production in period t. Over time, Z_t is discounted by ρ which is the family's perceived discount rate (including the probability of divorce). Human capital and asset constraints are as follows:

$$\dot{K}_{M_t} = g(S_{M_t}, K_{M_t})$$

$$\dot{K}_{F_t} = g(S_{F_t}, K_{F_t})$$

$$\dot{A} = w_M (1 - T_{M_t} - S_{M_t}) K_{M_t} + w_F (1 - T_{F_t} - S_{F_t}) K_{F_t} - P_X X_t + rA_t$$

where $\dot{K}_{M_t} = \partial K_{M_t} / \partial t$, $\dot{K}_{F_t} = \partial K_{F_t} / \partial t$, and $\dot{A} = \partial A / \partial t$, K_{M_t} = husband's stock of human capital at time t, K_{F_t} = wife's stock of human capital at time t, S_{M_t} = time spent by the husband investing in earnings augmenting human capital in time t, S_{F_t} = time spent by the wife investing in earnings enhancing human capital in time t, w_M = rental rate per unit of husband's human capital, w_F = rental rate per unit of wife's human capital, A_t = family assets at time t, $(1 - T_{M_t} - S_{M_t})$ = husband's time spent at work in time period t, and $(1 - T_{F_t} - S_{F_t})$ = wife's time spent at work in time period t.

[8] Obviously marriage length is not known with certainly. The model is more applicable the longer one expects the marriage to last. Another approach is to maximize household utility, or even better the gain in utility from being married, which can be analyzed in a Nash equilibrium type model derived by McElroy and Horney (1981) and Mancer and Brown (1980).

Such a model entails a complex decision process within the household. In each time period the household must determine both the husband's and wife's allocation of time to the household and to labor market work, as well as husband's and wife's allocation of time to human capital investment. To solve this problem, the household maximizes the Hamiltonian

$$H = e^{-\rho t} f(X_t, T_{M_t}, T_{F_t}) + \lambda_{M_t} g(S_{M_t}, K_{M_t}) + \lambda_{F_t} g(S_{F_t}, K_{F_t})$$

$$+ \mu_t[(1 - T_{M_t} - S_{M_t}) w_M K_{M_t} + (1 - T_{F_t} - S_{F_t}) w_F K_{F_t} - P_X X_t + rA_t]$$

with respect to decision variables $X_t, T_{M_t}, T_{F_t}, S_{M_t}.S_{F_t}$ to yield a set of optimal conditions implying the following within-period allocation:

$$\mu_t = \frac{e^{-\rho t}(\partial f / \partial x_t)}{P_{X_t}} = \frac{e^{-\rho t}(\partial f / \partial T_{M\,t})}{w_M K_{M_t}} = \frac{e^{-\rho t}(\partial f / \partial T_{F\,t})}{w_F K_{F_t}} = \frac{\lambda_{M_t}(\partial g / \partial S_{M\,t})}{w_M K_{M_t}} =$$

$$\frac{\lambda_{F_t}(\partial g / \partial S_{F\,t})}{w_F K_{F_t}} \qquad (4)$$

where the shadow prices are governed by the following differential equations

$$\dot{\lambda}_{M_t} = \mu_t w_{M_t}(1 - T_{M_t} - S_{M_t}) - \lambda_{M_t}(\partial g / \partial K_{M_t})$$

$$\dot{\lambda}_{F_t} = \mu_t w_{F_t}(1 - T_{F_t} - S_{F_t}) - \lambda_{F_t}(\partial g / \partial K_{F_t})$$

$$\dot{\mu} = \mu\rho$$

The closed form solution of these equilibrium conditions depends on both the system's initial conditions and the precise functional forms of the human capital and commodity production functions.[9]

The model's symmetry implies identical husband and wife labor force participation, investment and wages throughout the marriage assuming husbands and wives are equally efficient in producing household goods and human capital ($\partial f / \partial T_{M_t} = \partial f / \partial T_{F_t}$), and have the same human capital going into their marriages ($K_{M_0} = K_{F_0}$), and have the same rental (wage) rates per unit of human capital ($w_M = w_F$).[10] However, assuming equality at the outset of marriage is highly unrealistic.

[9] The above model applies equally well for a single person household. In this case variables pertaining to one's spouse are constrained to zero. It is highly likely in this case that equilibrium results differ for men and women because $\partial f / \partial T_M \neq \partial f / \partial T_F$.

[10] Bargaining models of the household achieved by embedding household production into a Nash bargaining model yield the same symmetric solution as long as husbands and wives have the same individual production functions and are equally adept at bargaining.

There are a number of reasons why husbands and wives differ. First, men and women could differ in household productivity ($\partial f / \partial T_{M_t} \neq \partial f / \partial T_{F_t}$). Second, discrimination could cause men to have higher rental rates (wages) per unit of human capital ($w_M \neq w_F$). But even without discrimination or differing husband-wife productivity, equality at the outset of marriage is unlikely because men and women bring different amounts of human capital to the marriage. In the U.S., 32.7% of husbands graduate from college compared to 29% of their wives. Also husbands are 2.1 years older than their spouses.[11] Being older and more educated at the outset of marriage indicates an opportunity for husbands to have acquired greater amounts of human capital. At least with respect to age at first marriage, these same patterns emerge worldwide. Table 1 examines age at first marriage across the 38 countries contained in the ISSP, LIS and OECD data, and which we examine in this study. In every case, husbands are older than their wives.[12] Whether or not these initial conditions are caused by societal preconditioning or the result of efficient mating processes, these demographic differences at the outset of marriage are sufficient to cause the symmetry of the above model to break down. Given that age and education are positively related to human capital and earnings, these differences in husband-wife age and education imply greater husband than wife human capital ($K_{M_0} > K_{F_0}$). In turn, differences in the market value of human capital ($w_M K_{M_0} > w_F K_{F_0}$) lead to specialization whereby the spouse with the greater market earnings potential (in this case the husband) concentrates more on market activities ($T_{M_t} < T_{F_t}$). This spouse works a greater proportion of time over the marriage, and as a result reaps greater gains from human capital investment ($\lambda_{M_0} > \lambda_{F_0}$). As such, this spouse invests more in human capital. Thus, despite the reasons for these initial differences, even if husbands are equal in all respects except initial endowment at the onset of marriage, efficient behavior (based on maximization of the present value of family income over time) dictates specialization so that the husband (or the spouse with the greater lifetime work) invests more in the market than in the home compared to his wife (or the spouse with lower lifetime work). Accordingly, greater human capital investments lead to higher wages.

V. Measures of the Gender Pay Gap

[11] These data are computed from Table 2, Nock (2001) and based on the 1999 March Current Population Survey (CPS) Demographic Supplement.

[12] In an examination of 209 UN countries, husbands are older than their wives in every country, except San Marino. There, wives exceed husbands age by 0.2 years. In all other countries, the difference in singulate mean age at marriage varies from 0.3 in Belize to 9.2 in Gambia.

The literature on how to estimate the gender pay gap is an important topic by itself. Using EconLit (in 2000), Weichselbaumer and Winter-Ebmer (2003) conducted a search of all empirical papers on measurements of the gender pay gap, and found 263 articles. These articles incorporate nine different methods of computing the gender pay gap. Among these methods, incorporating a dummy variable into the Mincer earnings equation and computing a discrimination coefficient based on the Blinder-Oaxaca decomposition appear to be the most common.[13] In this section, we will examine these two approaches and compare them to simply looking at the unadjusted raw wage differential so we can determine the most appropriate measure to use for this study.

The Mincer earnings equation is probably the most widely adopted equation used to estimate the age-earnings profile, largely because of its estimation convenience and its explanatory power.[14] The dependent variable in this equation is the natural logarithm of earnings, and the most common independent variables include number of years of schooling, number of years of labor market experience, and a quadratic term of experience. Often this earnings equation is extended to include demographic variables, such as gender to measure the female wage deficiency "unexplained" by the above human capital variables, assuming males and females have same returns to skills (e.g. schooling, experience).

This gender pay gap measure is subject to debate because it assumes that men and women have the same returns to skills. Instead, many argue that employers value similar skills differently for men and women. Based on this argument, Blinder (1973) and Oaxaca (1973) first propose a technique to decompose the observed gender pay gap into two parts: the differential due to "discrimination" and the differential due to difference in skills. More specifically, in the Blinder-Oaxaca decomposition, the unadjusted wage differential is

$$\Delta \overline{w} = \overline{w}_M - \overline{w}_F = \overline{x}_M \beta_M - \overline{x}_F \beta_F ,$$

where $\overline{x}_M$ and $\overline{x}_F$ represent mean values of vectors of characteristics of men and women respectively, β_M and β_F are coefficients from male and female separated earnings regressions. Adding and subtracting $\overline{x}_F \beta_M$ yields,

$$\Delta \overline{w} = \overline{x}_F (\beta_M - \beta_F) + (\overline{x}_M - \overline{x}_F)\beta_M ,$$

[13] Other than these two ways, there are another four decomposition techniques as well as methods by IV, panel data, and Heckman's selectivity correction. See Table 2C in Weichselbaumer and Winter-Ebmer (2003) for details.
[14] See Mincer (1974) for details on the derivation of this earnings equation, and Heckman and Polachek (1974) for an empirical test of the functional form of the earnings-schooling relationship. Also see Limieux (2006) for a critical survey of the approach.

where the first term on the right hand side is often interpreted to represent "discrimination" and the second term to be the wage differential due to skill differences.

However, this decomposed gender pay gap invites some criticism. A number of statistical biases mar this computation (e.g., see Polachek,1975a, Jones, 1983, and Borjas, 2000, p.365). The validity of the "discrimination" estimate is dependent upon whether one controls for differences of all relevant characteristics. If any human capital attributes that affect earnings are omitted, the measured "discrimination" part would be contaminated with unmeasured human capital, thereby failing to capture the real meaning of discrimination.[15] One particularly relevant bias is the failure to account for the amount of job skills women would have sought had they *expected* to work continuously. Typical implementation of the decomposition adjusts for training received given *observed* work experience, but not the training one *would have* received had one *intended* to work continuously. By not including this extra training, these decompositions underestimate a discontinuous worker's potential wage. As such, discrimination is overestimated, given that discrimination is the difference between what the continuous worker *actually* earns and what one *projects* a discontinuous to earn were she to have continuous participation. This criticism also applies to adjusting for marital status which, because of the division of labor, has a very different meaning for husbands and wives.

Blau and Kahn (2003:117) propose predicting "the gender pay gap on the assumption that the men and women in each country-year … have the same average levels of measured characteristics as U.S. men and women for that year." This measure is designed to normalize each country's gender pay gap by eliminating cross-country differences in human capital. Based on country-specific earnings functions, their measure computes a predicted gender pay gap in each country assuming comparable human capital (school and experience) cross-nationally. However, this measure might be biased if true earnings function coefficients in part depend on expected human capital, as suggested above. In this case, biases would result by not including expected lifetime labor force participations and/or by assuming that marital status (being married) has the same meaning for men and women. Similarly bona fide discrimination could influence women's accumulation of human capital via the education they get, the experience they acquire, and the job they obtain, in the first place. To avoid these potential biases, we view the unadjusted gender pay gap as an appropriate measure. [16]

VI. Data

[15] This same criticism holds when using a dummy variable in a Mincer earnings equation. It also applies when using newer versions of the Blinder-Oaxaca decomposition (Oaxaca and Ransom, 1994) which modify the original version essentially by taking the average of the male and female earnings function coefficients. This revision amounts to obtaining a discrimination coefficient that is virtually identical to the gender dummy variable of the Mincer earnings function.

[16] Blau and Kahn (1992, 1995, 1996b) also use a gender pay gap measure from raw wage data.

One critical issue in a comparative study is the choice of data. A representative sample can avoid biased conclusions induced by a non-random sample. However, data limitations are a common problem for researchers doing international comparisons of labor markets. This is particularly true for gender difference analyses because often many variables are only computed for the aggregate population, rather than broken down by gender. Because comprehensive information is mostly collected in developed countries, inferences are usually drawn from these nations (Blau and Kahn, 1996b). Little data are available for developing countries and thus they are omitted from the sample. As will be explained, we utilize the International Social Survey Programme (ISSP) data, the Luxembourg Income Survey (LIS), and OECD data.

The ISSP, which began in 1985, is an ongoing survey conducted annually for a sample of thirty-nine countries.[17] The topics emphasized for the survey varies each year, as do the participating countries.[18] In each survey, standardized questions are asked about social atitudes as well as respondents' age, sex, schooling years, earnings, and weekly working hours. Appendix 1 contains detailed data information regarding sample countries, their available years, and earnings definitions. After excluding a few outlier country-years, we have a total of 250 observations.[19] As can be seen from the appendix, most of these sample countries are OECD and have a relatively high development level. Also, the number of available years varies a great deal across sample countries: it ranges from one year to sixteen years. The last column in Appendix 1 shows the earnings definition for each country. They are grouped into two categories: gross earnings and net earnings depending upon whether earnings are calculated before or after taxes.[20] In a significant proportion of the sample, earnings are reported as midpoints of categories. Such categorical reporting smoothes earnings measures, which could either narrow or exaggerate the gender pay gap depending on how wages fit into the categories. For example, the measured gender pay gap would be smaller if women are likely to have earnings in low percentiles of a category whereas men have earnings in high percentiles of the same category. On the other hand, the gender pay gap would be exaggerated if men and women were in two adjacent earnings categories, say if women were in high percentiles of the low category while men were in low percentiles of the high category. This categorical data limitation could be more serious than omitting taxes, because compared to taxes

[17] Blau and Kahn also use the ISSP. Their sample consists of 100 observations covering the 1985-1994 time period. This study extends their sample to the year 2002.

[18] The ISSP surveys topics on Role of Government in 1985, 1990, and 1996, Social Networks in 1986, Social Inequality in 1987, 1992, and 1999, Family and Changing Gender Roles in 1988, 1994, and 2002, Work Orientations in 1989, 1997, and 2005, Religion in 1991, and 1998, Environment in 1993, and 2000, National Identity in 1995, and 2003, Citizenship in 2004, and Social Relations and Support Systems in 2001. Data are downloadable from Inter-University Consortium for Political and Social Research (ICPSR), except for years of 1999, 2001 and years after 2002.

[19] See footnote b in Appendix 1 for excluded country-years. Also, some country-years are omitted because of lack of crucial information (either earnings or weekly working hours).

[20] A few countries lack information on earnings definition, and they are labeled without gross or net. As argued by Blau and Kahn (2003), this difference does not have significant effect on computed gender pay gaps, indicated by the insignificant coefficient of a dummy for the group of net earnings countries (p.115).

earnings smoothing based on categorical data is more likely to have asymmetric effect on men and women.

Another issue is earnings are not calculated per hour. Ignoring working hours is likely to overestimate the gender pay gap, because women are more inclined to work part-time yielding lower earnings as a result of fewer working hours. The ISSP data contain information on weekly working hours, but do not collect data on weeks worked. Blau and Kahn (2003) employ a part-time dummy and two interaction terms (one between weekly working hours and the part-time dummy and the other between weekly working hours and a full-time dummy) to correct for the lack of precise hours information.[21] We focus on the sample of full-time workers (defined as working at least 30 hours per week) in order to maintain consistency with the two other datasets we use in this study.[22] Both the Blau-Kahn and our method yield similar results. Correlation coefficients comparing each gender pay gap measure are as high as .9 and regression coefficients are close to one when one measure is regressed on the other one.

The Luxembourg Income Study (LIS) is a collection of household data compiled from ongoing statistical surveys in twenty-nine countries widely spread across Europe, America, Asia and Oceania. The LIS began in 1983 and is now jointly sponsored by the Luxembourg government and the Centre for Population, Poverty and Policy Studies (CEPS), the Centre Universitaire (CU) de Luxembourg. The data are standardized in order to facilitate comparative research. Data include country-specific labor force surveys over various labor market structures and include demographic, income and expenditure information on three different levels: household, person and child. We extract information on gender, earnings, and weekly working hours data from the LIS person files.[23] To maintain consistency with ISSP data, we confine ourselves to those country-years that contain information on weekly working hours. These are listed in Appendix 2. Fewer countries and years are available in the LIS than in ISSP; LIS data yield a total number of 71 observations. Again OECD countries comprise most of the sample. As before, we restrict our sample to full-time workers who work at least 30 hours a week.

The OECD collects pretax (gross) wage data on full-time workers from surveys conducted by governments for each country (See Appendix 3).[24] Twenty-one countries are in the sample with varying number of years. The earliest available year starts in 1950 for France, but most countries begin to have data in the 1970s and the 1980s. For each country and gender, mean, median, as well as wage data for the 10^{th} to the 90^{th}, plus the 25^{th} and the 75^{th} and eleven percentile groups are reported. There

[21] For details see Blau and Kahn (2003, p.115-117).
[22] This 30 hours threshold for full-time work is set by OECD in 1997.
[23] The data information on weeks worked is available for a proportion of the sample in LIS. Again, this information is omitted here to keep it consistent with the other two datasets examined in this study. Computing gender pay gaps based on hourly earnings produce very similar regression results.
[24] The exception for the definition of full-time workers is Austria which uses information of both full-time and part-time employees. Also, the exception for the definition of gross earnings is France which uses net earnings .

are 292 observations at the 50th percentile measure and 322 observations at the mean value measure.

Current literature generally concentrates on both mean and median measures of the gender pay gap. As such, we compute the gender pay gap as a difference between male and female log of wages for each of the above three datasets (and do so both for means and medians). The antilogarithm is the female-to-male pay ratio. Because the time-period of the three datasets overlaps, we are able to compute correlation matrixes measuring the data's consistency between datasets. Table 2 gives the correlation based on median 50th percentile and mean measures. As may be seen from the correlation coefficients, the LIS and OECD gender pay gap measures are the most similar while the LIS and ISSP data are the least similar (correlation coefficients of .80 and .75 versus .36 and .31).[25]

To further test the consistency of the data, we examine each country's time-series trends from the early 1970s to 2002 for each of the three datasets.[26] These are plotted in Figures 1. Just as Blau et al. (2006) observes a declining gender gap in the United States, we find the gender wage gap to be getting smaller for most countries. This is especially true for Canada, Korea, and the UK where the wage gap is declining relatively more quickly than in the other countries. Generally the decline follows a smooth pattern for the OECD and LIS data, but the ISSP data appears a bit more erratic with the data oscillating from year-to-year. This year-to-year oscillation is somewhat unlikely because it seems implausible that the gender pay gap can change so significantly in two adjoining years. We suspect two possible reasons: First, the sample composition changes in the ISSP because each year's survey concentrates on a different particular survey topic. Second, the categorical reporting of earnings data in ISSP may be another factor. This ISSP weakness is consistent with the correlation matrices in Table 2 which shows the ISSP data to have the least linear relationship with the other two datasets.

All the above results lead to a conclusion that the best candidate for the calculation of gender pay gap is the OECD dataset. Compared to the ISSP dataset, it is much more consistent over time; whereas compared to the LIS dataset, it has many more observations. Nevertheless, we perform analysis using all three data sets combined, then rerun the analysis solely on OECD data. We place the greatest credence in the latter results based on the OECD data.

VII. How Women's Incentives for Labor Force Participation Affect the Gender Pay Gap

Measures of Women's Labor Force Participation Incentives

[25] This observation is strengthened by the P value; it is not significant at 1 percent level between the LIS and ISSP data.
[26] For France we plot data from 1950.

In Section IV we argued that expectations regarding lifetime labor force participation could affect human capital accumulation and consequently the gender wage gap. The division of labor in the family was considered as the underlying reason for low work incentives, especially for married women with children. Generally these incentives are unobservable, but one way to capture them is through observable factors that have a direct influence on women's expected lifetime work. In the following, we examine country attributes that we expect affect women's lifetime work incentives and hence the gender pay gap.

Arguably the variable most influencing women's (and men's) lifetime work behavior is fertility. The greater the number of children in a family the more pronounced the division of labor. Two observable consequences appear from high fertility: First, women are expected to drop out of labor force more frequently, which suggests less market experience and less human capital investment (Mincer and Polachek 1974). Second, women are likely to exert less effort in market work (Becker 1985). Both eventually lead to a larger gender pay gap.

Empirical evidence for this inverse relationship between the fertility rate and female labor force participation (and earnings) abounds. Eckstein and Wolpin (1989) use the National Longitudinal Surveys mature women's cohort to estimate a dynamic model of married women's labor-force participations and fertility, and their findings conclude that an increase in young children aged under six substantially reduces women's labor force participation. Using the 1980 Population Census of Japan, Yamada and Yamada (1984) find higher fertility rates to have a negative labor supply impact for married women. Based on a cohort of more than 2,000 women in the Cebu Longitudinal Health and Nutrition Survey, Adair, Guilkey, Bisgrove, and Gultiano (2002) conclude that an additional child aged under two would reduce women's working hours and that women's earnings are substantially decreased if they have two or more additional children. Further, Assaad and Zouari (2003) find that women (in urban Morocco) decrease their participation in all types of wage work (e.g. public and private wage work) in the presence of school-age children, even after accounting for endogeneity of fertility. In addition, there are many other case studies similarly suggesting this inverse relationship (e.g. Psacharopoulos and Tzannatos, 1992).

The only problem is that fertility may be endogenous. Given the time intensity of children, a number of studies beginning with Becker (1960) and Willis (1973) argue that women's opportunity costs to be a prime determinant of fertility. Should this be the case, fertility would not only determine female wages, but female wages would also determine fertility. As such, women's wages and fertility would be simultaneously related. Although this might not be the case here since we are using the *gap* in male and female wages rather than female wage *level* as the dependent variable, one might nevertheless argue that a large wage gap implies relatively low

female wages levels and hence high fertility. For this reason, we also adopt a simultaneous equations model.

A simultaneous equations approach requires we model fertility using exogenous determinants of fertility that do not directly affect wage. According to Galloway et al. (1994) and Khlat et al. (1997) religion might be such a variable since a number of religions are more pronatalist than others. We use the percent Islam, percent Catholic, percent Judaio-Chirstian, and the percent other religions. In addition, we use chronological time (measured by year) and religion's interaction with year since the passing of time is clearly exogenous.

A second variable that conveys information on women's incentive to participate in the labor market is the age gap between husband and wife. Generally older males are likely to have accumulated more wealth and have higher wages than their wives.[27] The larger this age gap the more pronounced the division of labor within the family because relatively higher husband human capital leads them to specialize in market activities. As a result, women in countries with larger husband-wife age gaps are likely to have a lower incentive to invest in the labor market. Despite husbands being universally older than their wives, there is no empirical evidence relating this age differential to the gender pay gap. But from applying the above argument to equation (4), it is expected that the gender pay gap is likely to be smaller in countries where the difference in a husband's and wife's ages are smallest holding all other factors constant.

Country-specific fiscal policies such as income tax rates can influence one's incentive to work. This is especially true for women because women's labor supply is more elastic, and therefore more sensitive to such tax rates. Married women might find it advantageous to specialize in household activities when a large proportion of secondary earner income has to go into paying taxes. By the same token a low income tax regime is likely to exert a positive effect on women's incentive to consistently participate in the labor market. In this circumstance the gender pay gap can diminish. The effect of tax rates on women's labor force participation has been studied in a number of papers. Baffoe-Bonnie (1995) investigates the effect of the negative income tax on the labor supply of different family members and finds that females are likely to reduce their labor supply at all levels of tax rates, whereas males can increase the labor supply at certain program parameter levels. Another study based on a sample of married women in the Antwerp district in Belgium finds that women's labor supply decreases over 20 percent if they receive an individual transfer of 15,000 Belgium Francs a month while simultaneously facing an increase in the income tax rate (Kesenne, 1990). Additionally, based on Britain, Denmark, Ireland, and East and

[27] Under the assumption that economic roles of males are more varied than the roles of females, Bergstrom and Bagnoli (1993) find in their model that in equilibrium "males with poor prospects marry at an early age, whereas those who expect success will marry later in life. All females marry relatively early in life. The more desirable females marry successful older males and the less desirable females marry the young males who do not expect to prosper" (p. 186).

West Germany, Smith, Dex, Vlasblom and Callan (2003) find that women's labor force participation rates are highly influenced by the design of tax schemes (e.g. joint taxation versus separate taxation).

Another variable to indicate women's work incentive is female educational attainment. Female educational attainment affects the gender pay gap in two ways. First, the pay gap is expected to decrease as a direct result of a larger female human capital stock. Second, more schooling instigates higher labor force participation. These higher labor force participation rates are evident in primary data (e.g. Table D in OECE Employment Outlook, 2002) as well as secondary analysis. Chaykowski and Powell (1999) examine the progress of Canadian women in the labor market during the period from 1978 to 1998, and find women's educational attainment to be one of the major factors contributing to the increase of women's labor force participation. Eckstein and Wolpin (1989) also find "increase in the level of schooling has the largest (positive) impact on participation" (p.389). In turn higher labor force participation increases on-the-job training and wages so that the higher women's education relative to men, the higher their wage and the lower the wage gap.

Finally, we include four institutional characteristics used in the literature on cross-country comparisons: centralized collective bargaining, economic competition, and the public/private employment ratio, and a measure of overall earnings dispersion.[28] Iversen (1999), Wallerstein (1999) and Blau and Kahn (2003) argue that bargaining centralization reduces wage differentials among different firms and sectors because bargaining includes more firms and sectors into a common wage settlement. This is relevant to the gender pay gap because in the real world we observe female workers in less remunerative sectors. Centralized bargaining tends to equalize these sectoral differences and, as such, we expect the gender pay gap to be negatively associated with this labor market institution. Economic competition is supposed to negatively affect the gender pay gap because firms would eliminate discrimination against women to minimize costs in a highly competitive market (Becker, 1957; Weichselbaumer and Winter-Ebmer, 2002). Public employment is another indicator of wage compression because public sectors are more inclined than private sectors to equalize wages for their employees (Kolberg 1991). Finally we include direct measures of the 90^{th} percentile minus 10^{th} percentile wage gap for males and for females. Blau and Kohn (2003) use the 50-10 wage gap as an independent variable in a regression to show that a more compressed male wage structure decreases the gender pay gap.

The sources for the above-mentioned variables are given in Appendix 5. Summary statistics for each are in Table 3. The first two variables in Table 3 are measures of the difference between male and female log of (median and mean) wages,

[28] In addition, we extended Rhum's (1998, 2000) parental leave data from nine to seventeen countries. However, because of the still limited number of observations using the data (and the inability to distinguish between countries with zero parental leave weeks and missing values), we report results incorporating this parental leave variable in a footnote later in the paper.

the dependent variable. The average wage gap is over 30 percent. Thus women are consistently in a disadvantaged wage position, but their situation varies significantly across countries and years. The median measure of the gender pay gap is smaller than the mean measure, suggesting that the female wage distribution tends to be more left skewed when compared to the male wage distribution.

Summary statistics for the independent variables follow. The fertility rate, defined as births per woman, is used to capture the effect of children on lifetime labor supply and wages. As can be seen from the range of this variable, women in some country-years have total fertility rates three times as high as women in other country-years, although most country-years are observed at relatively low fertility rates. On average men are 2.6 years older than their wives, but here too there is a great deal of variation, though this variable is more symmetrically distributed than the fertility rate. The top marginal income tax rate averages 53%, but varies from 13 to 89 percent. Marginal tax rates increase the gender wage gap to the extent they discourage women, as secondary earners, from labor market activity. Female educational attainment is defined as a ratio of females to males at the 'third level" which essentially translates to the ratio of women to men in post-secondary education. It measures women's relative human capital stock.[29]

The statistical Model

Given that the data are a pooled time-series cross-section, a general estimation model is

$$y_{ijt} = x_{ijt}\beta + C_i\gamma_i + D_j\gamma_j + v_i + \varepsilon_{ijt} \qquad (5)$$

where y_{ijt} represents the gender earnings difference for country i using data set j in year t, x_{ijt} represents the independent variable for country i using data set j in year t, C_i represents the country specific fixed-effect, D_j reflects the data set specific fixed-effect, v_i is a country error term, and ε_{ijt} country-data set-time varying error.

There is precedent to claim that over relatively short periods of time within country variance is smaller than between country variance so it makes sense to study how the wage gap varies across countries rather than within (Baltagi and Griffin, 1984). This means an analysis concentrating on the between country effects rather than accounting for country-specific effects. Thus we primarily focus on the between-group differences which we estimate assuming a random effects (RE) GLS model. But in addition, we show that the results also hold (albeit slightly less strongly) when

[29] The primary and secondary educational attainment ratios for men and women are similar. Only gender ratios of third level education exhibit sufficient variation.

accounting for country fixed-effects.[30] Also, because the gender wage gap might affect (as well as be affected by) the fertility decision, we estimate both the RE and FE regressions taking account of possible endogeneity. In this case, as was mentioned earlier, we primarily use religion to identify fertility differences across countries and estimate both models using two-stage least-squares. As already mentioned in Section VI (and illustrated in Table 2), one other problem is the ISSP and perhaps the LIS data do not correlate strongly with the OECD data. As we illustrate below, the γ_j coefficient is significant and robust for ISSP and sometimes significant for LIS. This confirms that, at least, the ISSP data are different -- most probably because they reflect a nonrandom population sample induced by emphasizing differing social questions from year-to-year, and that they measure earnings categorically. For this reason, we also present results concentrating solely on the OECD data.

Results of the Comparative Study

Our approach is to begin the analysis using all three data sets then narrow the focus exclusively to the OECD data because that data seem the most reliable of the three. Initially, we do not exploit fixed country effects since we are interested more in the between group differences. Looking within groups might be too narrow since there is far less variation within than between countries. So whereas one might want to control for unobserved country heterogeneity it is not obvious that the within-group differences especially over a relatively short time period are large enough to reflect sufficient change. Thus first we analyze differences between countries. Then second, on order to show the results to be relatively robust, we perform fixed-effects regressions, as well. In addition, for both the single equation RE and FE models, we incorporate data on religion to model differences in fertility across countries. In these, fertility is imputed based on percent Muslim, percent Catholic, percent Jewish, percent Christian and percent other, and the earnings gap regressions are re-estimated using 2SLS. Finally, we examine two measures of the gender pay gap: the mean $\log_e$ pay difference and the median $\log_e$ pay difference (to avoid the effect of outliers). Under each measure, there are several specifications designed to test robustness.

As shown in Table 4 and 5, we adopt four models for each of the two gender pay gap measures. The first model examines how a country's fertility rate, the husband-wife age difference at first marriage, and the top marginal income tax rate are related to the gender wage gap. For each we treat fertility as exogenous, then as endogenous, determined by religious differences between countries and how the impact of religion changes over time. Female educational attainment is not included in the first model because its effect on the gender pay gap is two fold: First, a higher educational level increases women's wage directly; second, higher education works to raise women's incentives for more lifetime labor force participation, which in turn increases

[30] A Hausman test for Models 1 and 2 and in some cases 3 and 4 (which will be explained shortly) indicates the difference in coefficients between the RE and FE models are not significantly different.

women's wages indirectly through more human capital investment. By excluding the direct effect of the educational attainment variable, the first model shows how female labor force participation (perhaps including education if education influences labor force participation) affects the gender pay gap. The direct role of education is captured in the second model, in which all four independent variables are included. Model 3 incorporates centralized bargaining, economy wide competition, and the economy's proportion of public employment. Finally Model 4 incorporates the 90-10 male and 90-10 female pay dispersion measures. For each model we present four estimation schemes: the first is RE, the second RE-2SLS, the third is FE, and the fourth FE-2SLS. Table 4 includes all three data sets, while Table 5 applies the same models solely to OECD data.

Begin with the regression results on the entire sample (Table 4). They generally support the argument that the gender pay gap is larger, the smaller women's incentives to work over their lifetimes. First, in Model 1, all three independent variables have positive and statistically significant coefficients. This suggests that variables connected to low lifetime labor force participation are associated with a bigger gender pay gap. By using an international cross-section made up of heterogeneous countries, these results regarding the fertility rate generalize past findings based on specific countries (such as the US) regarding fertility's negative impact on female-relative-to-male earnings. The results on the husband-wife age gap at first marriage (new to the literature) suggests that one fundamental determinant of the gender pay gap can be traced to specialization between family members, as was illustrated earlier in Section IV. Also, a higher top marginal income tax rate raises the gender pay gap asymmetrically reducing women's labor force participation relative to men's (Jaumotte, 2003).[31] Adding a measure of women's educational attainment in Model 2 leaves the results largely unchanged.[32] But in addition, the female educational attainment coefficients appear to support the argument that relatively more schooling for women reduces the gender pay gap across countries. As a group, these four variables lend empirical evidence to support the argument that women's incentives for labor force participation increase (decrease) the gender pay gap.[33] These results hold up strongly when modeling fertility as an endogenous variable. Most coefficients remain approximately the same, except fertility which becomes more significant in increasing the gender wage gap.

[31] Incorporating parental leave data, as mentioned earlier, only yielded a regression with 49 observations for Model 1, 44 observations for Model 2 and 19 observations for Models 3 and 4. Thus we don't report there regressions in Tables 4 and 5. However, we find a smaller gender wage gap in counties with greater parental leave opportunities. This result is statistically significant in Model 1, and consistent with our overall hypothesis that country policies favoring increased female lifetime labor force participation results in a smaller gender wage gap.

[32] For the fixed-effects regression, the age gap at the first marriage becomes insignificant under the mean measure, which is probably a result of its correlation with female educational attainment.

[33] Some simple bivariate regression results are shown in Appendix 6. The four independent variables all act in their predicted directions even after controlling for the country effect. As shown, the coefficient magnitude shrinks in the multivariate regressions except for the top marginal income tax rate.

Model 3 adds three institutional variables: centralized collective bargaining, economic competition, and the public-private employment ratio.[34] As can be seen, centralized bargaining is associated with a reduced gender wage gap, but economic competition is associated with an increased gap. Finally the public employment ratio is statistically insignificant. Interacting the economic competition and public employment variable (not presented) yielded a negative significant interaction term. Thus more public employment is associated with a lower gender wage gap, the greater the economic competition in an economy. As such public employment mitigates larger pay differentials brought about by competition. In light of Gary Becker (1957), these results are consistent with economy-wide discrimination against men, not women, because economic competition is associated with a wider (not smaller) gender wage gap, and market intervention through country-wide collective bargaining and public employment decreases (not increases) the gap. On the other hand, the results show that public intervention (through public employment and nation-wide collective bargaining) helps eradicate women's pay deficiencies, if competitive economies increase rather than decrease the gender pay gap. Incorporating the 90-10 overall male and female earnings spreads (Model 4) does not qualitatively alter the results. As with Blau and Kahn (2003), we find a greater male or female wage dispersion is associated with a wider gender pay gap. This holds true for both the male and female wage dispersions, but given the interaction term, the positive effect on the gender wage gap is mitigated when either the male or female wage dispersion increases. Again, specifying fertility endogenously simply increases its coefficient.

Adopting a country fixed effects model doesn't appreciably alter the results, except on average the coefficient magnitudes diminish. We do not know whether the difference in coefficients captures time-invariant fixed country-specific effects (e.g., culture and labor market tradition) or whether within country effects come about over relatively short time periods compared to the long time periods which must have taken place to get the larger inter-country effects. Nevertheless in either case, factors affecting lifetime female labor force participation appear to be important correlates of the gender pay gap across and within countries.[35]

Worth mentioning in Table 4 is the coefficient for the ISSP data. The 2.6%-8.1% positive coefficients indicate that the ISSP consistently overestimates the gender pay gap compared to the OECD. Similarly, while more in line with OECD, the LIS overstates the wage gap between zero and 5.5%. Coupled with the data idiosyncrasies mentioned in Section VI which were exhibited in Tables 2, we reran the analysis using solely OECD data. These results are presented in Table 5. The main structure of Table 5 is similar to Table 4. With few exceptions, the three lifetime labor force

[34] Minimum wage legislation is another alternative variable, but it would have to be dropped in the country fixed-effects models because whether a country has a minimum wage is completely correlated with country.

[35] Clearly as one moves from Model 1 through Model 4 the number of observations decrease because of missing values. To test whether the additional observations in Models 1 and 2 affect the results, we re-estimated these models using the same observations as in Models 3 and 4. The results were essentially the same. Thus the consistency across models is not driven by particular observations.

participation indicators remain positive and significant, strengthening the findings from Table 4 that factors decreasing the incentive for lifetime work are associated with a larger gender wage gap across countries. As before, the relative female education variable is generally negative again connoting the role of human capital. Centralized bargaining is still associated with a smaller gender wage gap, economic competition a positive wage gap, and public employment is associated with smaller gender differences.

As a final note regarding Tables 4 and 5, the top marginal income tax rate demonstrates a strong effect on the gender pay gap as illustrated by its statistical significance. Because this variable specifically refers to the tax rate at top wage percentiles, a further test is to examine its effect on the gender pay gap measured at different wage percentiles. We predict the top marginal income tax rate has a stronger effect on the gender pay gap measured at higher wage percentiles. The regression results obtained at eleven wage percentiles generally support this prediction as shown in Table 6. The coefficient of this tax variable is much more likely to be statistically significant in cases beyond the 50^{th} wage percentile. Furthermore, the coefficient magnitude increases the higher the wage percentile.

VIII. Conclusions

This paper tests the argument that women's incentive for lifetime labor force participation is an important determinant of the gender pay gap. Using a forty country data set covering 1970-2002, we find that the fertility rate, the age gap between husband and wife at the first marriage, and the top marginal income tax rate are all positively associated with the gender pay gap, while female educational attainment is negatively related to the gap. These results are tested to be robust against various model specifications. Because current comparative studies on the gender pay gap only focus on institutional factors affecting wage structures between countries, our study adds new findings by examining demographic variables using a wider set of data than in the past.

There are a number of ways to measure the significance of these results. One approach is simply to compute coefficient elasticities to evaluate the relative importance each variable. These elasticities give the percent change in outcome for a one percent change in the relevant independent variable. Table 8 (Column 1) gives these elasticities obtained by converting the coefficients of Model 3 already reported in Table 5. These range from .08 for public employment to 1.2 for market competition. The elasticities for the demographic variables range from .31 for the age gap at first husband-wife age gap to .71 for female-relative-to-male education. This means that countries with a 10% greater women's education relative to men's have a 7% smaller gender wage gap. Similarly a 10% smaller fertility rate is associated with a 5.5% smaller wage gap.

Another way to assess the results is to use the coefficients to predict how much each variable changes the wage gap when comparing the country with the largest variable value to the country with the smallest. In other words, the coefficients can be used to measure the proportion of the wage gap (between the countries where women do worst and countries where women do best) that each variable potentially could explain. To get at this we multiply each variable's range (i.e., the difference between its highest and lowest value) by its corresponding coefficient. The antilog of these depicts how much of the gender wage gap we can attribute to the maximum change in each variable. Comparing these "predicted" wage differences to the total wage gap yields a measure of the importance of each variable. These are also given on Table 8. Column 2 gives the predicted effect and Column 3 the proportion the wage gap explained. Take an example: If the most fertile country would decrease fertility from 3.71 to 1.09 births per woman (the value of the least fertile country), then the model predicts a decrease in the log wage gap by 0.10 (column 2 row 1) yielding a new wage ratio of .44 (.54-.10). This implies a wage gap of 36% instead of the 42% gap exhibited by the most fertile country. As such, raising fertility from the highest to the lowest level explains about 6/24 or 25% (column 3) of the gap.

Finally, another illustration of the significance of our results is simply to assess how well the empirical model tracks the data. To do this we plot the actual (OECD) data (on the ln difference in gender wage) for selected countries (United States, United Kingdom, Australia, Austria, Finland, Germany, Korea, New Zealand and Sweden) over time (Figure 2). These gender wage differences decline chronologically indicating a narrowing of the gender wage, and are labeled by relevant country name. Alongside these data are fitted points for Model 4 using each of the four specifications (RE, FE, RE-2SLS, and FE-2SLS) estimation. Recall these estimates rely solely on the demographic variables (fertility rate, age at first marriage, female relative to male education) and institutional variables relating to the overall earnings dispersion (i.e., the 90-10 wage gap). Getting precise predictions would attest to the power of these variables alone because no country-specific intercepts are used in the forecasts. As can be seen, the forecasts track the data fairly well. This is especially true for the United States, the United Kingdom, and Finland after 1985. For Germany the actual wage gap data are from 1984-1998. Information on independent variables enables estimation for 1990-1998. For Australia we plot data from 1976 through 2000 while for New Zealand, we plot data from 1983-1997. In both we estimate the trends very well, but overestimate the level. Perhaps comparable worth legislation in these contries accounts for the overestimation. For Korea and Sweden we underestimate the pay gap. As mentioned, all track the downward trend fairly accurately.

Our results underscore the role of demographic variables -- particularly those affecting lifetime work which in turn influences human capital investment -- in understanding the gender wage gap in a comparative country format. We show evidence that the gender pay gap at least in part results from factors affecting women's lifetime labor force participation. In turn, this finding sheds light on the

currently paradoxical finding that the gender wage gap is narrowing despite a wider dispersion in the overall wage structure. We argue higher expected female lifetime labor force participation leads to higher female rates of return, higher female earnings, a wider female wage dispersion, but a smaller *gender* pay gap.

Despite the results, a number of extensions are possible. For example, whereas we address endogeneity between the fertility rate and the gender pay gap one might additionally argue that the age gap between husband and wife and relative female educational attainment are endogenous, as well. However, the endogeneity problem is less severe here because these two variables are defined in relative terms and there is no clear theory that predicts how the relative values change as a result of the narrowing gender pay gap. For example, not only women but also men postponed their marriage age as the gender pay gap declined. Therefore, the age difference must be determined by something more than the gender pay gap in order to explain why men also postponed getting married Another issue relates to measures of income tax rate. This study assumes second-earners face the same tax rate as single individuals, which is an assumption subject to debate.[36] When data permit, both of these improvements could be done in the comparative study.

[36] The tax ratio of second earners over singles is not necessarily similar across countries. See Jaumotte (2003, p.58).

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Figure 1

Country-Specific Wage Gaps Over Time

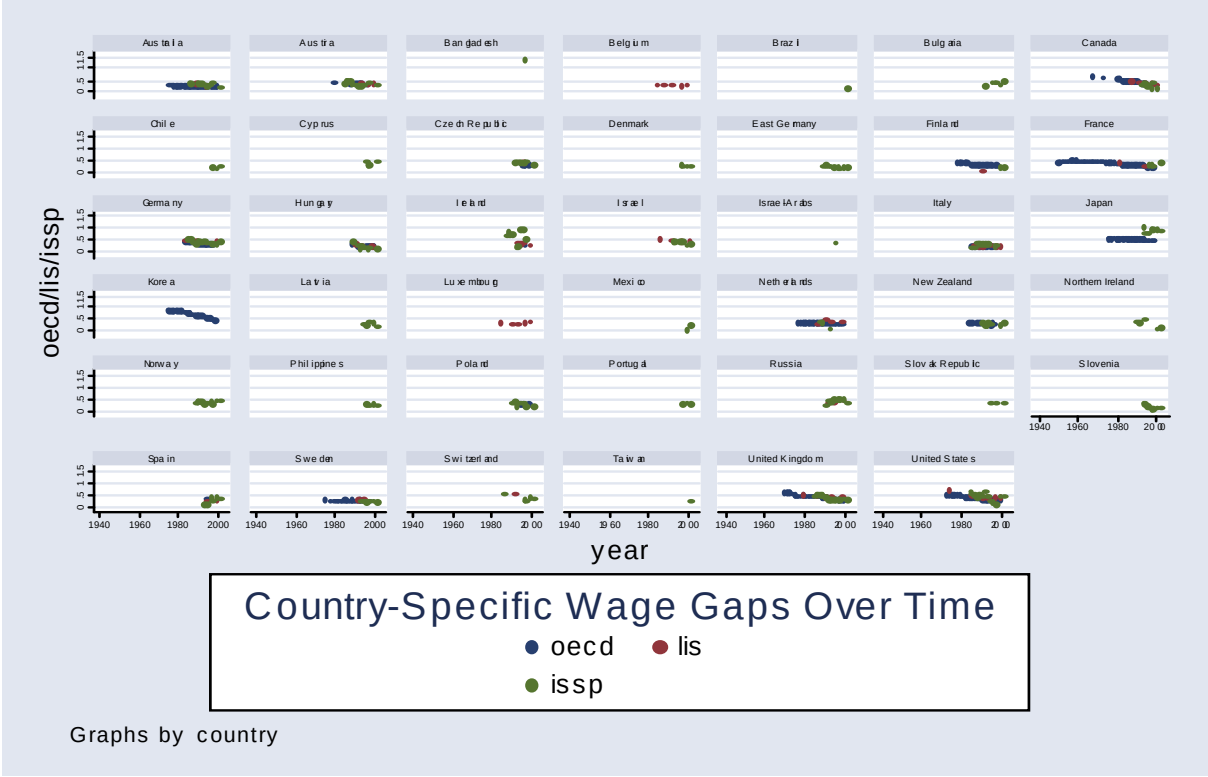
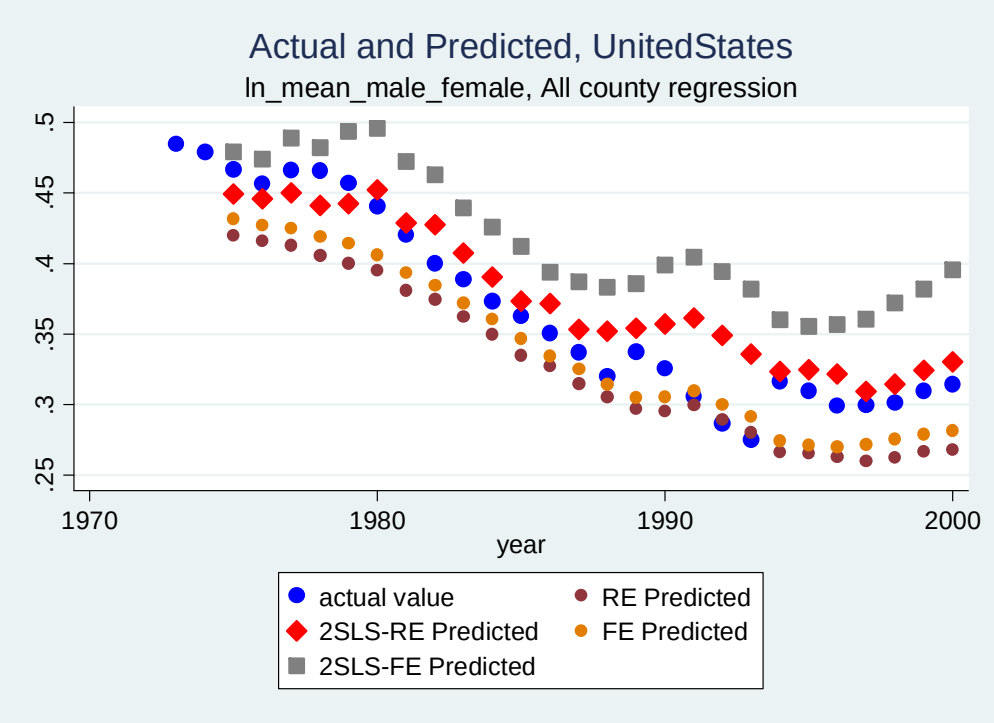
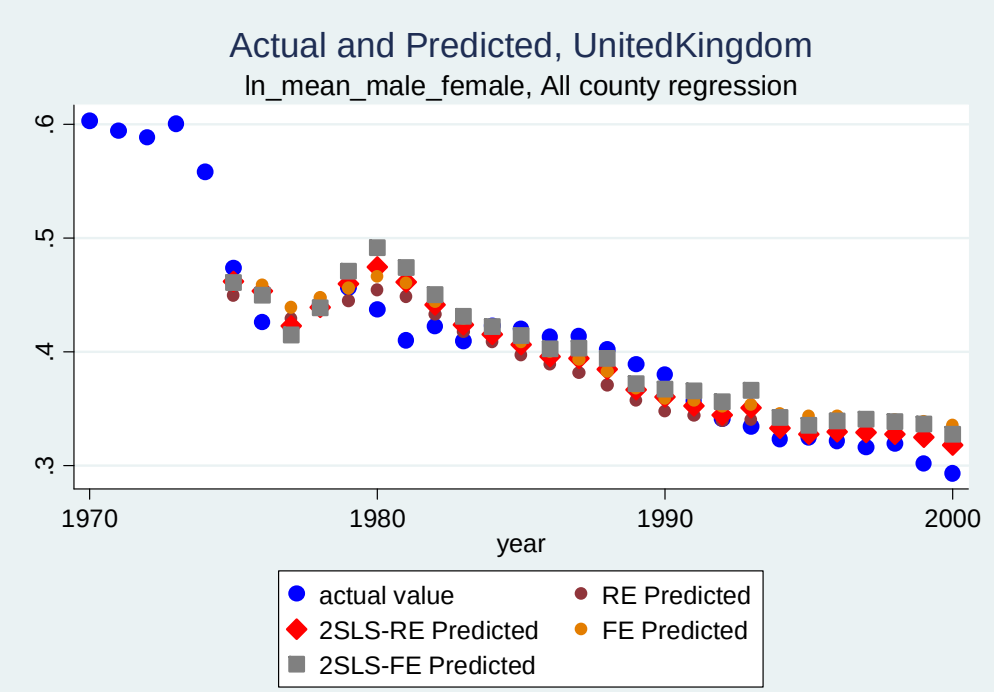
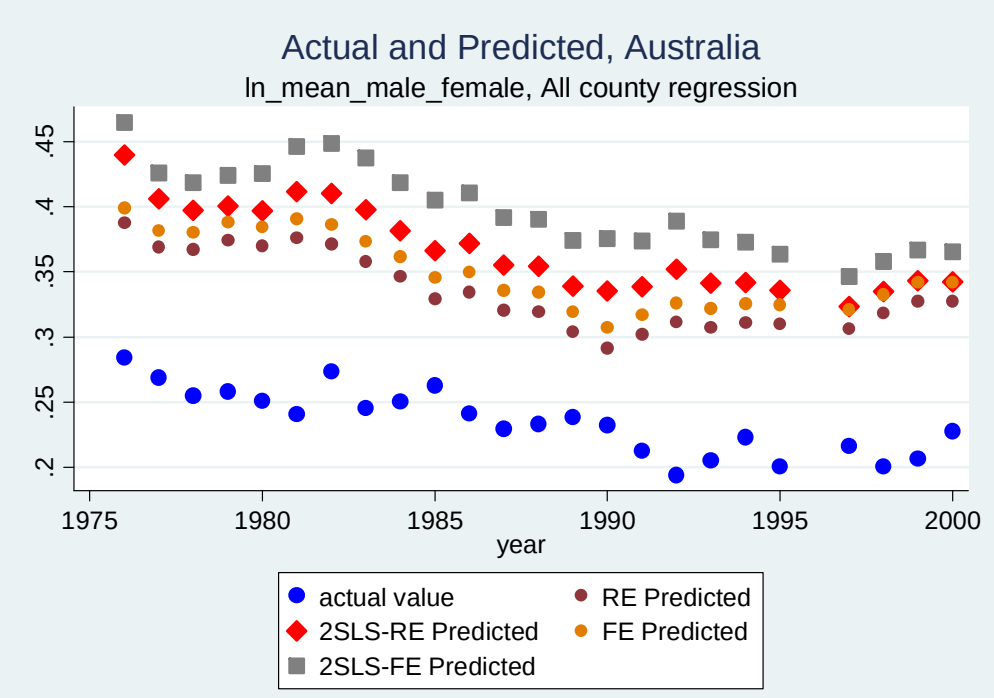
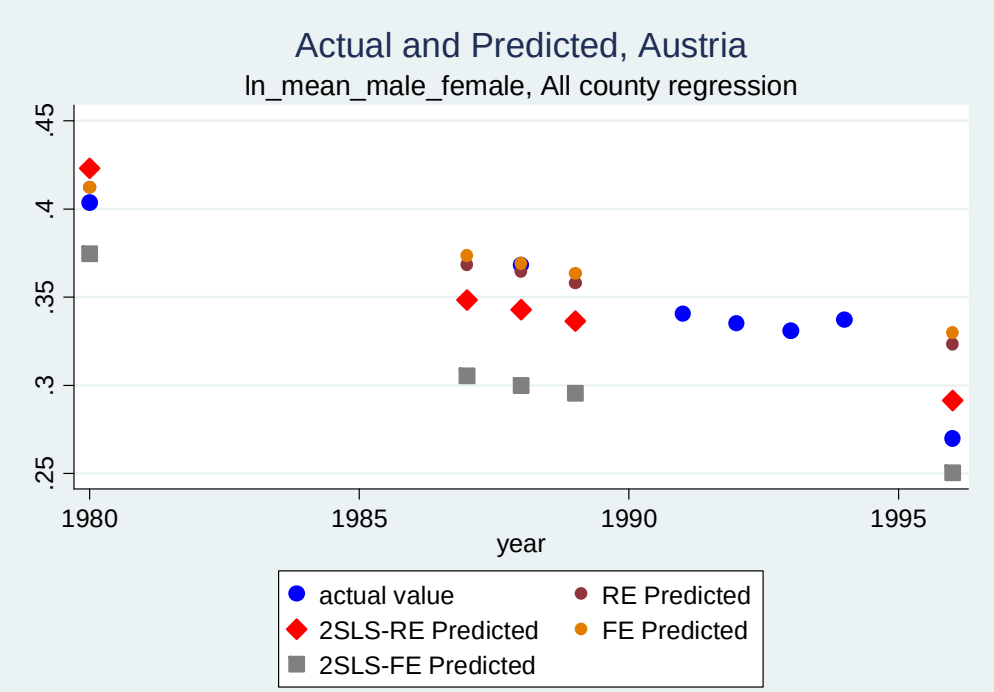


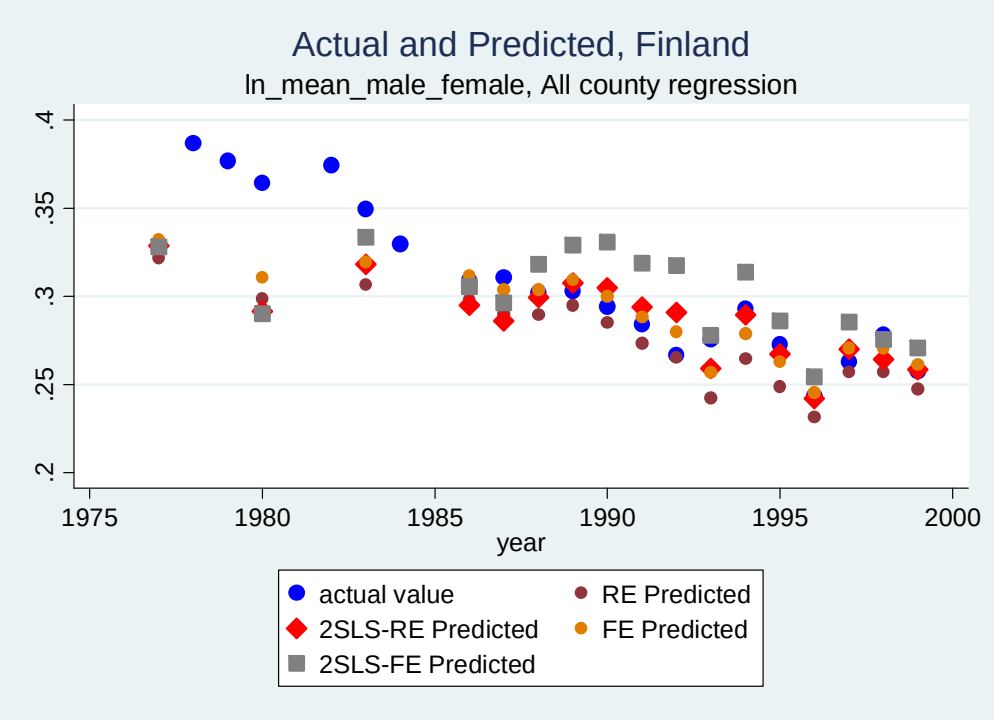
Figure 2
Actual and Predicted Estimates of the Gender Wage Gap for Selected Countries

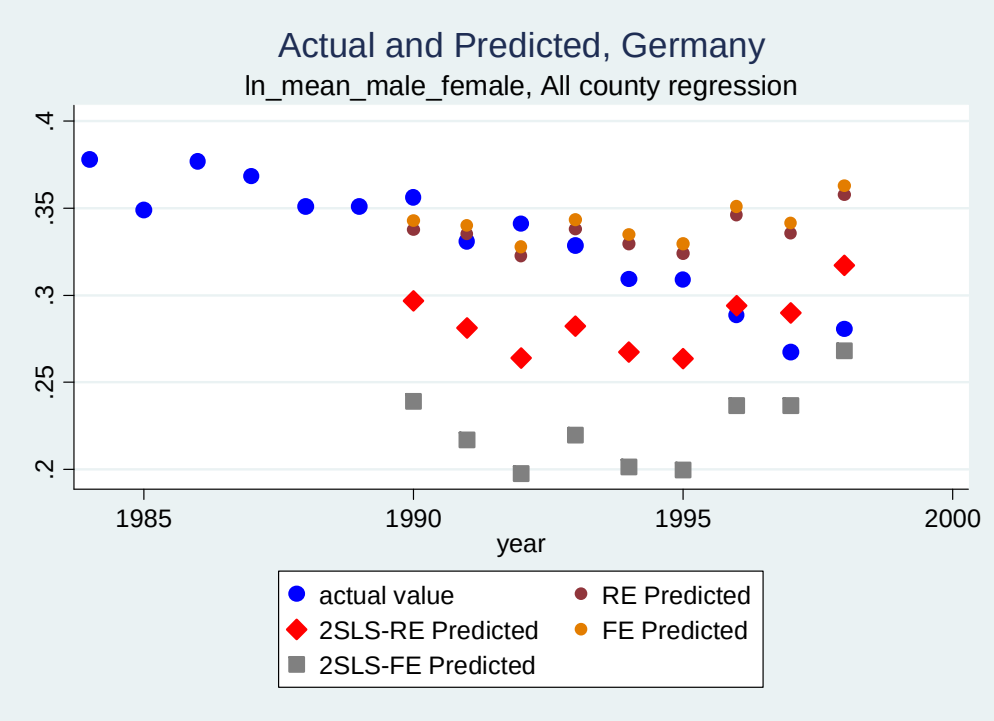


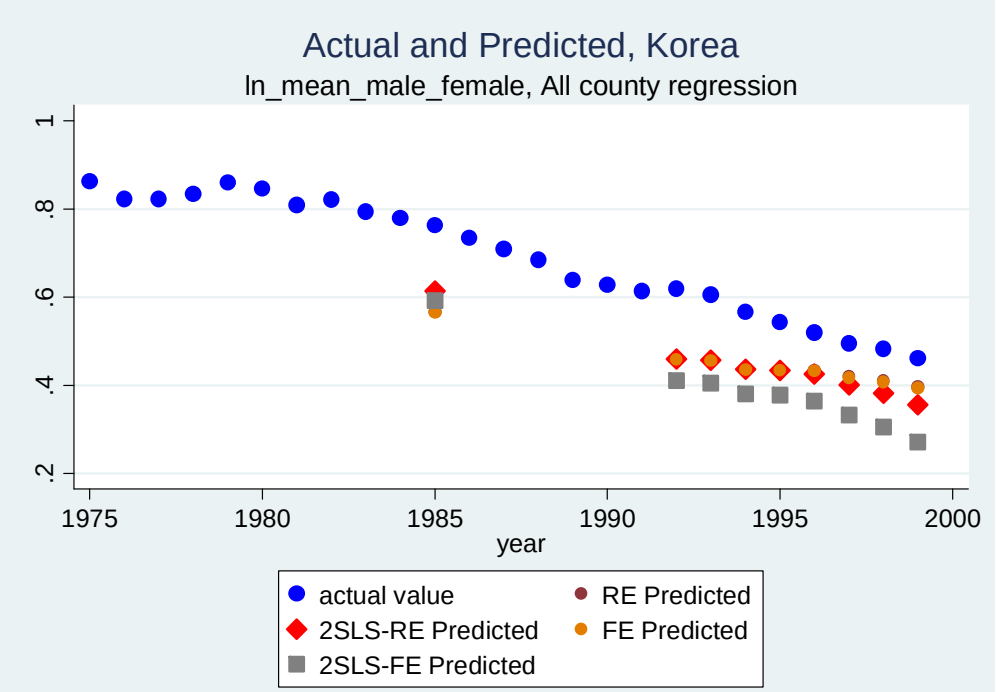

Actual and Predicted, UnitedKingdom
ln_mean_male_female, All county regression
.3
.4
.5
.6
1970
1980
1990
2000
year
actual value
RE Predicted
2SLS-RE Predicted
FE Predicted
2SLS-FE Predicted

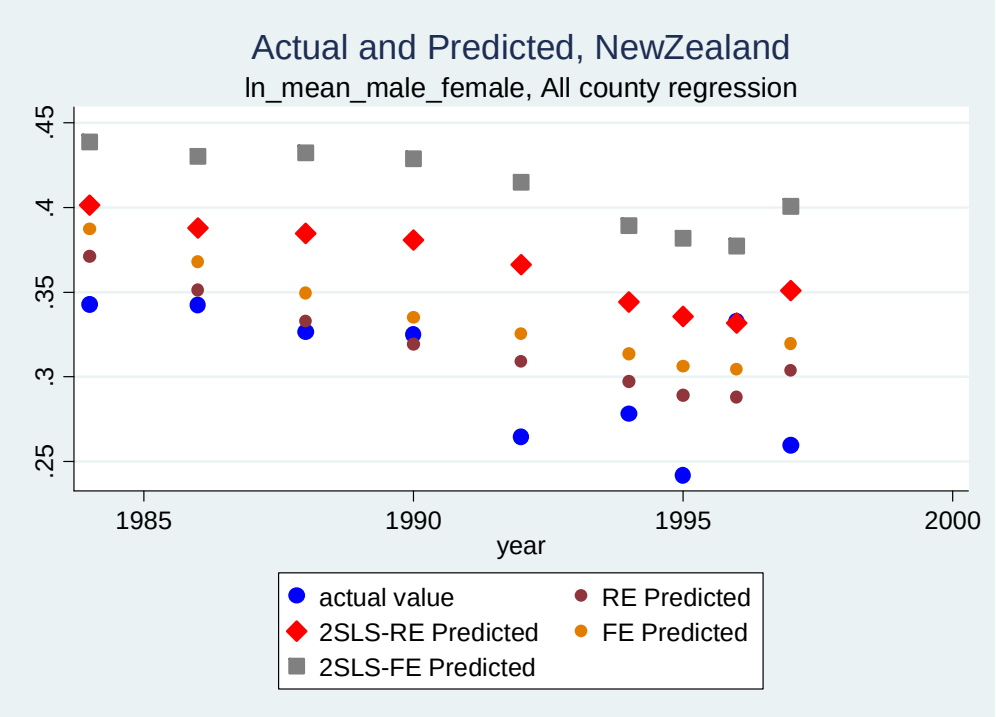

Actual and Predicted, Australia
ln_mean_male_female, All county regression
.2
.25
.3
.35
.4
.45
1975
1980
1985
1990
1995
2000
year
actual value
RE Predicted
2SLS-RE Predicted
FE Predicted
2SLS-FE Predicted


Actual and Predicted, Austria
ln_mean_male_female, All county regression
.25
.3
.35
.4
.45
1980
1985
1990
1995
year
actual value
RE Predicted
2SLS-RE Predicted
FE Predicted
2SLS-FE Predicted


Actual and Predicted, Finland
ln_mean_male_female, All county regression
.2
.25
.3
.35
.4
1975
1980
1985
1990
1995
2000
year
actual value
RE Predicted
2SLS-RE Predicted
FE Predicted
2SLS-FE Predicted


Actual and Predicted, Germany
ln_mean_male_female, All county regression
.2
.25
.3
.35
.4
1985
1990
1995
2000
year
actual value
RE Predicted
2SLS-RE Predicted
FE Predicted
2SLS-FE Predicted


Actual and Predicted, Korea
ln_mean_male_female, All county regression
1
.8
.6
.4
.2
1975
1980
1985
1990
1995
2000
year
actual value
RE Predicted
2SLS-RE Predicted
FE Predicted
2SLS-FE Predicted


Actual and Predicted, NewZealand
ln_mean_male_female, All county regression
.45
.4
.35
.3
.25
1985
1990
1995
2000
year
actual value
RE Predicted
2SLS-RE Predicted
FE Predicted
2SLS-FE Predicted

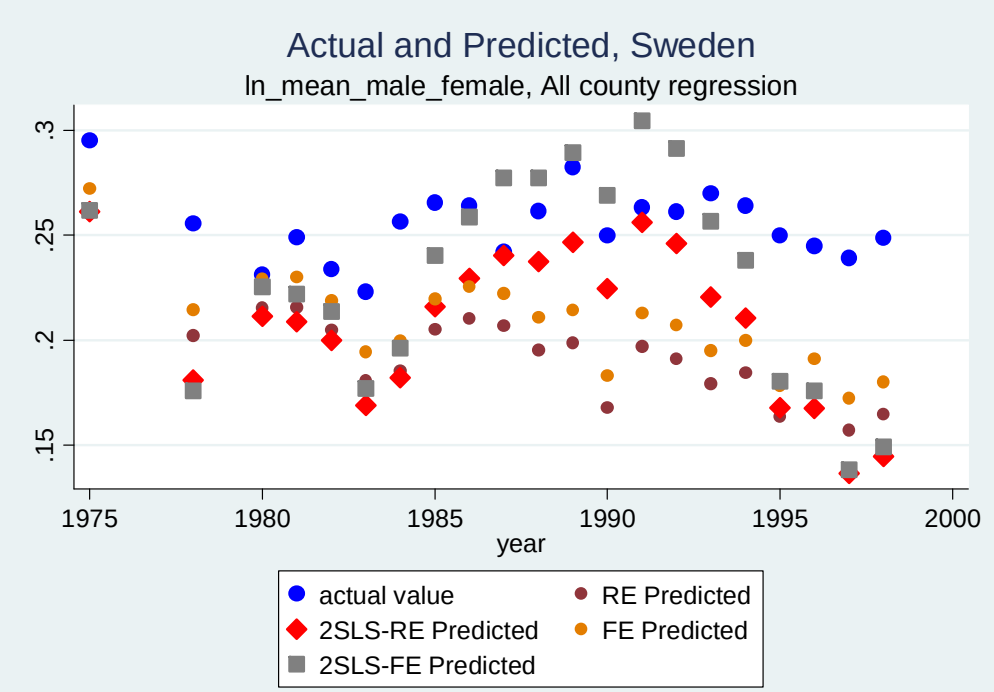

Actual and Predicted, Sweden
ln_mean_male_female, All county regression
.15
.2
.25
.3
1975
1980
1985
1990
1995
2000
year
actual value
2SLS-RE Predicted
2SLS-FE Predicted
RE Predicted
FE Predicted

Table 1
SINGULATE MEAN AGE AT MARRIAGE
BY COUNTRY

Country	Year of census or survey	Men SMAM	Women SMAM	SMAM Difference (Men - Women)
Australia	1994	29.2	27	2.2
Austria	1991	28.9	26.1	2.8
Bangladesh	1991	24.9	18.1	6.8
Belgium	1995	28.6	26.2	2.4
Brazil	1991	25.8	22.7	3.1
Bulgaria	1985	24.9	21.1	3.8
Canada	1994	28.9	26.2	2.7
Chile	1992	25.8	23.4	2.4
Cyprus	1992	27	23.1	3.9
Czech Republic	1994	26	23	3
Denmark	1995	27.7	25	2.7
Finland	1996	31.9	29.6	2.3
France	1990	29.8	27.7	2.1
Germany	1996	31.8	29	2.8
Hungary	1994	27.1	23.8	3.3
Ireland	1996	30	28.7	1.3
Israel	1993	25.5	24.3	1.2
Italy	1991	29.3	26.1	3.2
Japan	1990	30.3	26.9	3.4
Korea	1995	29.3	26.1	3.2
Latvia	1989	24.3	22	2.3
Luxembourg	1991	28.5	26	2.5
Mexico	1990	24.6	22.4	2.2
Netherlands	1995	28.8	26.1	2.7
New Zealand	1991	28.8	26.8	2
Northern Ireland	1996	30	28.7	1.3
Norway	1997	32.9	28.4	4.5
Philippines	1990	26.3	23.8	2.5
Poland	1990	26.2	23	3.2
Portugal	1991	26.7	23.9	2.8
Russia	1989	24.3	21.6	2.7
Slovak Republic	1991	25.5	22.6	2.9
Slovenia	1991	28.5	24.8	3.7
Spain	1991	28.5	26.1	2.4
Sweden	1997	34	31.8	2.2
Switzerland	1994	26	22.4	3.6
United Kingdom	1991	28.4	26.4	2
United States	1995	28.7	26	2.7

Source: United Nations (2000) World Marriage Patterns, Population Division, Department of Economic andSocial Affairs

Table 2A: Correlation Matrix of Gender Pay Gaps based on the 50th Percentile Measure

	ISSP	OECD	LIS
ISSP	1.0000		
	250		
OECD	0.5777	1.0000	
	0.0000		
	103	292	
LIS	0.3633	0.8025	1.0000
	0.0377	0.0000	
	33	41	71

Note: The first number is correlation coefficient, the second one is P value, and the last one is number of observations.

Table 2B: Correlation Matrix of Gender Pay Gaps based on the Mean Measure

	ISSP	OECD	LIS
ISSP	1.0000		
	250		
OECD	0.6919	1.0000	
	0.0000		
	97	322	
LIS	0.3138	0.7454	1.0000
	0.0754	0.0000	
	33	39	71

Note: The first number is correlation coefficient, the second one is P value, and the last one is number of observations.
b): Data sources refer to Appendix 3 and Appendix 5.

Table 3: Variable Summaries based on each data set

	OECD		LIS		ISSP		TOTAL				
Variable	Number of Observations	Mean	Number of Observations	Mean	Number of Observations	Mean	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Gender Pay Gap_50th	292	0.306	71	0.31	250	0.328	613	0.315	0.162	0.19	1.79
Gender Pay Gap_Mean	322	0.374	71	0.338	250	0.341	643	0.357	0.15	0.032	1.36
Fertility Rate	341	1.77	71	1.67	200	1.68	612	1.73	0.381	1.09	3.71
Age Gap at the First Marriage	330	2.62	70	2.52	204	2.71	604	2.64	0.543	1.2	6.8
Top Marginal Income Tax Rate	312	58	70	53	222	47	604	53	12.4	13	89
Female Educational Attainment	304	0.859	62	0.963	204	1.02	570	0.926	0.237	0.21	1.77
Bargianing Centralization	201	0.264	24	0.217	59	0.27	284	0.261	0.16	0.071	0.647
Economic Competition	331	6.8	70	7.1	227	6.9	628	6.9	0.96	3.6	8.6
Public Employment Ratio	275	10.98	44	10.58	114	11.46	433	11.07	4.41	5.57	24.97
90/10 Male Wage Gap	243	3.00	36	3.08	87	3.22	366	3.06	0.684	2.02	4.75
90/10 Female Wage Gap	253	2.70	38	2.89	90	2.97	381	2.78	0.626	1.64	4.29
Parental Leave	38	28.26	6	23.5	13	30.77	57	28.33	16.879	10	68

Note:

a) Variable Definitions:

Gender Pay Gap_50th: The difference between log of males' median wage and log of females' median wage based on the full-time sample.

Gender Pay Gap_Mean: The difference between log of males' mean wage and log of females' mean wage based on the full-time sample.

Fertility Rate: Births per women.

Age Gap at the First Marriage: Mean age gap between husband and wife at the first marriage.

Top Marginal Income Tax Rate: Top marginal income tax rate as a percentage.

Female Educational Attainment: The ratio of females-to-males at the "third level" post-secondary education level.

Bargaining Centralization: An index of the degree to which collective bargaining is centralized.

Economic Competition: The Economic Freedom Index.

Public Employment Ratio: Civilian government employment as a percentage of the working age population (15-64).

b) Precise definitions and data sources are given in Appendix 3 and Appendix 5.

Table 4: Effects of Women's Incentive for Labor Force Participation on the Gender Pay Gap, Based on the OECD, LIS, and ISSP data

OECD, LIS ISSP, ln_mean_male_female

	Model 1				Model 2				Model 3				Model 4			
	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS
fertility_wb	0.0977***	0.348***	0.0879***	0.204***	0.0787***	0.307***	0.0731***	0.167***	0.0607	0.392***	-0.0353	0.105	0.0342	0.162**	0.00771	0.137
	(0.0227)	(0.0497)	(0.0258)	(0.0413)	(0.0228)	(0.0512)	(0.0268)	(0.0420)	(0.0465)	(0.114)	(0.0676)	(0.145)	(0.0322)	(0.0667)	(0.0386)	(0.0914)
marriage_age_	0.0806***	0.0635***	0.0409	0.0388	0.0602***	0.0494**	0.0211	0.0214	-0.00975	0.0203	-0.00878	-0.0163	0.0284	0.0487*	0.0271	0.0278
	(0.0201)	(0.0220)	(0.0268)	(0.0273)	(0.0215)	(0.0230)	(0.0314)	(0.0318)	(0.0271)	(0.0325)	(0.0347)	(0.0357)	(0.0226)	(0.0259)	(0.0313)	(0.0319)
top_marg_incor	0.00239***	0.00164**	0.00280***	0.00236***	0.000346	0.000367	0.00145*	0.00144*	0.00177*	0.00408***	0.00113	0.00276	0.00162**	0.00196*	0.00171	0.00280**
	(0.000465)	(0.000530	(0.000497)	(0.000522	(0.000656)	(0.000709)	(0.000820	(0.000831	(0.000983	(0.00132)	(0.00130)	(0.00199)	(0.000696	(0.00076	(0.00105	(0.00128)
school_t_f_m					-0.275***	-0.190***	-0.191**	-0.147*	-0.246***	-0.158*	0.0819	0.206	-0.205***	-0.139**	-0.104	-0.00188
					(0.0628)	(0.0693)	(0.0848)	(0.0872)	(0.0673)	(0.0839)	(0.166)	(0.202)	(0.0601)	(0.0692)	(0.0941)	(0.116)
centralization									-0.107*	0.00820	-0.0606	-0.00811				
									(0.0571)	(0.0724)	(0.0767)	(0.0910)				
freedom_index									0.0308	0.0468*	-0.0554	-0.0525				
									(0.0215)	(0.0257)	(0.0367)	(0.0372)				
public_emp_rat									-0.00146	-0.0108**	-0.00481	-0.0117				
									(0.00307)	(0.00452)	(0.00732)	(0.00968)				
lis_dummy	0.0323**	0.0305**	0.0334**	0.0323**	0.0334**	0.0299**	0.0339**	0.0322**	0.0248	0.0324*	0.0411**	0.0405**	0.0512***	0.0526***	0.0539**	0.0531***
	(0.0133)	(0.0148)	(0.0133)	(0.0136)	(0.0138)	(0.0152)	(0.0139)	(0.0141)	(0.0173)	(0.0189)	(0.0166)	(0.0168)	(0.0135)	(0.0137)	(0.0135)	(0.0137)
issp_dummy	0.0534***	0.0512***	0.0565***	0.0556***	0.0581***	0.0547***	0.0604***	0.0590***	0.0751***	0.0848***	0.0800***	0.0811***	0.0703***	0.0714***	0.0716**	0.0722***
	(0.0100)	(0.0112)	(0.0100)	(0.0103)	(0.0103)	(0.0114)	(0.0104)	(0.0106)	(0.0129)	(0.0142)	(0.0121)	(0.0122)	(0.00971)	(0.00986	(0.00962	(0.00979)
ln90_10male													0.919***	1.020***	0.720***	0.933***
													(0.179)	(0.197)	(0.247)	(0.286)
ln90_10female													0.618***	0.768***	0.496*	0.689**
													(0.193)	(0.215)	(0.258)	(0.290)
int_ln90_10mf													-0.674***	-0.793***	-0.589***	-0.757***
													(0.148)	(0.164)	(0.188)	(0.220)
Constant	-0.195***	-0.545***	-0.0727	-0.242***	0.265**	-0.185	0.254	0.0531	0.207	-0.679*	0.744**	0.361	-0.584**	-1.049***	-0.376	-0.983*
	(0.0679)	(0.0945)	(0.0745)	(0.0889)	(0.127)	(0.162)	(0.160)	(0.176)	(0.241)	(0.390)	(0.290)	(0.455)	(0.252)	(0.338)	(0.367)	(0.539)
Observations	542	542	542	542	514	514	514	514	238	238	238	238	348	348	348	348
R-squared	.	.	0.153	.	.	.	0.161	.	.	.	0.225	.	.	.	0.279	.
Number of cour	35	35	35	35	34	34	34	34	15	15	15	15	21	21	21	21

Note:

a): *** denotes P<.01, **denotes P< .05, * denotes P< .10. Standard errors are in parentheses.

b): Robust standard errors are experimented, and the statistical significance of the variables holds in most cases, despite of small fall in the t-values.

OECD, LIS, ISSP, ln_50_male_female

	Model 1				Model 2				Model 3				Model 4			
	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS
fertility_wb	0.109***	0.511***	0.0593	0.475***	0.0847**	0.408***	0.0315	0.291**	-0.0144	0.592***	-0.137	-0.0699	0.0823**	0.189***	0.0654*	0.196**
	(0.0340)	(0.0804)	(0.0422)	(0.118)	(0.0337)	(0.0791)	(0.0448)	(0.123)	(0.0632)	(0.228)	(0.0851)	(0.188)	(0.0327)	(0.0691)	(0.0381)	(0.0915)
marriage_a	0.138***	0.124***	0.0897***	0.109***	0.116***	0.110***	0.0756*	0.0962**	0.0699*	0.0846*	0.0814*	0.0744	0.0505**	0.0644**	0.0410	0.0421
	(0.0242)	(0.0267)	(0.0328)	(0.0363)	(0.0258)	(0.0274)	(0.0388)	(0.0412)	(0.0366)	(0.0445)	(0.0439)	(0.0473)	(0.0236)	(0.0261)	(0.0310)	(0.0315)
top_marg_i	0.00184***	0.00158**	0.00246***	0.00173**	-0.000794	3.08e-05	0.000405	0.00103	0.00156	0.00766***	1.31e-06	0.000989	0.00185**	0.00220***	0.00223**	0.00332***
	(0.000564)	(0.000638	(0.000604)	(0.000688)	(0.000809)	(0.000890)	(0.00104)	(0.00111)	(0.00133)	(0.00271)	(0.00183)	(0.00307)	(0.000709	(0.000769)	(0.00103)	(0.00125)
school_t_f_					-0.348***	-0.229***	-0.272**	-0.142	-0.151	0.0534	-0.0121	0.0546	-0.187***	-0.128*	-0.0695	0.0330
					(0.0758)	(0.0850)	(0.105)	(0.123)	(0.0989)	(0.141)	(0.204)	(0.264)	(0.0628)	(0.0714)	(0.0926)	(0.114)
centralizatic									-0.0535	0.182	-0.0887	-0.0633				
									(0.0789)	(0.126)	(0.0924)	(0.112)				
freedom_in									0.0258	0.0934**	-0.0362	-0.0321				
									(0.0290)	(0.0435)	(0.0446)	(0.0459)				
public_emp									0.00143	-0.0193**	0.00612	0.00233				
									(0.00483)	(0.00945)	(0.00904)	(0.0131)				
lis_dummy	0.0293**	0.0300*	0.0293**	0.0302*	0.0287*	0.0271	0.0281*	0.0271*	0.0505***	0.0512**	0.0554***	0.0554***	0.0478***	0.0482***	0.0492***	0.0484***
	(0.0149)	(0.0169)	(0.0148)	(0.0163)	(0.0154)	(0.0169)	(0.0155)	(0.0160)	(0.0187)	(0.0220)	(0.0182)	(0.0182)	(0.0132)	(0.0133)	(0.0130)	(0.0133)
issp_dumm	0.0596***	0.0604***	0.0623***	0.0635***	0.0637***	0.0624***	0.0649***	0.0640***	0.0625***	0.0698***	0.0623***	0.0630***	0.0671***	0.0675***	0.0678***	0.0683***
	(0.0114)	(0.0129)	(0.0114)	(0.0125)	(0.0117)	(0.0128)	(0.0118)	(0.0122)	(0.0143)	(0.0171)	(0.0140)	(0.0141)	(0.00946)	(0.00953)	(0.00935)	(0.00952)
ln90_10ma													1.079***	1.170***	0.900***	1.113***
													(0.182)	(0.199)	(0.237)	(0.277)
ln90_10fem													1.027***	1.153***	0.929***	1.124***
													(0.197)	(0.217)	(0.250)	(0.282)
int_ln90_1(													-0.928***	-1.030***	-0.861***	-1.030***
													(0.151)	(0.166)	(0.183)	(0.215)
Constant	-0.361***	-1.006***	-0.171	-0.884***	0.211	-0.488**	0.280	-0.367	-0.00445	-1.890**	0.551	0.345	-1.073***	-1.462***	-0.914**	-1.524***
	(0.0904)	(0.150)	(0.106)	(0.220)	(0.160)	(0.229)	(0.214)	(0.360)	(0.324)	(0.778)	(0.382)	(0.640)	(0.257)	(0.347)	(0.354)	(0.528)
Observatio	528	528	528	528	500	500	500	500	232	232	232	232	366	366	366	366
R-squared	.	.	0.115	.	.	.	0.132	.	.	.	0.170	.	.	.	0.314	.
Number of	35	35	35	35	34	34	34	34	15	15	15	15	21	21	21	21

Note:

a): *** denotes P<.01, **denotes P< .05, * denotes P< .10. Standard errors are in parentheses.

b): Robust standard errors are experimented, and the statistical significance of the variables holds in most cases, despite of small fall in the t-values.

Table 5: Effects of Women's Incentive for Labor Force Participation on the Gender Pay Gap, Based on the OECD data

OECD, ln_mean_male_female

	Model 1				Model 2				Model 3				Model 4			
	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS
fertility_wb	0.129***	0.225***	0.128***	0.199***	0.119***	0.208***	0.120***	0.176***	0.0675**	0.259***	0.0740**	0.231***	0.0687***	0.179***	0.0720***	0.195***
	(0.0114)	(0.0190)	(0.0115)	(0.0173)	(0.0114)	(0.0189)	(0.0115)	(0.0167)	(0.0285)	(0.0916)	(0.0297)	(0.0633)	(0.0161)	(0.0366)	(0.0169)	(0.0379)
marriage_a	0.0357***	0.0304**	0.0322**	0.0245	0.0191	0.0168	0.0134	0.00693	0.000575	-0.0107	0.00344	-0.0114	0.00746	0.0193	-0.00161	-0.00272
	(0.0138)	(0.0154)	(0.0146)	(0.0157)	(0.0159)	(0.0176)	(0.0173)	(0.0182)	(0.0179)	(0.0210)	(0.0187)	(0.0212)	(0.0150)	(0.0167)	(0.0171)	(0.0193)
top_marg_i	0.00312***	0.00281***	0.00315***	0.00294***	0.00239***	0.00249***	0.00271***	0.00286***	0.00282***	0.00496***	0.00300***	0.00485***	0.00183***	0.00250***	0.00193***	0.00296***
	(0.000232)	(0.000265)	(0.000235)	(0.000254)	(0.000393)	(0.000436)	(0.000414)	(0.000435)	(0.000560)	(0.00115)	(0.000581)	(0.000903)	(0.000415)	(0.000496)	(0.000457)	(0.000586)
school_t_f_					-0.107***	-0.0607	-0.0727*	-0.0368	-0.0502	0.102	-0.0117	0.137	-0.202***	-0.134***	-0.188***	-0.0896*
					(0.0394)	(0.0444)	(0.0418)	(0.0444)	(0.0713)	(0.106)	(0.0860)	(0.107)	(0.0373)	(0.0456)	(0.0415)	(0.0536)
centralizatic									-0.0490	0.0224	-0.0441	0.0125				
									(0.0322)	(0.0484)	(0.0325)	(0.0406)				
freedom_in									0.00547	0.0105	0.00149	0.00203				
									(0.0158)	(0.0185)	(0.0190)	(0.0209)				
public_emp									-0.0113***	-0.0206***	-0.0142***	-0.0222***				
									(0.00289)	(0.00522)	(0.00329)	(0.00454)				
ln90_10mal													0.837***	0.955***	0.859***	1.016***
													(0.0959)	(0.111)	(0.104)	(0.125)
ln90_10fem													0.709***	0.833***	0.738***	0.901***
													(0.105)	(0.122)	(0.113)	(0.135)
int_ln90_10													-0.640***	-0.740***	-0.668***	-0.803***
													(0.0776)	(0.0909)	(0.0826)	(0.0999)
Constant	-0.142***	-0.269***	-0.126***	-0.217***	0.0530	-0.134	0.0272	-0.0934	0.207*	-0.295	0.208	-0.198	-0.626***	-1.075***	-0.638***	-1.175***
	(0.0428)	(0.0503)	(0.0377)	(0.0432)	(0.0768)	(0.0902)	(0.0772)	(0.0847)	(0.125)	(0.267)	(0.129)	(0.199)	(0.143)	(0.204)	(0.153)	(0.224)
Observatior	287	287	287	287	266	266	266	266	157	157	157	157	218	218	218	218
R-squared	.	.	0.637	.	.	.	0.658	.	.	.	0.560	.	.	.	0.656	.
Number of	19	19	19	19	19	19	19	19	12	12	12	12	19	19	19	19

Note:

a): *** denotes P<.01, **denotes P< .05, * denotes P< .10. Standard errors are in parentheses.

b): Robust standard errors are experimented, and the statistical significance of the variables holds in most cases, despite of small fall in the t-values.

OECD, LIS, ISSP, ln_50_male_female

	Model 1				Model 2				Model 3				Model 4			
	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS	RE	RE-2SLS	FE	FE-2SLS
fertility_wb	0.109***	0.511***	0.0593	0.475***	0.0847**	0.408***	0.0315	0.291**	-0.0144	0.592***	-0.137	-0.0699	0.0823**	0.189***	0.0654*	0.196**
	(0.0340)	(0.0804)	(0.0422)	(0.118)	(0.0337)	(0.0791)	(0.0448)	(0.123)	(0.0632)	(0.228)	(0.0851)	(0.188)	(0.0327)	(0.0691)	(0.0381)	(0.0915)
marriage_a	0.138***	0.124***	0.0897***	0.109***	0.116***	0.110***	0.0756*	0.0962**	0.0699*	0.0846*	0.0814*	0.0744	0.0505**	0.0644**	0.0410	0.0421
	(0.0242)	(0.0267)	(0.0328)	(0.0363)	(0.0258)	(0.0274)	(0.0388)	(0.0412)	(0.0366)	(0.0445)	(0.0439)	(0.0473)	(0.0236)	(0.0261)	(0.0310)	(0.0315)
top_marg_i	0.00184***	0.00158**	0.00246***	0.00173**	-0.000794	3.08e-05	0.000405	0.00103	0.00156	0.00768***	1.31e-06	0.000989	0.00185**	0.00220***	0.00223**	0.00332***
	(0.000564)	(0.000638	(0.000604)	(0.000688)	(0.000809)	(0.000890)	(0.00104)	(0.00111)	(0.00133)	(0.00271)	(0.00183)	(0.00307)	(0.000709	(0.000769)	(0.00103)	(0.00125)
school_t_f_					-0.348***	-0.229***	-0.272**	-0.142	-0.151	0.0534	-0.0121	0.0546	-0.187***	-0.128*	-0.0695	0.0330
					(0.0758)	(0.0850)	(0.105)	(0.123)	(0.0989)	(0.141)	(0.204)	(0.264)	(0.0628)	(0.0714)	(0.0926)	(0.114)
centralizatic									-0.0535	0.182	-0.0887	-0.0633				
									(0.0789)	(0.126)	(0.0924)	(0.112)				
freedom_in									0.0258	0.0934**	-0.0362	-0.0321				
									(0.0290)	(0.0435)	(0.0446)	(0.0459)				
public_emp									0.00143	-0.0193**	0.00612	0.00233				
									(0.00483)	(0.00945)	(0.00904)	(0.0131)				
lis_dummy	0.0293**	0.0300*	0.0293**	0.0302*	0.0287*	0.0271	0.0281*	0.0271*	0.0505***	0.0512**	0.0554***	0.0554***	0.0478***	0.0482***	0.0492***	0.0484***
	(0.0149)	(0.0169)	(0.0148)	(0.0163)	(0.0154)	(0.0169)	(0.0155)	(0.0160)	(0.0187)	(0.0220)	(0.0182)	(0.0182)	(0.0132)	(0.0133)	(0.0130)	(0.0133)
issp_dumm	0.0596***	0.0604***	0.0623***	0.0635***	0.0637***	0.0624***	0.0649***	0.0640***	0.0625***	0.0698***	0.0623***	0.0630***	0.0671***	0.0675***	0.0678***	0.0683***
	(0.0114)	(0.0129)	(0.0114)	(0.0125)	(0.0117)	(0.0128)	(0.0118)	(0.0122)	(0.0143)	(0.0171)	(0.0140)	(0.0141)	(0.00946)	(0.00953)	(0.00935)	(0.00952)
ln90_10ma													1.079***	1.170***	0.900***	1.113***
													(0.182)	(0.199)	(0.237)	(0.277)
ln90_10fem													1.027***	1.153***	0.929***	1.124***
													(0.197)	(0.217)	(0.250)	(0.282)
int_ln90_1(													-0.928***	-1.030***	-0.861***	-1.030***
													(0.151)	(0.166)	(0.183)	(0.215)
Constant	-0.361***	-1.006***	-0.171	-0.884***	0.211	-0.488**	0.280	-0.367	-0.00445	-1.890**	0.551	0.345	-1.073***	-1.462***	-0.914**	-1.524***
	(0.0904)	(0.150)	(0.106)	(0.220)	(0.160)	(0.229)	(0.214)	(0.360)	(0.324)	(0.778)	(0.382)	(0.640)	(0.257)	(0.347)	(0.354)	(0.528)
Observatio	528	528	528	528	500	500	500	500	232	232	232	232	366	366	366	366
R-squared	.	.	0.115	.	.	.	0.132	.	.	.	0.170	.	.	.	0.314	.
Number of	35	35	35	35	34	34	34	34	15	15	15	15	21	21	21	21

Note:

a): *** denotes P<.01, **denotes P< .05, * denotes P< .10. Standard errors are in parentheses.

b): Robust standard errors are experimented, and the statistical significance of the variables holds in most cases, despite of small fall in the t-values.

Table 6: The Effect of Top Marginal Income Tax Rate on the Gender Pay Gap Measured at Different Percentiles

	10th	20th	25th	30th	40th	50th	60th	70th	75th	80th	90th
Marginal Income Tax Rate	-.0002	.0002	.0015***	.0004	.0007	.0012***	.0019***	.0022***	.0035***	.0021***	.0010
	(.0007)	(.0005)	(.0006)	(.0005)	(.0005)	(.0004)	(.0005)	(.0005)	(.0006)	(.0005)	(.0006)
ntry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
nber of Observations	247	231	160	231	231	252	231	231	160	231	236
ability>F	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

Note:

a): *** denotes P<.01, **denotes P< .05, * denotes P< .10. Standard errors are in parentheses.

b): Robust standard errors are experimented, and the statistical significance of the variables holds, despite of small fall in the t-values.

c): In addition to top marginal income tax rate, the independent variables include fertility rate, age gap at the first marriage, and female educational attainment.

Table 7: Assessment of Model 3

	No Country Fixed Effects			Country Fixed Effects		
	Model 3 Mean Pay Gap			Model 3 Mean Pay Gap		
	Coefficient	Predicted	Explanatory	Coefficient	Predicted	Explanatory
Variable	Elasticity	Effect	Power	Elasticity	Effect	Power
Fertility rate	0.55	0.10	25.78	0.35	0.07	16.36
Age gap at first marriage	0.31	0.06	16.01	0.02	0.00	1.08
Top marginal tax rate	0.44	0.13	32.00	0.52	0.15	38.89
Female educ rel to male	0.71	0.22	47.47	0.03	0.01	2.15
Collective bargaining	0.21	0.14	31.31	0.03	0.02	5.42
Market competititon	1.20	0.19	49.83	0.44	0.27	57.15
Public employment	0.08	0.05	11.94	0.02	0.00	0.73

	Model 3 Median Pay Gap			Model 3 Median Pay Gap		
	Coefficient	Predicted	Explanatory	Coefficient	Predicted	Explanatory
Variable	Elasticity	Effect	Power	Elasticity	Effect	Power
Fertility rate	1.06	0.20	52.23	0.26	0.05	11.83
Age gap at first marriage	0.90	0.19	49.12	0.38	0.08	19.49
Top marginal tax rate	0.52	0.15	38.89	0.52	0.15	38.89
Female educ rel to male	0.80	0.25	52.98	0.03	0.01	1.97
Collective bargaining	0.18	0.12	26.88	0.04	0.03	6.51
Market competititon	1.69	0.27	73.15	0.12	0.02	4.39
Public employment	0.09	0.06	14.40	0.28	0.17	38.50

Appendix 1: Earnings Data Definitions, ISSP Data

Country	Years	Earnings definition
Australia	1986-87, 1990-92, 1994-96, 1998, 2002	Annual gross wage and salary income
Austria	1985-89, 1991-92, 1994-95, 1998, 2002	Monthly net earnings
Bangladesh	1997	Annual gross income
Brazil	2002	Monthly earnings
Bulgaria	1992, 1996-98, 2000, 2002	Monthly net earnings
Canada	1992-98, 2000	Annual gross personal income
Chile	1998, 2000, 2002	Monthly net income
Cyprus	1996-98, 2002	Monthly gross earnings
Czech Republic	1992, 1994-98, 2002	Monthly net income
Denmark	1997-98, 2000, 2002	Annual gross earnings
France	1996-98, 2002	Monthly earnings
East Germany	1990-93, 1995, 1997-98, 2000, 2002	Monthly net earnings
Germany (West)	1985-93, 1995, 1997-98, 2000, 2002	Monthly net earnings
Hungary	1990, 1992-98, 2002	Monthly net earnings
Ireland	1988-91, 1993-96, 1998	Annual gross earnings (1988-91, 1995-96); weekly net earnings (1993-94); weekly gross earnings (1998)
Israel	1993-94, 1996, 1998, 2000, 2002	Monthly net earnings
Italy	1986-94, 1997-98	Monthly net income
Japan	1993-98, 2000, 2002	Annual gross earnings
Latvia	1995-96, 1998, 2000, 2002	Monthly net income
Mexico	2000, 2002	Monthly earnings*
Netherlands	1988-89, 1993	Annual net earnings
New Zealand	1991-95, 2000, 2002	Annual gross income
Northern Ireland	1990-91, 1994, 2000, 2002	Annual gross earnings
Norway	1989-98, 2000, 2002	Annual gross earnings
Philippines	1996, 1998, 2000, 2002	Monthly earnings
Poland	1991-98, 2002	Monthly net earnings,
Portugal	1998, 2000, 2002	Monthly net income
Russia	1991-98, 2000, 2002	Monthly gross earnings
Slovak Republic	1995, 1998, 2002	Annual gross earnings
Slovenia	1993-98, 2000, 2002	Monthly net regular income
Spain	1993, 1995, 1997-98, 2000, 2002	Monthly gross earnings
Sweden	1994-98, 2000, 2002	Monthly gross earnings
Switzerland	1987, 1997-98, 2000, 2002	Monthly net income
Taiwan	2002	Monthly earnings*
United Kingdom	1985-98, 2000, 2002	Annual gross earnings
United States	1985-98, 2000, 2002	Annual gross earnings

Note:
a): All surveys are conducted by the ISSP group to its thirty-nine member countries.
b): The above data sample only includes country-years with both of the variables earnings and weekly working hours. Data are excluded for Australia (1985), Bulgaria (1993), Flanders (2002), Netherlands (1991, 1994-95), and Philippines (1992) because computed gender pay gaps in those country-years are negative which are inconsistent either with empirical evidence or with other years of data for that country. Data on Finland (2000, 2002) are also excluded because personal income is mixed with household income.
c): * denotes the information is not obtained directly from the codebooks, but is inferred from earnings data.
d): Gross earnings and net earnings refer to earnings before and after income taxes respectively.

Data Link: http://www.icpsr.com/ and search by "ISSP".

Appendix 2: Earnings Data Definitions, LIS Data

Country	Years	Earnings definition	Survey Name
Australia	1989, 1994	Annual gross wage/salary	Australian Income and Housing Survey
Austria	1994, 1997, 2000	Annual net wage/salary	European Community Household Panel (ECHP)
Belgium	1985, 1988, 1992, 1997, 2000	Annual net wage/salary (1985, 1988, and 2000); Annual gross wage/salary (1992 and 1997)	Socio-Economic Panel Survey (CBS -Centre for Social Policy) for 1997; Panel Study of Belgian Households (PSBH) for 2000
Canada	1987, 1991, 1994, 1997, 1998, 2000	Annual gross wage/salary	Survey of Consumer Finances for years before 1998; Survey of Labour and Income Dynamics for 1998 and 2000.
Czech Republic	1996	Annual gross wage/salary	Microcensus
Finland	1991	Annual gross wage/salary	Income Distribution Survey
France	1981, 1994	Annual net wage/salary	Family Budget Survey
Germany	1984, 1989, 1994, 2000	Annual gross wage/salary	German Social Economic Panel Study (GSOEP)
Hungary	1991, 1994, 1999	Annual net wage/salary	Hungarian Household Panel
Ireland	1994, 1995, 1996, 2000	Annual net wage/salary	European Community Household Panel (ECHP)
Israel	1986, 1992, 1997, 2001	Annual gross wage/salary	Family Expenditure Survey
Italy	1987, 1989, 1991, 1993, 1995, 1998, 2000	Annual net wage/salary	The Bank of Italy Survey (Indagine Campionaria sui Bilanci Delle Famiglie)
Luxembourg	1985, 1991, 1994, 1997, 2000	Annual net wage/salary	The Luxembourg Social Economic Panel Study "Liewen zu Letzebuerg"
Netherlands	1987, 1991, 1994, 1999	Annual gross wage/salary	Additional Enquiry on the Use of (Public) Services (AVO) for 1983; Socio-Economic Panel (SEP) for 1994 and 1999.
Russia	1992, 1995, 2000	Annual net wage/salary	Russian Longitudinal Monitoring Survey
Spain	1995, 2000	Annual net wage/salary	Expenditure and Income Survey
Sweden	1992, 1995	Annual gross wage/salary	Income Distribution Survey (Inkomstfördelningsundersokningen)
Switzerland	1992	Annual gross wage/salary	Swiss Poverty Survey
United Kingdom	1979, 1986, 1991, 1994, 1995, 1999	Annual gross wage/salary	The Family Expenditure Survey for 1991 and 1995; The Family Resources Survey for 1994 and 1999
United States	1974, 1986, 1991, 1994, 1997, 2000	Annual gross wage/salary	March Current Population Survey

Note:
a): The above data sample only includes country-years with both of the variables earnings and weekly working hours. Data of Mexico produce either negative or close to zero gender pay gaps that are inconsistent with empirical evidence, and they are omitted here.
b): Annual gross wage/salary includes cash wage and salary income, including employer bonuses, 13th month bonus, etc. It is recorded gross of employee social insurance contributions/taxes but net of employer social insurance contributions/taxes. In some cases employer provided sick pay is included in the wages.
Annual net wage/salary is the amount after taxes.

Data Link: http://www.lisproject.org/techdoc.htm

Appendix 3: Earnings Data Definitions and sources, OECD Statistics

Country	Years	Earnings definition	Original source	Publication/data provider
Australia	1976-95, 1997-2000	Gross weekly earnings in main job (all jobs prior to 1988) of full-time employees.	Household survey (annual supplement, usually in August, to monthly labour force survey).	Australian Bureau of Statistics, *Weekly Earnings of Employees (Distribution)*.
Austria	1980, 1987-94, 1996	Gross daily earnings, standardized to a monthly basis, taking into account the recorded number of days of insurance contributions (excluding civil servants).	Social security data.	Austrian Central Statistical Office.
Belgium	1985-95	Gross weekly earnings of full-time workers (including civil servants).	Social security data.	Belgium Institut national d'assurance maladie-invalidité (INAMI).
Canada	1967, 1973, 1980-94	Gross annual earnings of full-time, full-year workers.	Household survey (*Survey of Consumer Finances*).	Analytical Studies Branch, Statistics Canada.
Czech Republic	1996-99	Gross monthly earnings of full-time, full-year employees.	Enterprise survey (*Periodic Census of Employers)*.	Czech Statistical Office.
Finland	1977-80, 1982-84, 1986-99	Gross annual earnings of full-time, full-year workers.	Household survey (*Income Distribution Survey*).	Statistics Finland.
France	1950-98	Net annual earnings of full-time, full-year workers.	Salary records of enterprises. (*Déclarations Annuelles des Données Sociales*).	Institut national de la statistique et des études économiques (INSEE), *Séries longues sur les salaires.*
Germany (western Germany)	1984-98	Gross monthly earnings of full-time workers.	Household survey (German Socio-Economic Panel).	Secretariat alculations.
Hungary	1989, 1992, 1994,1996, 1998-2000	Gross monthly earnings of full-time employees in May of each year.	Household survey (*Survey of Individual Wages and Earnings*).	National Labour Centre, Ministry of Labour.
Ireland	1994, 1997	Gross weekly earnings of full-time employees.	Household survey (*Living in Ireland Survey*).	The data and decile calculations were provided by Brian Nolan, Economic and Social Research Institute, Dublin.
Italy	1986-96	Gross monthly earnings of full-time employees.	Social security data collected by the Instituto Nazionale de Previdenza Sociale (INPS).	Data provided by Claudia Villosio, Ricerche e Progetti, Torino, based on the INPS Panel Data
Japan	1975-99	Scheduled monthly earnings of regular, full-time employees.	Entreprise Survey (*Basic Survey on Wage Structure*).	Policy Planning and Rresearch Department, Ministry of Labour, *Yearbook of Labour Statistics*.
Korea (South)	1975-99	Gross monthly earnings of full-time workers	Enterprise Survey (*Wage Structure Survey*).	Korean Ministry of Labour, *Yearbook of Labour Statistics* and data provided directly by the Korean authorities.
Netherlands	1977-99	Annual earnings of full-time, full-year equivalent workers.	Enterprise survey (*Survey of Earnings*).	Sociaal-Economische Maandstatistiek, Dutch Central Bureau of Statistics.
New Zealand	1984, 1986, 1988, 1990, 1992, 1994-97	Usual gross weekly earnings of full-time employees.	Household survey (*Household Economic Survey*).	Estimates provided by the New Zealand Department of Labour.
Poland	1991-99	Gross monthly earnings of full-time employees.	Enterprise survey.	Polish Central Statistical Office, Statistical Yearbook of Poland and *Earnings Distribution in the National Economy as of September 1995*.
Spain	1995	Gross annual earnings of full-time employees.	Entreprise survey (*Structure of Earnings Survey, 1995)*.	Instituto Nacional de Estadistica.

Appendix 3 Continued

Sweden	1975, 1978, 1980-98	Gross annual earnings of full-year, full-time workers.	Household survey *(Income Distribution Survey*).	Statistics Sweden.
Switzerland	1991-98	Annual earnings of full-time, full-year equivalent workers.	Household survey (Annual Swiss labour force survey, *Enquête Suisse de la Population Active* (EPSA)).	Swiss Office fédéral de la statistique.
United Kingdom (Great Britain)	1970-2000	Gross weekly earnings of all full-time workers (i.e. on adult or junior rates of pay).	Enterprise survey (*New Earnings Survey*).	(former) U.K. Department of Employment.
United States	1973-2000	Gross usual weekly earnings of full-time workers aged 16 and over.	Household survey (*Current Population Survey*).	U.S. Bureau of Labor Statistics.

Note:
a): Gross earnings and net earnings refer to earnings before and after income taxes respectively.

Data Link: http://www1.oecd.org/scripts/cde/members/lfsdataauthenticate.asp and query under the dataset named "Percentile distribution of gross earnings".

Appendix 4: Estimates of the Gender Pay Gap at Mean, ISSP Data

Year / Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2002
Australia		.407	.372			.400	.345	.345		.278	.238	.299		.408		.209
Austria	.362	.437	.454	.454	.349		.314	.265		.253	.294			.398		.300
Bangladesh													1.361			
Brazil																.148
Bulgaria								.256				.393	.398	.401	.305	.437
Canada								.315	.345	.324	.203	.311	.169	.418	.140	
Chile														.205	.126	.256
Cyprus												.4511	.270	.313		.403
Czech Republic								.387		.421	.395	.337	.346	.450		.281
Denmark													.288	.223	.225	.244
France												.276	.269	.253		.351
East Germany						.253	.293	.222	.251		.204		.208	.118	.193	.199
Germany (West)	.522	.433	.477	.356	.326	.424	.456	.350	.456		.355		.360	.310	.334	.412
Hungary						.391		.286	.094	.238	.170	.175	.120	.161		.075
Ireland				.662	.807	.724	.720		.172	.182	.893	.893		.515		
Israel									.378	.403		.374		.380	.280	.299
Italy		.162	.162	.354	.354	.318	.318	.312	.250	.311			.196	.234		
Japan									1.002	.762	.753	.755	.932	.898	.916	.833
Latvia											.304	.228		.394	.364	.177
Mexico															.061	.248
Netherlands				.414	.337				.078							
New Zealand							.329	.225	.241	.360	.300				.249	.337
Northern Ireland						.371	.318			.476					.111	.174
Norway					.302	.343	.405	.336	.257	.290	.318	.332	.336	.268	.389	.413
Philippines												.238		.209	.261	.205
Poland							.321	.379	.156	.317	.282	.313	.274	.182		.159
Portugal														.277	.309	.272
Russia							.199	.414	.379	.359	.456	.439	.486	.492	.469	.312
Slovak Republic											.294			.325		.309
Slovenia									.319	.246	.177	.167	.055	.075	.095	.089

Spain									.084		.096		.383	.211	.347	.323
Sweden										.239	.218	.202	.234	.233	.241	.192
Switzerland			.536										.308	.264	.372	.325
Taiwan																.219
United Kingdom	.434	.483	.532	.477	.497	.432	.400	.306	.280	.298	.269	.319	.284	.267	.321	.274
United States	.632	.516	.482	.399	.507	.563	.452	.643	.431	.407	.229	.177	.150	.103	.441	.402

Appendix 4A: Estimates of the Gender Pay Gap at 50th, ISSP Data

Year / Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2002
Australia		.383	.345			.375	.288	.288		.247	.143	.272		.379		.234
Austria	.201	.368	.619	.619	.310		.268	.268		.268	.336			.379		.236
Bangladesh													1.792			
Brazil																.182
Bulgaria								.405				.357	.416	.288	.288	.511
Canada								.288	.288	.288	.288	.511	.288	.288	.182	
Chile														.250	.200	.253
Cyprus												.693	.452	.201		.241
Czech Republic								.405		.368	.321	.313	.274	.452		.254
Denmark													.201	.201	.201	.201
France												.386	.386	.386		.386
East Germany						.182	.231	.100	.288		.511		0	.125	.140	.118
Germany (West)	.588	.336	.560	.318	.228	.368	.388	.381	.444		.336		.336	.314	.359	.379
Hungary						.408		.318	.105	.163	.140	.205	.113	.099		.138
Ireland				.619	.852	.852	.852		.336	0	1.204	1.204		.693		
Israel									.511	.336		.251		.511	.511	0
Italy		.134	.134	.251	.251	.201	.201	.201	.201	.368			.182	.190		
Japan									1.099	.588	.588	.588	.588	.588	.588	.588
Latvia											.288	.288		.223	.405	.241
Mexico															.087	.143
Netherlands				.379	.236				.134							
New Zealand							.442	.241	.241	.241	.241				0	.251
Northern Ireland						.383	.201			.405					.336	0
Norway					.249	.336	.588	.251	.251	.251	.251	.274	.262	.223	.332	.223
Philippines												.251		.288	.288	.223
Poland							.301	.357	.310	.336	.341	.319	.223	.223		.163
Portugal														0	.486	.486
Russia							.215	.405	.511	.288	.560	.470	.511	.348	.568	.405
Slovak																

Republic											.288			.375		.339
Slovenia									.151	.118	.095	.154	.085	.017	.049	.069
Spain									.357		0		.357	0	0	.336
Sweden										.336	0	.251	.164	.194	.163	.163
Switzerland			.241										.223	.442	.201	.233
Taiwan																.288
United Kingdom	.310	.492	.693	.588	.485	.463	.405	.405	.205	.405	.201	.271	.208	.342	.465	.265
United States	.547	.435	.547	.379	.526	.526	.383	.383	.258	.425	.201	.201	.201	.143	.457	.310

Appendix 5: Definitions and Sources of Independent Variables

Fertility Rate: The total fertility rate, defined as births per woman. Source: World Development Indicators, World Bank CD-ROM, 2004. Data are available for most years. Linear interpolation is used to create a time series.

Age Gap at the First Marriage: Mean age gap between husband and wife at the first marriage. Source: United Nations Women's Indicators and Statistics Database, version 4, United Nations 1999. Data on mean age at the first marriage by sex are available in 1970, 1980, 1990, and the latest year (around 1995). Linear interpolation is used to create a time series.

Top Marginal Income Tax Rate: Top marginal income tax rate in percentage. Source: Economic Freedom of the World 2004 Annual Report, James Gwartney and Robert Lawson (eds). Data are available at 5-year intervals. Linear interpolation is used to create a time series.

Female Educational Attainment: The ratio of female educational attainment over male educational attainment at the third level (educational attainment is originally defined as third level students per 1000,000 population by sex). Source: United Nations Women's Indicators and Statistics Database, version 4, United Nations 1999. Data on third level students per 1000,000 population by sex are available in 1970, 1980, 1990, and the latest year (around 1995). Linear interpolation is used to create a time series.

Bargaining Centralization: The Index of Centralization. Source: Torben Iversen, "Wage Bargaining, Central Bank Independence and the Real Effects of Money," *International Organization*, 52, summer 1998.

Economic Competition: The Economic Freedom Index. Source: Economic Freedom of the World 2004 Annual Report, James Gwartney and Robert Lawson (eds). Data are available at 5-year intervals. Linear interpolation is used to create a time series.

Public Employment Ratio: Civilian government employment as a percentage of the working age population (15-64). Source: Comparative Welfare States Dataset, 2004 (downloaded from Luxembourg Income Study). Find the Original Sources in the Comparative Welfare States Dataset.

Appendix 6: Effects of Women's Incentive for Labor Force Participation on the Gender Pay Gap, Based on the OECD data

Explanatory Variables	Gender Pay Gap_50th				Gender Pay Gap_Mean			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Fertility Rate	.151***				.177***			
	(.019)				(.012)			
Age Gap at the First Marriage		.188***				.171***		
		(.016)				(.018)		
Top Marginal Income Tax Rate			.003***				.004***	
			(.0002)				(.0003)	
				-.387***				-.417***
				(.020)				(.024)
Female Educational Attainment								
Constant	.047	-.182***	.114***	.654***	.057***	-.079*	.139***	.730***
	(.032)	(.041)	(.013)	(.018)	(.021)	(.046)	(.015)	(.021)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	290	287	273	265	312	301	287	275
Probability>F	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

Note:

a): *** denotes P<.01, **denotes P< .05, * denotes P< .10. Standard errors are in parentheses.

b): Robust standard errors are experimented, and the statistical significance of the variables holds, despite of small fall in the t-values.