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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, 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.

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, some gender wage gaps have risen, some have fallen, and some have even remained constant. During this time period demographic and institutional factors 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.

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 that may be relevant 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 Polachek (1975a) and Becker (1985) resort 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 (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 but few are detailed enough to contain specifics such as subjects studied, quality of schooling, or types of on-the-job training. 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).

Given the difficulty in incorporating precise measures of human capital, 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 comparative data across countries. 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 be done by examining whether cross-country *differences* in institutional variables that affect lifetime labor force participation and the incentive to invest in human capital 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) than in past studies. 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 of 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)."[3]

Blau and Kahn's decomposition presents at least two problems, however. First, this decomposition can lead to erroneous conclusions when statistical assumptions about earnings dispersion underlying their approach are violated (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 the same earnings structure 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* age-earning profiles for men because division of labor in the home causes them to specialize in market human capital investment, whereas being married may yield *flatter* age-earnings profiles 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.[4]

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.

Neither of these sets of studies concentrates on the implications of gender differences in expected lifetime labor force participation coming about because of division of labor in the home. 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 (Polachek, 1975). 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. female-male 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 typical econometric 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. 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.[5] 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.[6]

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. Equivalently, 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. Also, 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).

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).[7] 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.

The solution to such a model depends on both the system's initial conditions and the precise functional forms of the human capital and commodity production functions.[8] The created model assumes symmetry between both husband and wife as inputs to the model. It 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, and have the same human capital going into their marriages, and have the same rental (wage) rates per unit of human capital. However, assuming equality at the outset of marriage is highly unrealistic.

There are a number of reasons why husbands and wives differ. First, men and women could differ in household productivity. Second, discrimination could cause men to have higher wages per unit of human capital. 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, namely education. 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.[9] 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. Using 38 countries contained in the ISSP, LIS, and OECD data, which we examine in this study, in every case, husbands are older than their wives.[10] 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 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. In turn, differences in the market value of human capital lead to specialization whereby the spouse with the greater market earnings potential (in this case the husband) concentrates more on market activities. This spouse works a greater proportion of time over the marriage, and as a result reaps greater gains from human capital investment. 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. 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.[11] The topics emphasized for the survey varies each year, as do the participating countries.[12] In each survey, standardized questions are asked about social atitudes as well as respondents' age, sex, schooling years, earnings, and weekly working hours. After excluding a few outlier country-years, we have a total of 250 observations.[13] It turns out that 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. 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.[14] This categorical data limitation could be more serious than omitting taxes, because compared to taxes 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. Because women are more likely to work part-time, ignoring working hours is likely to overestimate the gender pay gap. The ISSP data contain information on weekly working hours, but do not collect data on weeks worked. 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.[15] 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.[16] To maintain consistency with ISSP data, we confine ourselves to those country-years that contain information on weekly working hours.

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.[17] 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 are 292 observations at the 50^{th} 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. The correlation matrixes show that 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).[18]

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.[19] These are plotted in Figures 1. Just as Blau et al. (2006) observe 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 seems implausible and 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 weakness is consistent with the correlation matrixes which show 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, but in the analysis we include a variable denoting which of the three data sets we obtain the information so that we can take account of the reliability of each dataset.

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

Measures of Women's Labor Force Participation Incentives

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. In addition, there are many other case studies similarly suggesting this inverse relationship (e.g. Psacharopoulos and Tzannatos, 1992).

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.[20] 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. Based on the above argument, 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 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.[21] 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 1. Summary statistics for each are in Table 1. The first two variables in Table 1 are measures of the difference between male and female log of (median and mean) wages, 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 male wage distribution tends to be more right skewed when compared to the female wage distribution, implying a larger proportion of high earning males than females.

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.[22]

The Statistical Model

We use a multivariate regression analysis to reveal how international differences in institutional variables are related to the gender wage gap. The estimation model we use is

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

where y_{ijt} represents the gender earnings difference for country i using data set j in year t (for which we use two measures), x_{ijt} represents the set of independent time-varying institutional variables for country i using data set j in year t, D_j reflects which of the three data sets was used to obtain the information, v_i is a country error term depicting innate random differences between countries, and ε_{ijt} country-dataset-time varying random term reflecting measurement or other errors intrinsic within the data.

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 it is important to perform the analysis concentrating on the between country differences rather than small changes within countries over time. For this reason, we primarily focus on the between-country differences which we estimate assuming a random effects (RE) GLS model, rather than a fixed-effect (FE) approach.[23]

Results of the Comparative Study

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 2, 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. 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 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.

Begin with the regression results on the entire sample (Table 2). 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).[24] Adding a measure of women's educational attainment in Model 2 leaves the results largely unchanged. 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 decrease the gender pay gap.

Model 3 adds three institutional variables: centralized collective bargaining, economic competition, and the public-private employment ratio. 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.

Worth mentioning in Table 2 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%.

As a final note regarding Table 2, the top marginal income tax rate demonstrates a strong effect on the gender pay gap. 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 top marginal income tax rates have stronger effects on reducing wives' incentives to work, thereby decreasing their human capital investment, and hence widening the gender wage gap. The regression results obtained at eleven wage percentiles generally support this prediction (Table 3). 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.

VII. 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.

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.

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Figure 1

Country-Specific Wage Gaps Over Time

Table 1: 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 1.

Table 2: Effects of Women's Incentive for Labor Force Participation on the Gender Pay Gap, Based on the OECD, LIS, and ISSP data

Dependent variable:	ln_mean_male_female				ln_50_male_female			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Fertility Rate	0.0977***	0.0787***	0.0607	0.0342	0.109***	0.0874***	-0.0144	0.0823*
	(0.0227)	(0.0228)	(0.0465)	(0.0322)	(0.0340)	(0.0337)	(0.0632)	(0.0327)
Age Gap at first Marriage	0.0806***	0.0602***	-0.00975	0.0284	0.138***	0.116***	-0.0699*	0.0505**
	(0.0201)	(0.0215)	(0.0271)	(0.0226)	(0.0242)	(0.0258)	(0.0366)	(0.0236)
Top Marginal Income Tax Rate	0.00239***	0.000346	0.00177*	0.00162**	0.00184***	-0.000794	0.00156	0.00185**
	(0.000465)	(0.000656)	(0.000983)	(0.000696)	(0.000564)	(0.000809)	(0.00133)	(0.000709)
Female Educational Attainment		-0.275***	-0.246***	-0.205***		-0.348***	-0.151	-0.187***
		(0.0628)	(0.0673)	(0.0601)		(0.0758)	(0.0989)	(0.0628)
Centralized Bargaining			-0.107*				-0.0535	
			(0.0571)				(0.0789)	
Economic Freedom			0.0308				0.0258	
			(0.0215)				(0.0290)	
Public Employment Ratio			-0.00146				0.00143	
			(0.00307)				(0.00483)	
LIS Data	0.0323**	0.0334**	0.0248	0.0512***	0.0293**	0.0287*	0.0505***	0.0478***
	(0.0133)	(0.0138)	(0.0173)	(0.0135)	(0.0149)	(0.0154)	(0.0197)	(0.0132)
ISSP Data	0.0534***	0.0581***	0.0751***	0.0703***	0.0596***	0.0637***	0.0625***	0.0671***
	(0.0100)	(0.0103)	(0.0129)	(0.00971)	(0.0114)	(0.0117)	(0.0143)	(0.00946)
ln90_10male				0.919***				1.079***
				(0.179)				(0.182)
ln90_10female				0.618***				1.027***
				(0.193)				(0.197)
int_ln90_10mf				-0.674***				-0.928***
				(0.148)				(0.151)
Constant	-0.195***	0.265**	0.207	-0.584**	-0.361***	0.211	-.00445	-1.073***
	(0.0679)	(0.127)	(0.241)	(0.252)	(0.0904)	(0.160)	(0.324)	(0.257)
Observations	542	514	238	348	528	500	232	366
R-squared	.	.	.	.	.	.	.	.
Number of country_id	35	34	15	21	35	34	15	21

Dependent variable depict the percent gender difference in mean (columns 1-4) and median (columns 5-8) earnings.
Other variables defined in the text.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3: 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
Top Marginal Income	-0.0002	0.0002	.0015***	0.0004	0.0007	0.0012***	0.0019***	0.0022***	0.0035***	0.0021***	0.001
Income Tax Rate	(0.0007)	(0.0005)	(0.0006)	(0.0005)	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0006)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	247	231	160	231	231	252	231	231	160	231	236
Probability>F	0	0	0	0	0	0	0	0	0	0	0

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, female educational attainment.

Appendix 1: 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.

[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] We compute the gender pay gap as the difference between male and female log of mean or median wages. Here, for this computation, wages are measured at the median of the wage distribution, using raw wage data for the sample of full-time workers.

[3] 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)

[4] 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).

[5] 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.

[6] 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).

[7] Obviously marriage length is not known with certainty. 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).

[8] The above model applies equally well for a single person household. In this case variables pertaining to one's spouse are constrained to zero.

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

[10] 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.

[11] 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.

[12] 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.

[13] Also, some country-years are omitted because of lack of crucial information (either earnings or weekly working hours).

[14] We use a numerical example to illustrate these two cases. Suppose two reported earnings categories are $0-$20,000 and $20,001-$40,000. Since the ISSP data reports the category midpoints, a worker's earning is shown as $10,000 in the first category and $30,000 in the second one. When a male worker earns $18,000 and a female worker earns $9,000, both are reported to earn a wage of $10,000 in the data. In this case, the calculated gender pay gap is underestimated. On the other hand, if a male worker earns $25,000 and a female worker earns $15,000, the data reports $30,000 and $10,000 respectively. In this latter case, the calculated pay gap is inflated.

[15] This 30 hours threshold for full-time work is set by OECD in 1997.

[16] 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.

[17] 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 .

[18] This observation is strengthened by the P value; it is not significant at 1 percent level between the LIS and ISSP data.

[19] For France we plot data from 1950.

[20] 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).

[21] 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.

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

[23] See standard econometrics text books such as Greene (2012).

[24] 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.