Top Earnings Inequality and the Gender Pay Gap: Canada, Sweden, and the United Kingdom ☆

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Abstract

This paper explores the consequences of the under-representation of women in top jobs for the overall gender pay gap. Using administrative annual earnings data from Canada, Sweden, and the United Kingdom, it applies the approach used in the analysis of earnings inequality in top incomes, as well as reweighting techniques, to the analysis of the gender pay gap. The analysis is supplemented by classic O-B decompositions of hourly wages using data from the Canadian and U.K. Labour Force Surveys. The paper finds that recent increases in top earnings led to substantial "swimming upstream" effects, therefore accounting for differential progress in the gender pay gap across time periods and a growing share of the gap unexplained by traditional factors.

Keywords: Earnings Inequality, Top Incomes, Gender Pay Gap

JEL: J15, J16, J70

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1. Introduction

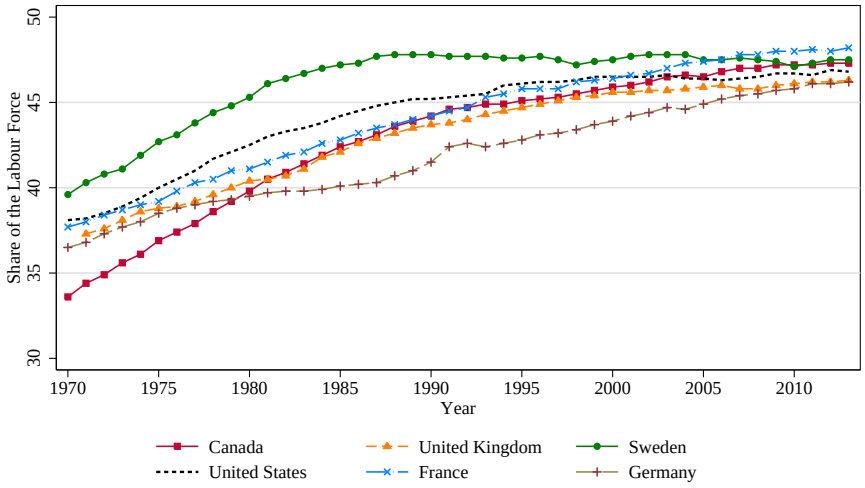
Since the 1980s, many industrialized countries have seen stupendous increases in top income inequality. As documented by Piketty and Saez (2003, 2013), in the United States the share of income accruing to the top 10% reached 50% in 2012, exceeding early 20th century levels of inequality. These increases are concentrated in the very top incomes. The United States has witnessed a doubling of the income share accruing to the top 1% from 10 percent in 1980 to numbers now in the 20 percent range. As shown in Alvaredo, Atkinson, Piketty and Saez (2013), Canada and the United Kingdom follow closely behind. Their top 1% income share increased by 5 percentage points going from 10 percent in 1980 to 15 percent before the Great Recession. Increases in top income shares in Continental Europe were less pronounced, with the exception of Sweden. This country also experienced a doubling of the income share of the top 1%, albeit at lower levels than the United States, going from 5 percent in 1990 to 10 percent in 2007. Our focus in this paper on Canada, Sweden, and the United Kingdom is motivated by these large increases in top income inequality, as well as data availability.

Interestingly, countries with the largest increases in top income shares are also countries that have among the highest rates of female labour force participation as shown in Figure 1. For more than 20 years, women have represented more than 45% of the labour force. [1] These countries thus have a long standing tradition of high female labour force participation. One would think that this would have opened opportunities for women to advance in career ladders. Yet, the numbers celebrated in terms of the percentage of women on British boards (FTSE 100) in 2015 were around 25% (Davies, 2015). In Canada, that percentage was about 21% for companies on the S&P/TSX 60 index in 2014 (CSA, 2015). In the same year in Sweden, women held 29% of board seats for companies in the OMX Stockholm 30 index.

For the United States, Guvenen, Kaplan and Song (2014) use Social Security data to document substantial increases over the last thirty years in the share of women among top earners. They find that the share of women in the top 0.1% of earners increased from 1.9% in 1985 to 10.5% in 2012; for the next 0.9% of earners, the share increased from 3.3% to 17.0% over the same period. These authors study the role of changes in labour force participation,

[1] We will see numbers later that concentrate on prime-age workers where women actually constitute half of the workers.

Figure 1: Women's Share of the Labour Force



Source: BLS and Conference Board, International Labor Statistics, adjusted to US concepts, persons aged 15/16 and over.

changes in the persistence of top earnings, and changes in industry and age composition as explanatory factors for changes in the gender composition of top earners. Atkinson, Casarico, and Voitchovsky (2016) document the evolution of female shares in top income groups in eight advanced economies, including Canada and the United Kingdom. They report numbers in the same range as in the United States: in 2013, the share of women in the top 1% was 21.9% in Canada and 17.8% in the United Kingdom. For the top 0.1%, the share of women was 15.8% in Canada and 9.2% in the United Kingdom. Both papers note different rates of progress over time in women's shares in top income groups, but neither paper draws implications for the overall gender pay gap.

We attempt to fill this knowledge gap by asking: what are the consequences of the underrepresentation of women in top jobs for the overall gender pay gap? When residual inequality experienced substantial increases in the 1980s, Blau and Kahn (1997) coined the term "swimming upstream" to characterize women's pursuit of pay equality in the face of countervailing currents. Have recent increases in top incomes led to similar effects, therefore accounting for the slower progress in the narrowing of the gender pay gap and a growing unexplained (by traditional factors) share? Because increases in residual inequality have in large part been attributed to

technological change, abating this trend would be counterproductive. [2] On the other hand, there is a lack of consensus on the potential causes of recent increases in top incomes. Explanations range from cuts in top tax rates (Piketty, Saez, and Stantcheva, 2014) to increases in firm size in a global economy (Gabaix and Landier, 2008), and the interplay of weak corporate governance and rent seeking (Bertrand and Mullainathan, 2001; Malmendier and Tate, 2009). To the extent that some increases in top incomes have been curtailed in the aftermath of the 2008 financial crisis, we can observe the impact of these income downturns on the gender pay gap. [3]

Our findings indicate that the under-representation of women in top income groups accounts for a substantial share, often a majority share, of the gender pay gap in annual earnings in the three countries under study. In light of these findings, we discuss the public policies and private sector initiatives likely to be most effective in improving the under-representation of women among top earners. For that purpose, we extend our analysis beyond the three countries of interest above and consider a set of forty countries for which information on the percentage of women on corporate boards is available over several years.

The paper is organized as follows. Section 2 introduces the data and displays trends in average annual earnings by centile groupings. Section 3 illustrates the female shares and gender earnings ratios within the centile groupings in comparison with the overall. Section 4 presents the counterfactual experiments that give women the same representation as men across these centile groupings. The explanatory power of our centile groupings as a measure of vertical segregation, that is segregation across the echelons of corporate and adminstrative hierarchies is compared to that of more traditional explanatory factors, such as demographics, education, tenure, occupation, and industry. Section 5 turns to a review of the potential impact of existing and proposed policies to foster gender equality in pay in light of these findings. It discusses the potential impact of quotas for women on corporate boards to improve the representation of women among

[2] The role of institutions in increasing wage inequality, discussed in DiNardo, Fortin, and Lemieux (1996) for example, is concentrated in the bottom half of the distribution.

[3] For the United Kingdom, Bell and Van Reenen (2014) find evidence of a small decline in the share of the wage bill going to those in the top decile after 2008, but the decline was not uniform across sectors. They find that bankers in the top percentile actually saw a small increase of 0.2 percentage points in their share of the total wage bill between 2008 and 2011. For Canada, Bonikowska, Drolet, and Fortin (2017) find a shift of the share of financial sector workers from the top 0.1% to the next 0.9% after the financial crisis. For the United States, ExecuComp data shows slower growth of salaries and bonuses of executives after 2008, but solid growth in other forms of compensation, such as stock options and awards.

top earners in a cross-country framework. Section 6 concludes.

2. Data and Trends in Annual Earnings

Because survey data tend to include relatively few individuals from the upper tail of the income distribution, we need to appeal to administrative data to capture the income of top earners. We use annual earnings data from the Canadian Longitudinal Worker Files (LWF, 1983–2010) , the British Annual Surveys of Hours and Earnings (ASHE, 1999–2015), and the Swedish *Longitudinell Integrationsdatabas för Sjukförsäkrings- och Arbetsmarknadsstudier* (LISA, 1990–2013).[4]

An unfortunate consequence of appealing to administrative and income tax data is that labour supply information, the numbers of weeks worked in a year or the number of hours worked a year, is unavailable. Therefore the gender pay ratios in annual earnings that we analyze could be used in the popular vernacular only with caveats: *Women earn 65 cents (öre/pence) out of every dollar (krona/pound) men earn, given that women have a lower wage rate and/or work fewer hours than men on average.*[5] In other words, our measure of the gender pay ratio is not appropriate to gauge whether employers treat women fairly with regards to compensation. Instead, it is instructive about the income shortfalls accruing from the lower labour supply of women and their lower rate of pay.[6] In some instances, this lower labour supply can be attributed to an unbalanced division of housework hours within the household. There is a large and growing literature, discussed in section 5, attributing the lower earnings of mothers following childbirth to the move to family-friendly employers who offer more flexible work hours, but lower pay rates. We restrict our samples to workers aged 25 to 64 to focus on those more likely to have stronger labour market

[4]These data are available from Statistics Canada, the U.K. Office of National Statistics, and Statistics Sweden under strict confidentiality agreements with these agencies. But the analysis of these data does not reflect the endorsement of these agencies in relation to the interpretation of the results.

[5]Note that for Canada and the United Kingdom, we also provide classic O-B decomposition of the gender pay gap in hourly wages using the Labour Force Surveys of each country. This caveat does not apply to these analyses which additionally account for gender differences in productive characteristics.

[6]The lower number of hours worked a year by women arises in part from the fact that more women than men work part-time rather than full-time. But even when women work full-time, many work less hours per week (e.g. those working in clerical jobs) then many men (e.g. those working in manufacturing) who are also more likely to engage in overtime work. Thus focusing on full-time full-year workers eliminates only part of the gender differences in work hours.

attachments than students or retirees. All earnings have been adjusted for inflation using each country's respective Consumer Price Index normalized to have 2010 as base year.

The Canadian LWF is a 10% random longitudinal sample of all Canadian workers that integrates tax data from T1 and T4 forms filed with the Canada Revenue Agency (CRA) and information from Statistics Canada's Longitudinal Employment Analysis Program (LEAP). Our annual earnings measure includes earnings from all paid jobs held in a given year, including wages and salaries, bonuses, honorariums, etc., but excluding self-employment income. These data are available separately by gender because couples file their income taxes separately. Individuals with earnings below a minimum threshold are excluded from the sample; the threshold is the income of someone working 13 weeks a year at 40 hours a week at the minimum wage in their province of residence in a given year. This sample selection yields roughly between 850,000 and 1,320,000 observations per year.

The UK-ASHE data are based on a 1% longitudinal sample of all workers, using the last two-digits of an individual's social security number. The information on earnings and hours is obtained from employers (who are legally required to provide the data to ONS), and therefore does not cover self-employment income. The annual (gross) earnings includes basic pay and allowances, overtime payments, and incentive/bonus payments. It excludes any share-based remuneration. As with the LWF data, observations with pay corresponding to less than half the minimum wage for adults are excluded from the sample. The resulting sample sizes vary from 110,000 to 140,000 observations per year.

Because both the LWF and ASHE lack crucial information on the education level of the workers, among other worker characteristics, and because of the issues surrounding the annual gender ratio measures, we appeal to the public use files of the Canadian and British Labour Force Surveys to supplement our analysis. We use these data to provide more typical Oaxaca-Blinder (O-B) decomposition of the gender pay gap in hourly wages. The analyses account for typical explanatory variables such as age, education, union (only in Canada) and part-time status, tenure, occupation, and industry, in addition to the measure of vertical segregation we introduce below. We note however that the hourly wage measure in both surveys is top-coded, therefore the centile groupings based on hourly wage data do not capture the very top earners.[7] We apply the same

[7] In the U.K. LFS data, ONS top-codes the hourly wage at £99 in nominal terms. In the Canadian LFS, hourly wages above the percentile 99.9 are imputed; this cut-off varies from $95/hour in 1997 to $125/hour in 2015 in nominal terms.

age-related and too low income sample selection criteria as with the annual earnings data.

The Swedish LISA database is the most complete database we utilize. It integrates information for the labour market, educational, and social sectors from Statistics Sweden, the Social Insurance Agency and the Swedish Agency for Innovative Systems. LISA is a continuously updated database containing yearly detailed demographic, income and employment/unemployment information on all individuals residing in Sweden. The annual earnings data are the labour earnings from the largest source of income, in case where the individual has multiple employers, and include performance pay and bonuses. To be consistent with the United Kingdom and Canada, self-employment income is removed.[8] Following the sample selection, we are left with approximately 2.5–3 million observations per year. In addition, because LISA includes key variables such as education, occupation, industry, and region of residence, we are able to apply standard O-B decomposition to these data.

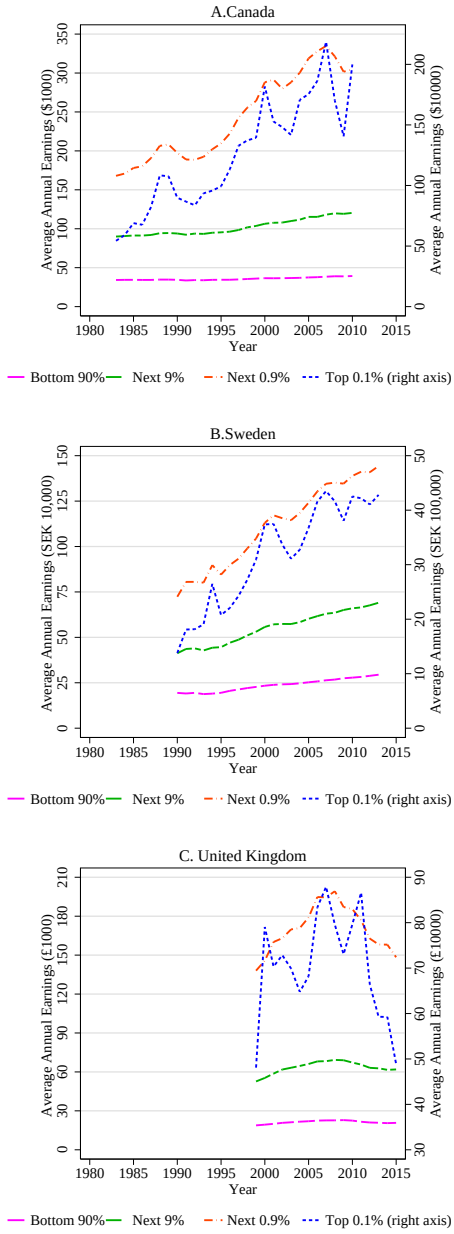
Our descriptive statistics begin by displaying trends in average annual earnings by four mutually exclusive centile groupings to reflect the disproportionate increases in top incomes documented by others. Following Brewer et al. (2007) and Guvenen et al. (2014), we divide the earnings distribution of men and women combined into mutually exclusive centile groupings, but we additionally distinguish the next 9% from the bottom 90%. This leaves us with four percentile groupings: the bottom 90%, the next 9%, the next 0.9% and the top 0.1%.

These choices of percentile groupings enable us to characterize increases in top incomes in a parsimonious way. They allow us to construct counterfactuals asking "what if women were represented at the top of the earnings distribution of men and women combined in the same way men are?" We are not the first to use positional ranks in the context of wage and earnings decompositions. Fortin and Lemieux (1998) use positional ranks to characterize the 1980s changes in the U.S. gender pay gap along the wage distribution as coming from changes in skills, changes in the wage structure, and positional improvements. Bayer and Charles (2016) characterize changes, from 1940 to 2014, in the black-white wage gap in the United States at lower, middle, and upper quantiles as coming from improvements in positional ranks and from changes in the overall

The Canadian LFS is a monthly survey on approximately 100,000 individuals with rotating 6-months panel sample design. The U.K. LFS is quarterly survey on approximately 100,000 individuals, also with rotating 6-months panel sample design, but the wage data is available only for sub-sample.

[8] In robustness checks we also included capital gains (e.g. from stock compensation) as well as other benefits and deductions (disposable income) and found similar results.

Figure 2: Average Annual Earnings Trends by Selected Centile Groupings



Note: Computed from the Canadian LWF, the Swedish LISA, and the U.K. ASHE annual earnings of workers age 25 to 64.

structure of the earnings distribution (changes in shape).[9] It is nevertheless important to clarify some features of counterfactuals using positional ranks. Clearly, counterfactuals asking "what if the representation of women across all centiles or deciles of the combined earnings distribution was the same as men's" would explain all average gender differences in earnings. Given that gender-specific earnings distributions typically feature relatively more women in the lower tail and relatively more men in the upper tail of the overall distribution (Fortin and Lemieux, 2000), the corresponding detailed decomposition of the average pay gap would show the negative explanatory power of lower deciles and the positive explanatory power of upper deciles, including the relatively higher explanatory power of the top decile.[10] It would tell us "where" in the earnings distribution are the most important sources of gender differences in average earnings. Are they arising mostly from sticky floors or glass ceiling effects? Here this decomposition would be too encompassing, as we want to focus on how changes in glass ceiling effects can account for changes in the average gender pay gap, while leaving room for traditional factors to come into play.

To quantify glass ceiling effects, our emphasis on a few top centiles groupings borrowed from the literature that has documented increases in top incomes appears appropriate. But we also perform sensitivity analyses of our results to alternative percentile groupings.[11] Our expectation is that our percentile groupings will account for a sizeable share of the gender earnings gap, a share that should be increasing over time. However, the goal of our accounting exercise is to quantify the importance of this measure of vertical segregation. We thus depart from the traditional literature on glass ceiling effects (Albrecht, Bj¨orklund, Vroman, 2003; Arulampalam, Booth, and Bryan, 2007), which computes the earnings differences between women and men in top centiles of the gender-specific distributions. Keeping the analysis in levels rather than in logarithms also avoids any compression at the top.

[9] They find relatively lower positional improvements at lower and middle quantiles, but more substantial improvements at upper quantiles arising mostly from increases in educational attainment.

[10] The negative explanatory power of lower deciles comes from negative male-female difference in representation in the lower tail. This is similar to the negative explanatory power of education, which comes from the recent negative male-female difference in educational attainment.

[11] Given the paucity of women among top earners, we consider a coarser resolution of the top 1% into the next 0.5% and top 0.5%. We also consider a finer resolution of the next 9% by dividing it into a next 5% and next 4%. Finally, we go down the distribution and distinguish the second top decile from the bottom 80%. We discuss these alternative counterfactuals in section 4.

Figure 2 displays the time trends in average annual earnings for Canada in Panel A, for Sweden in Panel B, and for the United Kingdom in Panel C: showing precisely the time span for which these data are not available. Importantly, the Canadian data mostly misses the aftermath of the 2008 financial crisis and the British data barely captures one data point before the 1990s vertiginous climb of top incomes. In all three countries, the income growth of the top 0.1% is literally off the scale, so that this income group gets its own axis (right axis) on a scale ten times that of the other groupings. We can discern the same income peaks in 2000 (the "dot.com" boom) and in 2007, before the financial crisis which had different rebounds across these countries.

In Canada, over the 1983–2010 period, the real earnings growth of the bottom 90% is quite meager at 0.5% per year; the earnings growth of those in the next 9% was double that rate at 1.1% a year. The earnings of the next 0.9% grew by 2.3% a year, and those of the top 0.1% by again more than double that rate at 6% a year. In the United Kingdom, the disparities in earnings growth between the bottom 90%, whose average earnings grew by 0.6% a year over the 1999-2015 time period, and the next 9%, who saw average increases of 1.1% a year, are quite similar to those of Canada. But the next 0.9% and the top 0.1% were more severely impacted by the financial crisis: the next 0.9% saw average earnings increases of 0.6% a year, no better than the bottom 90%, while any growth for the top 0.1% essentially vanished with the crisis. In Sweden, the real earnings growth of the bottom 90% and the next 9% also differ by 0.5% per year at 1.8% a year and 2.3% a year, respectively over the 1990-2013 period. Meanwhile, the earnings growth of the next 0.9% and the top 0.1% stood at 3.1% and 5.8% respectively. To the extent that women are under-represented in top income groups, these disparate increases will act as countervailing currents of different strengths in different time periods.

3. Female Shares and Gender Ratios by Centile Groupings

A straightforward but relatively new way to track the progress of women among top income groups over time is to compare the progress of female shares in these groups to the overall female share in the labour market. For the United States, Kopczuk, Saez, and Song (2010) were the first to document the evolution from 1937 to 2004 of the fractions of women in the top 1%, top 10%, next 10%, and in the fourth quintile, along with the overall fraction of women in the

labour force.[12] They find that the fraction of women in the top percentile only starts to increase significantly in 1980 from 2 percent to reach almost 14 percent in 2004. Part of the difficulty is that in many countries, such as the United States or France, couples file income tax jointly and do not record individual incomes. For the United States, this issue is circumvented by appealing to Social Security Administration (SSA) data which however is not easily accessible. In Canada, couples file separately, but for the United Kingdom and Sweden we have to appeal to specialized data sets as indicated above.

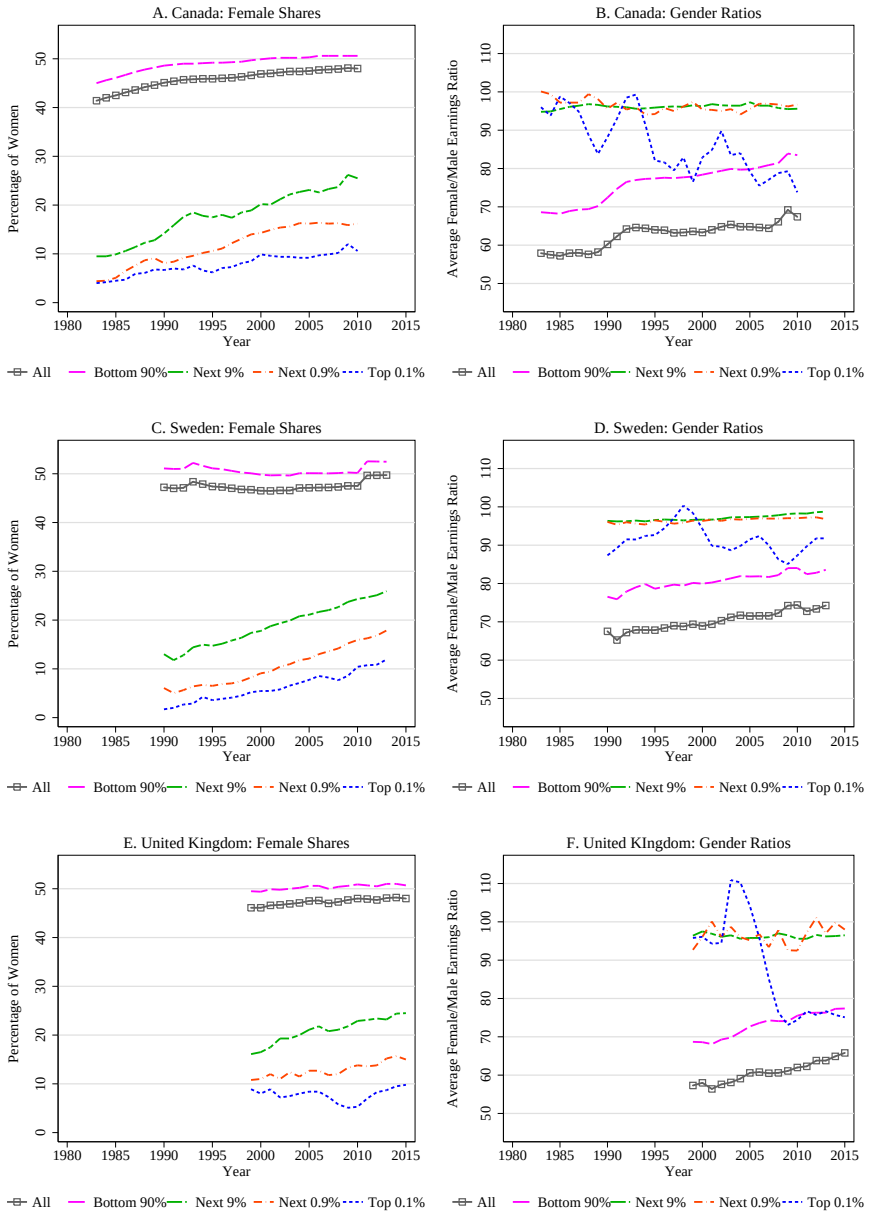
We display in the left panels of Figure 3 the shares of women in the overall labour market, as well as among the four percentile groupings: the bottom 90%, the next 9%, the next 0.9% and the top 0.1% for the three countries under study. The trends displayed show that in Canada, Sweden and the United Kingdom, the share of women in the bottom 90% not only exceeds the overall share of women in the respective labour markets, but it also exceeds 50 percent starting in the 2000s in Canada and the United Kingdom, and already in the 1990s in Sweden. In 2010, the latest year for which we have data from all three countries, the percentage of women in the "next" income categories are in similar ranges: from 23 to 26 percent in the next 9% and from 14 to 16 percent in the next 0.9%. These female shares also increase at similar rates. [13] What is qualitatively different across countries is the behaviour of the female share in the top 0.1%. In Canada, it appears stalled around 10 percent in the 2000s. In Sweden, it shows a continuous growth exceeding 10 percent in 2015. In the United Kingdom, its growth was tested by the 2008 financial crisis, but it reached 10 percent in 2013. Thinking of 50-25-15-10 female shares for the bottom 90%, the next 9%, the next 0.9%, and the top 0.1% gives a rough but pretty accurate summary. Importantly, the growth in the female shares in the top income groups does not match the growth in average earnings in these groups illustrated in Figure 2.

In the right panels of Figure 3, we introduce a novel way of looking at gender pay ratios by displaying the ratios of female-to-male average annual earnings of individuals who fall in each

[12] Guvenen, Kaplan and Song (2014) study the dynamics of female shares and earnings in top income groups for the United States. Atkinson, Casarico, and Voitchovsky (2016) extended their earlier analysis of female shares in top income groups, using several income measures to eight other countries, including Canada and the United Kingdom. Denk (2015) reports the share of women in the top 1% and the bottom 99% across 18 European countries using the Eurostat Structure of Earnings Survey (SES) from 2010.

[13] Brewer, Sibieta and Wren-Lewis (2007) who uses data from the Survey of Personal Incomes report equivalent percentages of males in the top 0.1%, the next 0.09%, next 9% and in the overall for 2004-05 in the United Kingdom.

Figure 3: Female Shares and Gender Ratio in Average Annual Earnings by Centile Groupings



Note: Computed from the Canadian LWF, the Swedish LISA, and the U.K. ASHE annual earnings of workers age 25 to 64. Gender ratio in the top 0.1% is a 3-year moving average.

of the four percentile groupings of the distribution of men and women combined. In addition, we illustrate the overall gender pay ratio which this time appears at the bottom of all panels.

To the extent that, as illustrated in the left panels, women are vastly under-represented in the top 10%, where men can be found at a ratio of 3-to-1, when computing the gender pay ratio in the bottom 90%, relatively more highly paid men than highly paid women are excluded. As a result, the gender pay ratio in the bottom 90% should mechanically be more favourable than the overall gender pay ratio. What is perhaps surprising is by how much. In 2010, the gender ratio in the bottom 90% is more favourable by 16 percentage points in Canada, 10 percentage points in Sweden, and 14 percentage points in the United Kingdom than the overall ratio. There is a silver lining to the over-representation of men in the top decile, for women in the bottom 90% — the vast majority of women — the female/male average annual earnings ratio is substantially more favourable than overall numbers suggest. Because of possibly changing selection over time, we do not want to push too far the interpretation of trends in these gender ratios, they nevertheless illustrate the importance of what happens in the top decile for the overall gender pay gap.

A second finding is that glass ceiling effects in earnings appear to be concentrated in the top 0.1% income group. Indeed, the gender ratio in the next 9% and next 0.9% are in the upper nineties. In 2010, the ratios reached 95.6 percent in Canada and the United Kingdom, and 98.3 percent in Sweden for the next 9%. The numbers for the next 0.9% are 96.7 percent in Canada, 97.1 percent in Sweden, and 92.5 percent in the United Kingdom, although average earnings there reached parity in subsequent years. They indicate that in these "next" top income groups, women work at an intensity and level of pay similar to those of men.

On the other hand, in the top 0.1%, we find the highest glass ceiling. Not only are there very few women, as documented earlier, which makes for volatile estimates of the earnings ratio, but women do not seem to obtain top earnings in ranges similar to those of men. [14] In all three countries, the gender earnings ratio for the top 0.1% is decreasing over the 5-year period preceding the decline associated with the financial crisis. In Canada, these difficulties have a longer history. It is unclear whether this is due to the decline in family businesses or inherited wealth (Edlund and Kopczuk, 2009) or the growing importance of oil and gas extraction as a source of enrichment. Alternatively, if the required set of abilities to enter the top 0.1% are in shorter supply among women than men, as argued by Gneezy and Pietrasz (2013) regarding competitiveness, as the

[14] Note that we display a 3-year moving average of that ratio to avoid larger spikes.

share of women in this group grows, it pulls in women with lower endowments of these abilities, which lowers the gender earnings ratio. This selection mechanism would apply less to the United Kingdom where the decline in the gender earnings ratio in the top 0.1% is not accompagnied by an increase of female shares in that grouping. Notwithstanding difficulties for this very top income group, it does appear that women on average would benefit if more of them were able to move to the next 9% and next 0.9%. We next ask more formally: by how much?

4. Counterfactual Earnings Ratios

The analysis of the gender gap, which corresponds to one minus the gender ratio we display, commonly proceeds with the construction of counterfactual female earnings. "What if women had the same level of human capital (e.g. educational attainment and labour market experience) as men," was the counterfactual envisaged by Mincer and Polachek (1974) to predict that the gender pay gap would vanish when these milestones were reached. The Oaxaca-Blinder decomposition is the classic method to assess the relative explanatory power of different factors with the construction of counterfactual wages. It starts with gender-specific OLS regressions of individual characteristics on (log) earnings/wages Y_i on covariates, X_i, assuming that the error term υ_i^g is conditionally independent of X_i:

$$Y_i^g = X_i\beta^g + \upsilon_i^g, \qquad \text{for} \quad g = 0, 1.$$

where $\mathbb{E}[\upsilon_i^g|X_i] = 0$. Let $D = 1$ denote male workers, as in the treatment-control literature. [15] Then the overall mean wage gap Δ_O^μ between male and female workers can be written as

$$\Delta_O^\mu = \mathbb{E}\left[X_i|D_i = 1\right]\beta^1 - \mathbb{E}\left[X_i|D_i = 0\right]\beta^0. \tag{1}$$

Given the progress of women in closing the educational gap, for example, we want to construct a counterfactual wage telling us "what would be the average wage of women if they had the same characteristics as men," or "what would be the average wage of men if they were paid as women," that is, $\mu_0^1 = \mathbb{E}\left[X_i|D_i = 1\right]\beta^0$.[16] Adding and subtracting this counterfactual wage to equation (1), the overall mean wage gap can be written as

$$\Delta_O^\mu = \mathbb{E}\left[X_i|D_i = 1\right](\beta_1 - \beta_0) + \left(\mathbb{E}\left[X_i|D_i = 1\right] - \mathbb{E}\left[X_i|D_i = 0\right]\right)\beta_0 \tag{2}$$

[15] The outcome $Y_i = Y_i^1 D_i + (1 - Y_i^1)D_i$, and the potential outcomes are assumed to be independent of the treatment given the covariates, $(Y_i^1, Y_i^0) \perp D_i|X_i$.

[16] This equality follows from the fact that β^0 is identified from the sample for which $D_i = 0$. See Kline (2011).

where the first term is usually called the "unexplained" component Δ_U^μ, and the second term Δ_X^μ is the part explained by differences in characteristics X_i, evaluated at female returns or "prices".[17]

Kline (2011) shows that, under some assumptions, this counterfactual can be computed either using the regression coefficients, or the reweighting factor $w_i(X)$ proposed by DiNardo, Fortin, and Lemieux (1996),

$$\begin{aligned}\mu_0^1 &= \mathbb{E}\left[X_i|D_i=1\right]' \mathbb{E}\left[X_i' X_i|D_i=0\right]^{-1} \mathbb{E}\left[X_i' Y_i|D_i=0\right] \quad \text{or} \\ &= \mathbb{E}\left[w_i(X) Y_i|D_i=0\right] \quad \text{where} \quad w_i(X) = \frac{dF(X_i|D_i=1)}{dF(X_i|D_i=0)}\end{aligned}$$

Letting $P(X_i) = P(X_i|D_i=1)$ denote the propensity score and $\pi = P(D_i=1)$, under the assumptions of common support, $P(X_i) < 1$, and conditional independence of the treatment, then following the application of Bayes' rule, the reweighting factor can be written as

$$w_i(X) = \frac{P(X_i)}{1-P(X_i)} \frac{(1-\pi)}{\pi}. \tag{3}$$

The sample analogs, in the case where X_{ij} is a J-categorical variable, such as education classes or our four centile groupings, are $\widehat{P}(X_i) = N_{1j}/N_j$ and $1 - \widehat{P}(X_i) = N_{0j}/N_j$, and $\hat{\pi} = N_1/N$ and $(1-\hat{\pi}) = N_0/N$. Thus the reweighting factor corresponds to the ratio of the gender shares in each j-category

$$\widehat{w}_i(X_j) = \frac{N_{1j}}{N_{0j}} \cdot \frac{N_0}{N_1} = \frac{S_{1j}}{S_{0j}}, \tag{4}$$

where $S_{1j} = N_{1j}/N_1$ is the share of group 1 in category j.

This implies that the above counterfactual average can simply be computed from gender-specific distributional shares and conditional averages, $\overline{Y_j^0} = \sum_i Y_{ij}^0$, as follows:

$$\overline{Y_0^1} = \sum_j S_{1j}/S_{0j} \cdot S_{0j} \overline{Y_j^0} = \sum_j S_{1j} \overline{Y_j^0}.$$

The reweighting factor in equation (4) utilizes the gender distributional shares across the centile groupings.[18] But it also can be expressed as in equation (3), $\widehat{w}_i(X_j) = (1-p_{0j})/p_{0j} \cdot p_0/(1-p_0)$,

[17] An alternative counterfactual might ask "what would be the average wage of men if they had the same characteristics as women," or "what would be the average wage of women if they were paid as men." In these cases, gender differences in characteristics would be evaluated at male prices. We discuss below how our results differ in this case.

[18] For example, in 2010 in Canada, the female distributional shares across the bottom 90%, next 9%, next 0.9% and top 0.1%. are 94.89, 4.78, 0.30, and 0.02, and the corresponding male distributional shares are 85.48, 12.90, 1.45, 0.17.

in terms of female shares in each grouping j, $p_{0j} = N_{0j}/N_j$, and in the overall, $p_0 = N_0/N$. These are the shares displayed in Figure 3 as in the previous literature.

We note that the typical assumption of invariance of the conditional distribution implies that the average female earnings conditional on the percentile grouping are held constant in the construction of the counterfactual, likely a strong assumption.[19] In this context, our choice of using female prices rather than male prices is therefore conservative, as it does not presume that women moving up into top jobs will necessarily be compensated as men are.[20] In the end, this choice is not consequential for the effects sought, as discussed below.

Figure 4 presents the result of this exercise using our centile groupings as the single 4-category variable. We compute gender-specific categorical average earnings, similar to those shown in Figure 2 for the men and women combined, and multiply the female average categorical earnings by the male shares in the centile groupings. The counterfactual asks "what would be the average gender earnings ratio among all earners if the representation of women among the four centile groupings was the same as men? This counterfactual thought experiment removes the effects of vertical segregation; that is gender disparities across the echelons of administrative and corporate hierarchies. In the context of professorial salaries, this would correspond to asking "what would be the academic gender pay gap if women were distributed across the three typical North-American professorial ranks (Full Professor, Associate Professor, Assistant Professor) as men are."[21] In this context, horizontal segregation corresponds to the fact that men and women are distributed differently across disciplines (e.g. relatively fewer women than men in the STEM than in the Arts, Education, and Social Work, for example). The equivalence between reweighting and the O-B decomposition is illustrated in Appendix A for the case of gender differentials in professorial salaries at UBC.

Figure 4 shows that the counterfactual gender ratio is more favourable by 14 to 25 percentage points. More precisely, in 2010 gender disparities across the centile groupings account for 58%

[19] See Table 1 in Fortin, Lemieux, and Firpo (2011).

[20] Several papers (Goldin, 2013; Pan, 2015) have actually documented declines in occupational wages when occupations "tipped" from being male jobs to female jobs.

[21] Instead in many institutions women appear "stuck in the middle" as Associate Professors, and reaching the rank of Full Professor in smaller proportions than men. Bakker et al. (2010) show that gender differences in rank accounted for 46% of the gender gap in professorial salaries in 2010 at the University of British Columbia, whereas gender differences in academic disciplines accounted for 23%.

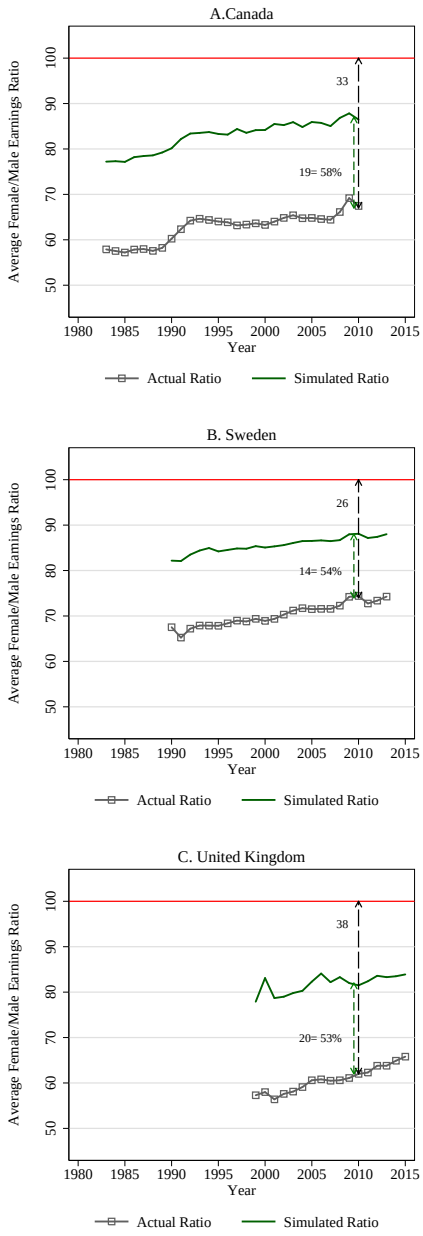


Figure 4: Counterfactual Gender Ratios in Average Annual Earnings

Note: Simulated gender ratio if the distribution of women across the four earnings centiles groupings were the same as that of men.

Computed from the Canadian LWF, the Swedish LISA, and the U.K. ASHE annual earnings of workers ages 25 to 64.

of the earnings gap (19 out of 33 percentage points) in Canada. In Sweden, they account for 54% of the gap (14 out of 26 percentage points) and in the United Kingdom, the gender disparities also account for more than half, 51%, of the gap (20 out of 38 percentage points). The fact that this proxy of vertical segregation alone accounts for more than half of the gender gap is quite significant in terms of the literature on gender wage differentials. Indeed, in a recent review Blau and Kahn (2016) find that, for the United States, the share of the hourly wage gap explained by an extensive set of human capital variables, occupation, industry, private/public sector and union coverage dummies portion adds up to only 62% of the gap in 2010. [22] They suggest that complementary explanations in future research might include gender differences in employment distributions.

As indicated earlier, our choice of centile groupings although borrowed from the literature on top income inequality can be seen as arbitrary. Therefore we perform three alternative counterfactuals that provide in turn a coarser partition of the top 1%, a finer partition of the next 9%, and another partition that goes further down in the distribution distinguishing the bottom 80% from the second decile and from our initial partition of the top decile. The results of these alternative counterfactuals are presented in Appendix Figure B1. For all three countries, the alternative partitions of the top decile alter the counterfactual gender earnings ratio by less than one percentage point. On the other hand, as anticipated from our discussion in section 2, going down the distribution to distinguish the bottom 80% from the next 10%, adds on average 5 percentage points of explanatory power to the percentile groupings. As sole explanatory factor, the under-representation of women in the top decile accounts for about 50% to 55% percent of the pay gap, while the under-representation of women in the second upper decile accounts for another 15% to 17%. This confirms that our emphasis on the top decile is not misplaced.

Figure 4 also illustrates that the gender earnings ratio has improved in all countries over time, as the vertical distance between the 100% line and the actual ratio line (with squares) narrows over time. However the vertical distance between the actual and simulated ratio (solid line) lines narrows very little, indicating that the improvements in the under-representation of women among top earners have not kept pace with increases in average top earnings. To make that point more salient and to assess the explanatory power of gender disparities in representation among

[22] For this analysis, Blau and Kahn (2016) appeal to the PSID and can include a measure of actual labour market experience.

Table 1: O-B Decomposition of Gender Differentials in Annual Earnings – Sweden

Explanatory Variables	Model 1				Model 2			
Year	1990	% of gap	2010	% of gap	1990	% of gap	2010	% of gap
Raw Gender Earnings Gap (2010SEK 1,000)	85.7 ***		97.2 ***		85.7 ***		97.2 ***	
Accounted for by differences in characteristics								
Centiles Groupings	32.8 ***	38.3	47.6 ***	48.9	30.7 ***	35.9	42.4 ***	43.6
Demographics (age only)	-0.8 ***	-0.9	-1.4 ***	-1.5	-0.8 ***	-0.9	-1.3 ***	-1.3
Education	-2.1 ***	-2.4	-6.6 ***	-6.7	-0.9 ***	-1.0	-1.1 ***	-1.1
Industry					7.7 ***	9.0	10.3 ***	10.6
Occupation					3.8 ***	4.4	5.5 ***	5.6
Region	0.0 ***	-0.1	-0.1 ***	-0.1	-0.1 ***	-0.1	-0.1 ***	-0.1
Total Explained	29.9 ***	34.8	39.5 ***	40.6	40.6 ***	47.3	55.7 ***	57.3
Total Unexplained	55.8 ***	65.2	57.7 ***	59.4	45.1 ***	52.7	41.6 ***	42.7

Note: The gender ratio in annual earnings increased from 67.2% in 1990 to 74.1% in 2010. Entries are male/female differences in the explanatory variables multiplied by the corresponding female coefficients. There are 8 five-year age bins, 5 education classes, 11 industry, 26 occupation, and 25 region dummies. Selected centiles grouping: bottom 90%, next 9%, next 0.9%, top 0.1%. Number of observations: 2,646,352 in 1990; 2,948,877 in 2010. *** p < 0.01, ** p < 0.05, * p < 0.1.

top earners in comparison to other factors, we now turn to a classic O-B decomposition. We provide the decomposition for two specific years at the beginning and end periods to gauge the outcome of the race between progress in the representation of women in top earner groups and increases in these top earnings. For Sweden, the LISA dataset contains a reasonably comprehensive set of covariates. But for Canada and the United Kingdom, we have to turn to the more conventional Labour Force Surveys, and thus use less accurate measures of centile groupings.

Table 1 reports the results of the O-B decomposition for Sweden for the years 1990 and 2010 using two models of earnings determination. Model 1 includes indicator variables of being in one of our four centile groupings (lowest omitted), of education, age, and region of residence. [23] Model 2 adds industry and occupation, factors that may capture gender segregation in the workplace. The entries are the sum of the product of male/female differences in the averages of each variable in the indicated groups of variables and the corresponding female estimated coefficients. The percentage explained by each group of variables is reported in the adjacent columns.

[23] Among the important missing variables are measures of hours worked or part-time status as well as labour market experience.

Table 2: O-B Decomposition of Gender Differentials in Hourly Wages – Canadian LFS

Explanatory Variables	Model 1				Model 2			
Year	1997	% of gap	2015	% of gap	1997	% of gap	2015	% of gap
Raw Gender Wage Gap ($CAN 2010)	4.66 ***		3.93 ***		4.66 ***		3.93 ***	
Accounted for by differences in characteristics								
Centiles Groupings	0.83 ***	17.9	1.67 ***	42.4	0.77 ***	16.5	1.46 ***	37.1
Demographics (age, marital status, kids)	0.04 ***	0.8	0.00 ***	0.0	0.01 ***	0.1	0.00 ***	0.0
Education	-0.17 ***	-3.6	-0.54 **	-13.8	-0.05 ***	-1.1	-0.10 ***	-2.6
Part-time, Union, Tenure					0.40 ***	8.7	-0.01 ***	-0.2
Industry					0.22 ***	4.8	0.32 ***	8.2
Occupation					0.19 ***	4.2	0.07 ***	1.8
Province	0.01 **	0.2	0.03 ***	0.8	0.01	0.1	0.03 ***	0.7
Total Explained	0.71 ***	15.2	1.16 ***	29.5	1.55 ***	33.3	1.77 ***	45.1
Total Unexplained	3.95 ***	84.8	2.77 ***	70.5	3.11 ***	66.7	2.16 ***	54.9

Note: The gender ratio in hourly wages increased from 80.6% in 1997 to 85.5% in 2015. Entries are male/female differences in the explanatory variables multiplied by the corresponding female coefficients. All variables except tenure are categorical. There are 4 marital status, 5 children, and 7 education classes, 11 industry, 47 occupation categories, and 10 provinces. Selected centiles grouping: bottom 90%, next 9%, next 0.9%, top 0.1%. Number of observations: 476,961 in 1997; 503,397 in 2015. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

There are three notable findings to emphasize. First, contrary to the Mincer-Polachek hypothesis, increases in educational attainment for women have not been met by commensurate increases in earnings: the explanatory power of education is negative. This finding is not new, but is worth noting as it signals the failure of the traditional human capital model to account for the gender pay gap.[24] Second, the explanatory power of the centiles groupings, although reduced by the addition of covariates (from 49% as the single explanatory factor in 2010 to 44% in Model 2), remains overwhelming. Industry and occupation together only add up to 16%. Third, the explanatory power of the centiles groupings has grown over time: from 36% in 1990 to 44% in 2010 (Model 2).[25] This result supports the view that increases in top earnings inequality are becoming an important "swimming upstream" factor.

[24] A negative sign on the share of the gender gap accounted by educational attainment has previously been noted in Canada (Baker and Drolet, 2010) and the United States (Blau and Kahn, 2016).

[25] Using male coefficients instead of female coefficients, the explanatory power of our centile groups does not change much, going from 33% in 1990 to 43% in 2010 (Model 2). On the other hand, the explanatory power of both occupations and industry increases from 13.4% to 19.7% in 1990, and from 16.3% to 24.4% in 2010, switching from female to male coefficients, with a resulting smaller unexplained gap.

Table 3: O-B Decomposition of Gender Differentials in Hourly Wages – British LFS

Explanatory Variables	Model 1				Model 2			
Year	1997	% of gap	2015	% of gap	1997	% of gap	2015	% of gap
Raw Gender Wage Gap (£2010)	3.15 ***		2.57 ***		3.15 ***		2.57 ***	
Accounted for by differences in characteristics								
Centiles Groupings	1.23 ***	39.2	1.35 ***	52.3	1.12 ***	35.7	1.23 ***	47.7
Demographics (age, marital status, kids)	-0.02 ***	-0.7	0.01 ***	0.3	0.00 ***	0.0	0.00 ***	-0.1
Education	0.33 ***	10.5	-0.13 **	-5.1	0.18 ***	5.8	-0.05 ***	-1.8
Part-time, Tenure					0.48 ***	15.3	0.21 ***	8.3
Industry					0.21 ***	6.8	0.27 ***	10.6
Occupation					0.13 ***	4.2	0.29 ***	11.4
Region	0.00 **	0.0	0.01 ***	0.4	0.00	0.0	0.01 ***	0.4
Total Explained	1.54 ***	49.0	1.23 ***	48.0	2.13 ***	67.7	1.97 ***	76.5
Total Unexplained	1.61 ***	51.0	1.34 ***	52.0	1.02 ***	32.3	0.60 ***	23.5

Note: The gender ratio in hourly wages increased from 73.5% in 1997 to 81.7% in 2015. Entries are male/female differences in the explanatory variables multiplied by the corresponding female coefficients. All variables except tenure are categorical. There are 4 marital status, 5 children, and 6 education classes, 11 industry, 33 occupation categories, and 13 regions. Selected centiles grouping: bottom 90%, next 9%, next 0.9%, top 0.1%. Number of observations: 55,199 in 1997; 31,136 in 2015. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Tables 2 and 3 reports the results of similar O-B decompositions of the gender gap in hourly wages using the Labour Force Surveys of Canada and the United Kingdom. Because we do not observe as many top earners in these public use files, the top centile groupings from the Labour Surveys correspond to lower centiles of the annual earnings distribution. [26] On the other hand, with hourly wages data we avoid the above shortcomings of not accounting for gender differences in labour supply. Furthermore, we can include some variables that proxy gender differences in labour force attachment and experience, namely part-time status and tenure on the job.

In Table 2, the results for Canada lead us to the same key findings as for Sweden. Educational attainment has negative explanatory power towards the gender gap in hourly wages and the under-representation of women in top centile groups has an overwhelming explanatory power that is growing over time. More precisely, the centile groupings account for 16.5% of the gap in 1997

[26] For Canada, in 2010 the annual earnings equivalent (assuming 2,080 hours a year) of the top 0.1% threshold of 66$CAN in the LFS corresponds to 137,000$CAN which is lower than the top 1% threshold of 206,785$CAN in annual earnings in the LWF. For the United Kingdom, the annual earnings equivalent of the top 0.1% threshold of £75 in the LFS corresponds to £156,000 which is in the range of the top 1% threshold of £125,651 in annual earnings in the ASHE.

and 37% in 2015. However, as Baker and Drolet (2010) argued, the unexplained share of the gap is particularly large in Canada at 67% in 1997, and remains above the half mark in at 55% in 2010.[27] It is lower than the 62% found for the United States (using male coefficients) by Blau and Kahn (2016).

Another notable finding is that the explanatory power of occupations has decreased over time from 4.8% to 1.8%, and it is the only country where we observe such a decline. This is attributable to the pay equity laws that were implemented in the private sector of Canada's two most populous provinces (in 1996 in Ontario and in 2001 in Quebec).[28] Because pay equity legislation addresses gender pay differentials resulting from horizontal occupational segregation in a within-establishment setting, it is conceivable that they reduce the explanatory power of occupations.[29] Pay equity laws are not set up to address pay differentials resulting from vertical segregation in a within-establishment setting and from industrial segregation, so their overall impact on the gender pay gap is mitigated in the presence of such segregation.

Our key findings above apply to the United Kingdom, although the negative explanatory power of educational attainment is more recent and smaller in magnitude. In Table 3, the results for the United Kingdom show the same overwhelming explanatory power of the centile groupings, and an increased importance over time: it grows from 36% of the gap in 1997 and 48% in 2015 (Model 2).[30] In the United Kingdom, the gender differences in part-time work status are particularly stark: in 2015, 40% of women worked part-time vs 7% of men. In Canada, the comparable percentages are 21% of women working part-time against 6% of men. This factor

[27] Using the male coefficients instead of the female coefficients, the shares accounted by centile groupings are very similar, going from 16.5% of the gap in 1997 to 38.1% in 2015. However, the share accounted by industry and occupations increases substantially from 20.6% to 30.5%, as a consequence the unexplained share is much lower going from 53.3% in 1997 to 30.6% in 2015. The fact that using male coefficients accounts for a larger share of the gap is common and shows that our use of female coefficients is conservative.

[28] Baker and Fortin (2004) do not find significant impacts of the Ontario law on the gender pay gap in DD and DDD settings that compared the gender pay gap in female-dominated jobs (treated) vs. other jobs and in large firms (treated) vs. and small firms.

[29] In province-specific O-B decompositions, the explanatory power of occupations in these two provinces, like that of education, become negative using female coefficients. This negative explanatory power implies that a larger share of gap remains unexplained.

[30] Using the male coefficients instead of the female coefficients, the corresponding shares go from 39% of the gap in 1997 to 46% in 2015.

thus captures a sizeable share of the gap in the United Kingdom. [31]

Our decomposition of the gender pay gap by centile groupings leads to two particularly striking lessons reinforced by the fact they emerge in all three countries under study. First, using mutually exclusive centiles groupings analogous to those from the literature on top income inequality, we find that this measure of vertical segregation has overwhelming explanatory power when compared to that of traditional factors, such as demographics, education, employment/union status, occupation, industry, and region of residence. The explanatory power of our centile groupings ranges from one fifth to close to half of the gap in the full specification (Model 2). Second, the explanatory power of this factor has grown over time, consistent with an increasing swimming upstream effect, where top earnings are rising faster than the representation of women in the top earnings groups.

5. Public Policies and Private Sector Initiatives to Foster Gender Equality among Top Earners

The results of Section 4 suggest that moving forward further reduction in the gender pay gap will primarily have to come from an increase in the representation of women among top earners. Keeping these findings in mind, we begin by discussing the effectiveness of existing public policies aimed directly at improving gender equality in pay and representation. Then we discuss family-friendly public policies and private sector initiatives that work at removing obstacles that women face in the workplace to level the playing field.

The more common public policies to foster the convergence of male and female earnings focus on within-job-establishment pay disparities, promoting "equal pay for equal work", or on within-establishment disparities, promoting "equal pay for work of equal value" also called comparable worth or pay equity. These policies essentially work on pay disparities at similar hierarchical levels within an organization. They have long been in place in the countries under study.[32]

[31] It is even larger using the male coefficients. In this case, part-time status accounts for 26.7% of the gap in 1997 and 14.1% in 2015. See Manning and Petrongolo (2008) for a more complete discussion of the part-time penalty and the association of part-time status with downward occupational mobility in the United Kingdom.

[32] In Canada, most jurisdictions introduced equal pay laws during the 1950s; many extended those in the context of pay equity legislation in the federal and provincial public sectors beginning in 1986. As noted above, pay equity laws

Legislative measures aimed at reducing vertical segregation have also been passed, but are harder to implement and often have limited incidence. Canadian employment equity laws, which started in 1986, apply only to the federal jurisdiction and to some provincial and municipal public servants, and generally lack an enforcement mechanism. The British "Duty to Promote Gender Equality" which came into effect in 2007 also applies only to public agencies and relies more on a voluntarist approach. Sweden's 2008 "Discrimination Act" applies to all employers and requires active plans to promote equality between men and women. [33] The employment equity (EE) laws rely on employers to come up with strategies to promote employment diversity, rather than requiring explicit targets or quotas in hiring found in "Affirmative Action" (AA) type of legislation.[34]

Policy makers and business leaders have recognized the need for greater diversity and gender equality at higher echelons of decision making. Some of these concerns pertain to improving the gender representation in legislative bodies, but also in governing boards of private firms. By 2014, a dozen of countries had introduced regulatory quotas for female directors on corporate boards, including Australia, Austria, Belgium, Denmark, France, Greece, Israel, Italy, Malaysia, the Netherlands, Norway, and Spain.[35]

The early Norwegian experience has provided opportunities to study the impact of female quotas, as arguably exogenous increases in female representation on corporate boards, on firm performance and employment.[36] But the results have been mixed: Ahern and Dittmar (2012)

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were implemented in the private sector of Canada's two most populous provinces in the late 1990s and beginning of the 2000s. The UK 1970 Equal Pay Act effectively implemented in 1975, was extended to "work of equal value" in 1983. In Sweden, an Equal Pay Act passed in 1979 went into effect in 1980; it was similarly extended in 1991 and 1994 (Meyersson Milgrom et. al, 2001) .

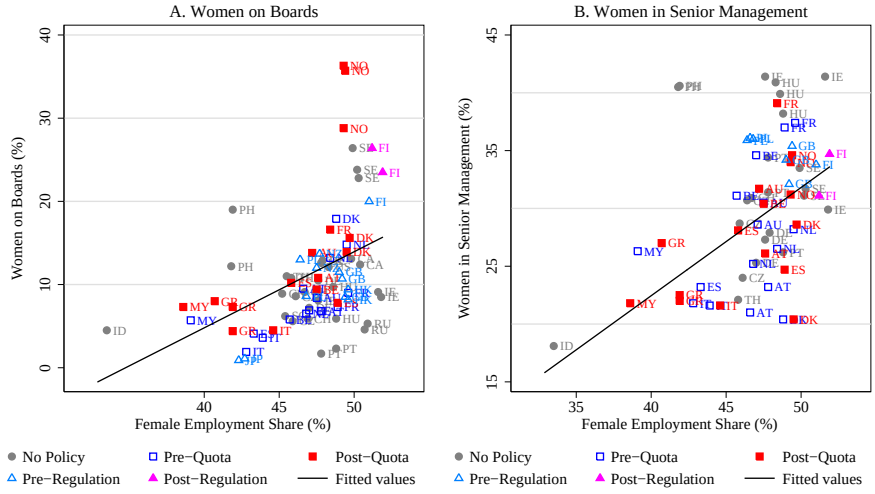
[33]Typical of EE laws, it also targets other forms of discrimination in relation to sex, race, gender, ethnic, and religious identity, as well as disability, sexual orientation, and age.

[34]Judge Abella, chair of the 1984 Canadian Royal Commission of Equity and Employment explicity coined the terms "employment equity" to avoid the controversy and stigma attached to AA and to allow for a more flexible process (Jain, et al. 2003). On the other hand, the lack of specific details and data for control groups has prevented more formal evaluation of EE laws.

[35]The information of the implementation of quotas or disclosure rules across countries has been obtained from Deloitte (2015) and Hastings (2013). Malaysia's affirmative action regime is interesting. Designed to expand upper-level occupations, traditionally held by ethnic Chinese and Indians, to the majority Bumiputera, it also improved the representation of women.

[36]As shown by Ryan and Haslam (2005), the appointment of female or minority CEOs is something of a sign that the firm is facing precarious conditions.

Figure 5: Women on Boards and in Senior Management vs. Female Employment Shares



Note: Countries were selected on the basis on data availability and minimum employment shares. Years: 2006, 2009, 2011, 2013. Data sources: female shares, of employment from the non-agricultural sector are from The World Bank; of board members, pre-2009 BoardEx data from European PWN (2008), and post-2009 GMI data from Gladman and Lamb (2013); of senior management from ILO (2014).

found a decline in Tobin's Q in the years following the 2003 announcement of the law, Matsa and Miller (2013) found that profits decreased following the 2006 full implementation as a result of increased labour costs from fewer layoffs and higher relative employment. Similarly, on the question of whether female quotas on corporate boards trickle down, the findings have been mixed. Kunze and Miller (2014) find that in Norway greater female representation at higher ranks narrows the gender gap in promotion rates at lower ranks. Bertrand, Black, Jensen, and Lleras-Muney (2014) find that the Norwegian quotas increased representation of women among the top five highest earners, but have no effect at other points in the distribution or on the gender pay gap.

Seven other countries, Finland, Hong Kong, Japan, New Zealand, Poland, Turkey, and the United Kingdom have passed regulatory disclosure rules regarding the percentage of women at different levels of the organisation (see Hastings, 2013). Finally, some countries passed quotas or voluntary codes too recently for them to appear in our data. A case in point, the Canadian Securities Administrators of seven provinces and territories (CSA, 2015) implemented "comply-

Table 4: Impact of Board Quotas and Disclosures Rules

Dependent Variable:	Women on Boards		Women in Senior Management	
Mean	11.14	12.12	29.73	29.86
Quotas	5.219***	5.478***	0.147	0.828
	(1.172)	(1.245)	(1.045)	(0.943)
Disclosure Rules	2.151**	2.308**	-1.124	-1.052
	(0.952)	(1.092)	(0.687)	(0.685)
Relative Female	50.664**	53.770**	-6.868	-12.408
Employment Rate	(20.377)	(21.225)	(37.805)	(37.792)
Log GDP per capita	2.566	5.644	-0.62	-0.25
(PPP)	(4.264)	(6.690)	(3.614)	(3.199)
R-square	0.272	0.356	0.131	0.286
No. of observations	224	173	213	195
OECD only	No	Yes	No	Yes
No.of countries	40	29	27	23

Note: Dependent variables are the share of women on corporate boards from BoardEx data (European PWN, 2008) from 2006 to 2009, from GMI data (Gladman and Lamb, 2013) from 2009 to 2014, and the share of women in senior management from ILO (2014). The data on the relative female employment rate, computed as the ratio of female employment rate to the total employment rate, is from the World Bank. Estimates from country fixed-effects models with robust standard errors clustered at the country level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

or-explain" female representation rules on January 1st, 2015. These require companies listed on their stock exchanges to disclose how many women they have on their boards and in their executive ranks. The "Swedish Code on Corporate Governance" which applies to listed private and public limited-liability companies came into force on November 1st, 2015; it includes a voluntary rule stating that "an equal distribution among the sexes shall be the goal".

Figure 5 illustrates the relationship between the share of women on corporate boards and the share of women in senior management and the overall female employment shares for selected countries and four representative years.[37] It shows that while Scandinavian countries have among the highest share of women on boards; this is less the case for the share of women in senior

[37]These countries include the twelve countries that implemented quotas, and the seven countries that implemented disclosure rules, listed above. Other countries act as controls; there are Canada, Chile, the Czech Republic, Egypt, Germany, Hungary, Indonesia, Ireland, Mexico, Morocco, Peru, Portugal, Philipines, Russia, Shanghai-China, South Africa, Sweden, Switzerland, Thailand, South Africa, and the United States. The figure excludes Egypt and Morocco whose female share is under 30%. In Figure 5, the average female employment share is around 48% while the average shares of women on boards is 11% and of women in senior management is 30%.

management, which is higher in Ireland, France, Hungary, and the Philippines.

We present in Table 4 the results of country fixed-effect models of the impact of quotas and disclosure rules on their target, the share of women of boards, and on the share of women in senior management to assess any trickle down effects, using all years of available data (2006–2014).[38] The regressions also control for the relative female employment share, and log GDP per capita in PPP. We distinguish the effects estimated for all countries (listed in footnote 26) from those limiting the analysis to OECD countries in the even columns.

To the extent that the imposition of quotas and disclosure rules is exogenous, the results show the causal effect of these policies on the share of women on boards and of women in senior management. We find sizeable direct effects of quotas of about 40% (5 points on average shares of 11 to 12 percentage points), and smaller but significant effects of disclosure rules. Importantly, however, we do not find any positive effect of either measure on the share of women in senior management. If anything, there might be some adverse effects of disclosure rules, although the significance is lacking.

We interpret these findings as the relative inefficacy of these policies at improving the representation of women at higher echelons of the firm, beyond the governing boards, and discuss the potential hindering role of family responsibilities. Many recent studies of the impact of children on mothers' earnings have found large and persistent negative effects on labour market outcomes: for the United States, Wilde, Batchelder, and Ellwood (2010); for Italy: Del Bono and Vuri (2011); for Germany: Fitzenberger, Sommerfeld, and Steffes (2013), Adda, Dustmann, and Stevens (2016); for Spain: Fernández-Kranz and Rodríguez-Planas (2011); for Austria: Frühwirth-Schnatter, Pamminger, Weber, and Winter-Ebmer (2014); for Portugal: Card, Cardoso and Kline (2016); for Sweden: Angelov, Johansson, and Lindahl (2016), Karimi, Hotz, and Johansson (2016); for Denmark: Kleven, Landais, and Sogaard (2016). While each paper offers more nuanced conclusions, in the end, they find that following childbirth, mothers are less likely to further their educational attainment. They often move to part-time work or a more flexible schedule, to family-friendly, less profitable, and lower paying firms, and are less likely to be promoted. What is yet unclear is whether the mothers' lower rate of promotions comes

[38] The regressions on the share of women in senior management exclude Canada, Chile, Egypt, Japan, Morocco, New Zealand, Peru, Russia, Shanghai-China, South Africa, Switzerland, and the United States from the countries listed in footnote 26, because data is not available.

from the fact that employers direct them to the "mommy track" or whether this lower rate results from mothers' preferences. Are mothers less likely to be offered leadership training as a result of employers (correctly or not) anticipating more absenteeism, less work effort, or more reluctance to travel for work?[39] Or are mothers less likely to apply for leadership positions because of their higher share of childcare responsibilities?[40]

The new results from these studies highlight the long recognized difficulties that women face reconciling work and family life.[41] As emphasized by Goldin (2014), the pressure to work long hours is particularly acute for professional women who aim for the top of the earnings distribution. The remedial public policies and firm practices fall into two camps: the measures that allow women to take time off from work (maternity and child care leave, flexible work hours) to attend to their family responsibilities, and the measures that assist women in finding substitutes for their child care responsibilities (on-site child care, universal childcare, etc.).

Although maternity leave policies are intended to help mothers retain their attachment to their employer or workplace, the results of the research above suggest that this is not necessarily the case. This first set of measures has the disadvantage of potentially lowering women's attachment to the labour market and therefore weakening their position in the organizational hierarchy. Blau and Kahn (2013) attributes the relative decline in U.S. female labor force participation rate in 2010 by comparison with other OECD countries to the expansion of family-friendly policies in these countries, including parental leave and part-time work entitlements. On the other hand, they note that American women are less likely to work part-time and more likely to work as managers or professionals. Olivetti and Petrolongo (2017) in their recent review of family policies across high-income countries conclude that the impacts of leave policies on employment and earnings, in particular, tended to be positive for less skilled women, but negative for the more highly skilled. They also argue that there is no evidence of paternity leave rights on mothers' careers. [42]

[39] There is an abundant literature, mostly from experimental evidence, trying to make the case that women possess less of the personality traits, such as competitiveness, overconfidence, hardiness under pressure, and risk taking, likely in demand in leadership positions. See for example Croson and Gneezy (2009).

[40] This last effort hypothesis was originally proposed by Becker (1985). He argued that mothers devote less effort at work because of their higher share of childcare responsibilities and that mothers value work amenities that allow them to more effectively integrate these responsibilities with their work.

[41] Olivetti and Petrolongo (2017) retrace the historical record of family policies and report that Sweden and the United Kingdom were the first countries to implement a four-weeks post-birth maternity leave in 1891.

[42] For example, Ekberg, Eriksson, and Friebel (2013) find that fathers who benefited from a "daddy-month" of leave

The second set of measures from subsidized daycare to universal child care have another set of stakeholders, the children themselves who can potentially be helped or hurt by the policies, and therefore they have been more contentious. Several studies of the impact of the Quebec (Canada) universal childcare program introduced in the late 1990s found positive impacts on maternal labour force participation and labour supply.[43] But Lefebvre, Merrigan, and Verstraete (2009) find that the long-term positive labour supply effects for mothers of pre-school children are driven by the experience of less educated mothers. Other studies (Baker, Gruber, and Milligan, 2008, 2015) have reported negative effects on short-run behavioural outcomes of toddlers and long-run non-cognitive deficits for school-age children, that even led to higher crime rates later in life for boys. Studies of the universal childcare expansion in Norway have shown less positive results on maternal employment (Havnes and Mogstad, 2011b), but more positive results on children's outcomes (Havnes and Mogstad, 2011a), again more so for girls and children from less educated mothers. In terms of long-run outcomes, Havnes and Mogstad (2015) find substantial heterogeneity in the gains in earnings associated with the Norwegian program, from positive for children of low income parents to negative for children from the upper-class. Olivetti and Petrongolo (2017) argue that the differential impact by country may depend on the relative price of child care (higher in Canada than in Norway). As with the other family-friendly policies, these policies are more likely to have higher impact in families who face financial constraints in accessing child-care services. But the children's outcomes do not provide much reassurance to high potential-earning working mothers who might suffer from "mother's guilt" as they log in their long hours. In fact, Guryan, Hurst, and Kearney (2008) find that highly educated mothers spend more time with their children than mothers with lower levels of education, likely because their higher income allows them to substitute away other household tasks that they enjoy less than parental time.

In the list of obstacles that women may face climbing the job ladder, this leaves room for the much discussed, but difficult to study, issues of gender bias and sexual harassment in the workplace. The latter instances have been difficult to pursue successfully in criminal courts given the "beyond reasonable doubt" standard of evidence that applies to criminal cases. But

in Sweden did not take larger shares of the leave to care of sick children. Others have argued that gender-neutral parental leaves end-up hurting women's advancement prospects as the bar is set higher given that fathers do not need the same childbearing relief.

[43] See for example, Baker, Gruber, and Milligan (2008) and Lefebvre and Merrigan (2008).

some highly publicized cases have led private firms and public agencies alike to adopt "codes of conduct" or "ethic rules". Such rules allow the dismissal of offending individuals when the balance of probabilities weighs against them and leads to the conclusion that a "breach of trust" prevent them from further exercising the authority associated with their position. Under these conditions, organizational practices are likely the better tools to counteract such obstacles faced by women as they make inroads in traditionally male-dominated environments.

Our critical overview of the remedial public policies and firm practices does not point to a proverbial "silver bullet". Universal family-friendly policies exert their largest impact on women in the lower end of the income distribution. It is yet unclear whether measures aimed at improving diversity at higher echelons of the organization are effective. As we look to the future and the fact that the current generation of young women attains higher levels of tertiary education than young men, a reversal in the traditional pattern of educational hypergamy (women marrying up) towards hypogamy (Esteve, García-Román, and Permanyer, 2012) might lead to a less traditional division of household responsibilities (Fortin, 2005). Although some recent analyses show little change in the traditional division of housework among dual-earners households with a wife outearner (Bertrand, Kamenica, and Pan, 2015; Sofer and Thibout, 2016). For many women who aim for top jobs, delaying marriage and childbirth (or foregoing it altogether) has become a practical alternative, but it likely has a too low benefit-cost ratio for women aiming to move into the next 9% income group.[44]

6. Conclusion

This paper uses empirical methods developed for the analysis of top income inequality to study the consequences of the under-representation of women in top income groups for the overall gender pay gap. We thus appeal to annual earnings information from administrative data sources, namely the LWF from Canada, the LISA from Sweden, and the ASHE from the United Kingdom. Our approach contrasts with the traditional literature that describes glass ceiling effects in terms of log earnings differences between the highest percentiles of the gender-specific distributions (e.g. Albrecht, Björklund, and Vroman, 2003). Instead, we consider the distribution of women and men across four top centiles groupings of the earnings distribution of men

[44] Delaying marriage comes with the additional bonus of reduced divorce rates (Rotz, 2016).

and women combined, in the spirit of approaches using positional ranks (Fortin and Lemieux, 1998; Bayer and Charles, 2016).

Like others (e.g. Kopczuk, Saez, and Song, 2010), we find decreasing shares of women moving up the overall earnings distribution. It can broadly speaking be described (at the end of the time period) as going from a 50% female share in the bottom 90%, to a 25% female share in the next 9%, to a 15% share in the next 0.9%, to a 10% female share among the top 0.1% of earners. Our country-specific descriptions in Figure 3 reveal more nuanced patterns following the 2008 financial crisis for example, when there were no increases in the female share among the top 0.1% of earners in the United Kingdom. Increases in female shares in the other partitions of the top decile have been more encouraging, namely a 6 to 8 percentage points increase in the next 9% and a 2 to 7 percentage points increase in the next 0.9% over the first decade of the 21st century across the three countries under study.[45]

We then document the evolution of gender earnings ratios within these four percentile groupings. This leads us to two glass-half-full findings. First, for close to 95% of women —those in the bottom 90% of the overall earnings distribution— the gender earnings ratio is substantially more favourable than the overall ratio measure depicts. In all three countries under study, the gender earnings ratio in the bottom 90% is more favourable by a sizeable 10 to 15 percentage points than the overall ratio. Second, women in the next 9% and next 0.9% face even more favourable gender ratio in the upper nineties. Glass ceiling effects seem to be increasing only for women in the top 0.1%.

Next, we present some counterfactual gender earnings ratios and perform some classic O-B decompositions. We ask "what would the gender earnings ratio be if women were distributed across our four centile groupings as men are?" While this may seem farfetched, a similar skepticism might have, decades ago, characterized the counterfactual "what would the gender earnings ratio be if women had the same education level as men?" We find that in all three countries under study, that have experienced the largest increases in top income inequality after the United States, the under-representation of women in the top income groups (the top 0.1%, the next 0.9%, the next 9%) alone account for more than half of the gender gap in annual earnings. When pitted down against the traditional explanatory factors such as age, education, occupation, and industry,

[45] Sweden has seen more comparable increases over the 1999-2010 period, from 8 to 7 to 5 percentage points, across all three top income groups.

the share of the pay gap explained by the under-representation of women in top income groups remains overwhelming and accounts for a growing proportion of the explained gap over time. [46]

Our findings show that increasing inequality in top incomes and the under-representation of women among top earners contributes to slower progress in the gender pay ratio. Fortin and Huberman (2002) had argued that over the 20th century the decline in vertical segregation had contributed more to the improvement of women's labour market outcomes than changes in horizontal segregation. Much of this decline was propelled by increases in women's educational attainment, including the reversal in the gender gap in higher education, but this is no longer sufficient. Further improvements in vertical segregation, "relatively more women in top jobs" are likely to be critical to further improvements in the gender pay ratio in the 21st century.

Thus, finally, we consider whether female quotas on corporate governing boards and gender diversity disclosures rules implemented in close to twenty countries in the last fifteen years can provide an effective way to improve the representation of women in top jobs. The results from our country fixed-effects models comparing the "before" and "after" changes in female representation with changes in a set of twenty control countries indicate that these measures exert sizeable direct effects on women's representation on corporate boards. But we cannot confirm any trickle down effects with available country-level measures of women's share in senior management. More detailed analyses of these effects are needed. Whilst women's choices of educational level and specialty exert first order effects on their careers, their choice of marriage partner and family formation decisions are also critical for their labour market prospects.

[46] We note that as women's educational attainment is now exceeding that of men in these three countries, the explanatory power of gender differences of education has gone negative.

Appendix

A. Reweighting vs O-B Decomposition

We illustrate the equivalence between the counterfactuals constructed using reweighting and the traditional O-B decomposition in the familiar case of professorial salaries. This case provides a clear example of vertical segregation across the three professorial ranks of Full Professor, Associate Professor, and Assistant Professor versus horizontal segregation across academic disciplines, with relatively more men than women in STEM disciplines than in Education and Social Sciences. With salaries broadly in the $CAN 90,000 to $CAN 300,000 range, these workers mostly belong to the next 9% income group (threshold of $CAN 92,000 in 2010), and in some case to the next 0.9% (threshold of $CAN 207,000). The results from the LWF above have shown gender earnings ratios for these income groups around 95%.

Table A.1: Average Professorial Salaries at UBC in 2010

Rank	Full Professor		Associate Professor		Associate Professor		All Professor	
Gender	Men	Women	Men	Women	Men	Women	Men	Women
Average Salary	152493.4	146047.5	121483.4	114594.9	106805.6	99708.87	134955.3	120623.1
Female/Male Ratio	0.96		0.94		0.93		0.89	
Numbers	501	130	297	184	170	105	968	419
Share in Rank	51.8	31	30.7	43.9	17.6	25.1	100	100
Share of Women	20.6		38.3		38.2		30.2	

Table A1 displays some summary statistics of the professorials salaries at the University of British Columbia (UBC) in 2010 by gender and professorial rank. It shows that the overall female-male ratio is less than 90%, whereas the gender ratios in each professorial rank, that is among Full, Associate, and Assistant Professors, are closer to 95%. The shares of professors in each rank show than men are over represented among Full Professors with 52% of men in the Full category vs. 31% of women. Women are over-represented at the Associate Professor level with 44% of women at this rank, they appear stuck in the middle.

As explained in section 4, we can construct the counterfactual average salary that women would have earned if they had been distributed across professorial ranks in the way as men are by multiplying the female average salaries conditional on rank by the male distributional shares:

$$501/968 \times 146048 + 297/968 \times 114595 + 170/968 \times 99709 = 128259.3,$$

Table A.2: Oaxaca-Blinder Decomposition of Professorial Salaries

Explanatory Variables	Model 1		Model 2	
Raw Gender Salary Differentials ($CAN 2010)	14332.24***		14332.24***	
Accounted for by differences in characteristics		% of gap		% of gap
Professorial Rank	7636.23***	53.3	6647.38***	46.4
Chair Holder Dummies			546.27**	3.8
Years in Rank			1180.13**	8.2
Departmental Dummies			3093.22**	21.6
Total Explained	7636.23***	53.3	11466.99***	80.0
Total Unexplained	6696.02***	46.7	2865.25***	20.0

Note: Entries are male/female differences in the explanatory variables multiplied by the corresponding female coefficients. All variables, except years in rank are categorical. There are two categories of Chair holders, and 68 Departmental dummies.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

and the overall ratio would be: $128259.3/134955.3(\times 100)$ =95%. The salary gap explained by rank is $128259.3 - 120623.1 = 7636.2$. More that 53% of the gap is accounted for by the gender differences in the proportion of faculty members across rank.

Table A2 illustrates the corresponding O-B decomposition. Model 1 finds that the salary gap explained by rank in the O-B decomposition is identical the one computed above using reweighting of the average female salaries by rank in the computation of the counterfactual female salaries. Model 2 adds years in rank, Chair holder and Departmental dummies, the latter are thought to capture horizontal segregation. The addition of the variables increase the share of the gap that is explained by differences in characteristics to 80%, but vertical segregation remains the factor with overwhelming explanatory power at 46% of the gap while horizontal segregation captures a sizeable share of the gap at 22%.

B. Alternative Counterfactuals

In Figure B.1, we illustrate the sensitivity of our results displayed in Figure 4 to three alternative choice of centile groupings. Our initial centile groupings use three thresholds – the top 10%, the top 1%, and the top 0.1%–frequently used in the literature of top income inequality, to partition the earnings distribution of men and women combined into four groups: the bottom 90% (b90), the next 9% (p9099), the next 0.9%(n09) and the top 0.1% (t01). Because there are relatively few women in the top 0.1%, we consider a coaser partition of the top 1%, the next 0.5% (n05) and the top 0.5% (t05) in a second choice of centile groupings. Because they are

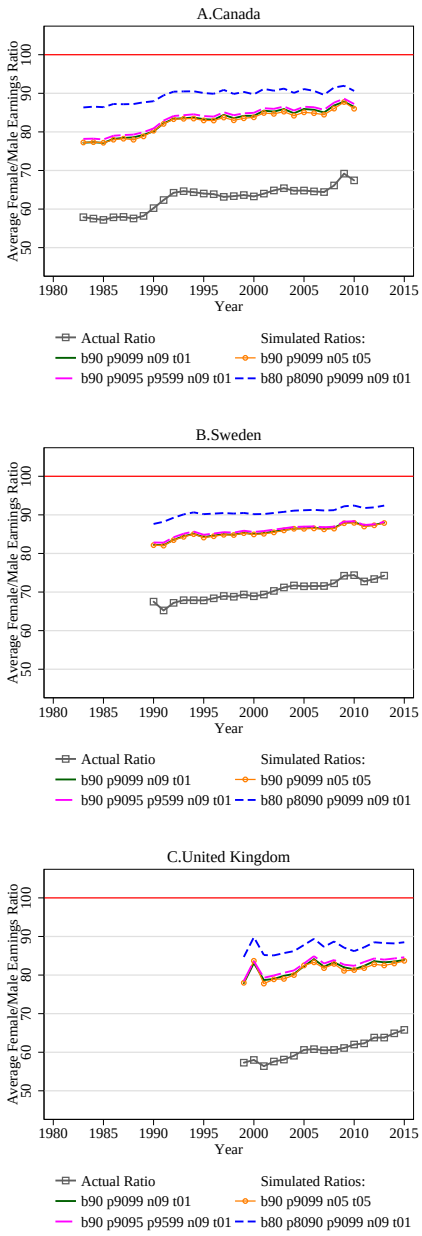


Figure B.1: Counterfactual Gender Ratios in Average Annual Earnings

Note: Simulated gender ratio if the distribution of women across the indicated centiles groupings were the same as that of men.

Computed from the Canadian LWF, the Swedish LISA, and the U.K. ASHE annual earnings of workers ages 25 to 64.

relatively more women at the bottom of the next 9% than at the top of that grouping, we divide it into p9095 and p9599 in our third option of five centile groupings. Finally, we go down further the earnings distribution and distinguish the bottom 80% (b80) from the next 10% (p8090) while using the same partition of the top 10 as in our initial grouping.

In all three countries, our initial counterfactual, the solid (green) line in Figure B.1, is barely visible as it is over-written by the counterfactuals resulting from the second and third options, which consists of refinements of the top 1% or the next 9%, respectively. Differences between the three counterfactual ratios are less than 1 percentage point, showing the robustness of our results to alternative partitions of the top decile.

On the other hand, the fourth counterfactual which goes down the earnings distributiona and asks "what if the representation of women in the second decile (in addition to the first decile) was the same as men," yields more favourable counterfactual earnings ratios than counterfactuals which focus only the top decile. In Canada, the differences between the last counterfactual and the first three are larger in the 1980s, around 9 percentage points, and narrow to 4 percentage points in the 2000s. In Sweden, the differences between our initial counterfactual and the fourth one also narrow over time from 6 to 4 percentage points. In the United Kingdom, these differences range from 7 to 5 percentage points. Overall, the results show the larger importance of the under-representation of women in the top decile by comparison with the second decile for the average gender pay gap. The first accounts on average for between 50% to 55% of the gap, while the second account for 13% to 17% of the gap. This shows that our focus on the top decile is appropriate.

References

Adda, J., Dustmann, C., Stevens, K., 2016. The career costs of children. Forthcoming in the Journal of Political Economy.

Ahern, K.R., Dittmar, A.K., 2012. The changing of the boards: the impact on firm valuation of mandated female board representation.Quarterly Journal of Economics, 127(1), 137–197.

Albrecht, J., Björklund, A., Vroman, S., 2003. Is there a glass ceiling in Sweden? Journal of Labor Economics, 21(1), 145–177.

Alvaredo, F., Atkinson, A. B., Piketty, T., Saez, E., 2013. The top 1 percent in international and historical perspective. Journal of Economic Perspectives, 27(3), 3–20.

Angelov, N., Johansson, P., Lindahl, E., 2016. Parenthood and the gender gap in pay. Journal of Labor Economics, 34(3), 545–579.

Arulampalam, W., Booth, A. L., Bryan, M.L., 2007. Is there a glass ceiling over Europe? Exploring the gender pay gap across the wage distribution. Industrial & Labor Relations Review, 60(2), 163–186.

Atkinson, A. B., Casarico, A., Voitchovsky, S., 2016. Top incomes and the gender divide. Melbourne Institute Working Paper Series, Working Paper No. 27/16.

Baker, M., Drolet, M., 2010. A new view of the male/female pay gap. Canadian Public Policy, 36(4), 429–464.

Baker, M., Fortin, N.M., 2004. Comparable worth in a decentralized labour market: the case of Ontario. Canadian Journal of Economics. 37(4), 850–878.

Baker, M., Gruber, J., Milligan, K., 2008. Universal child care, maternal labor supply, and family well-being. Journal of Political Economy. 116(4), 709–745.

Baker, M., Gruber, J., Milligan, K., 2015. Non-cognitive deficits and young adult outcomes: The long-run impacts of a universal child care program (No. w21571). National Bureau of Economic Research.

Bakker, K., Boyd, L., Fortin, N., Johnson, J., Patch, T., Trowell, M., Sudmant, W., 2010. An analysis of the gender pay gap in professorial salaries at UBC: Report of the pay equity (data) working group. University of British Columbia.

Bayer, P. and Charles, K.K., 2016. Divergent paths: Structural change, economic rank, and the evolution of black-white earnings differences, 1940-2014 Working Paper No. w22797. National Bureau of Economic Research.

Becker, G.S., 1985. Human capital, effort, and the sexual division of labor. Journal of Labor Economics, 3(1, Part 2), S33–S58.

Bell, B., Van Reenen, J., 2014. Bankers and their bonuses. The Economic Journal. 124(574), F1-F21.

Bertrand, M., Mullainathan, S., 2001. Are CEOs rewarded for luck? The ones without principals are. Quarterly Journal of Economics, 116(3), 901–932.

Bertrand, M., Black, S.E., Jensen S., Lleras-Muney, A., 2014. Breaking the glass ceiling? The effect of board quotas on female labor market outcomes in Norway (No. w20256). National Bureau of Economic Research.

Bertrand, M., Kamenica, E., Pan, J., 2015. Gender identity and relative income within households. Quarterly Journal of Economics. 130(2), 571–614.

Blau, F.D., Kahn, L. M., 1997. Swimming upstream: Trends in the gender wage differential in the 1980s. Journal of Labor Economics, 15(1), 1-42.

Blau, F.D., Kahn, L. M., 2013. Female labor supply: Why is the US falling behind?, American Economic Review, 103(3): 251–56.

Blau, F.D., Kahn, L. M., 2016. The gender wage gap: Extent, trends, and explanations (No. w21913). National Bureau of Economic Research.

Bonikowska, A., Drolet, M., Fortin, N.M., 2017. Earnings inequality and the gender pay gap: Insights from the longitudinal worker files, 1983-2010. Economic Insights, Statistics Canada.

Brewer, M., Sibieta, L., Wren-Lewis, L., 2007. Racing away? Income inequality and the evolution of high incomes. Institute for Fiscal Studies Briefing Notes, No. 76.

Canadian Securities Administrators (CSA). 2015. Multilateral staff notice 58-307: Staff review of women on boards and in executive officer positions – Compliance with NI 58-101 disclosure of corporate governance practice.

Card, D., Cardoso, A.R., Kline, P., 2016. Bargaining, sorting, and the gender wage gap: Quantifying the impact of firms on the relative pay of women. Quarterly Journal of Economics. 131(2), 633–686.

Croson, R., Gneezy, U., 2009. Gender differences in preferences. Journal of Economic Literature. 47(2),448–474.

Davies, M.L., 2015. Improving the gender balance on British boards: Women on boards 5 year summary. BIS research papers and Corporate governance, Department for Business, Inno-

vation & Skills, London.

Del Bono, E., Vuri, D., 2011. Job mobility and the gender wage gap in Italy. Labour Economics. 18(1), 130–142.

Deloitte., 2015. Women in the Boardroom: a Global Perspective 2015.

Denk, O., 2015. Who are the top 1% earners in Europe? OECD Economics Department Working Papers, No. 1274, OECD Publishing, Paris.

DiNardo, J., Fortin, N.M., Lemieux, T., 1996. Labor market institutions and the distribution of wages, 1973–1992: A semiparametric approach. Econometrica, 64 (5), 1001–1044.

Ekberg, J., Eriksson, R., Friebel, G., 2013. Parental leave–A policy evaluation of the Swedish 'Daddy-Month' reform. Journal of Public Economics. 97, 131-143.

Edlund, L., Kopczuk, W., 2009. Women, wealth, and mobility. American Economic Review. 99(1), 146–178.

Esteve, A., García-Román, J., Permanyer, I., 2012. The gender-gap reversal in education and its effect on union formation: The end of hypergamy? Population and Development Review. 38(3), 535–546.

European Professional Women's Network (PWN), 2008. Third bi-annual board women monitor, 2008. Retrieved from http://www.cartapariopportunita.it/files/15/womenmonitor.pdf

Fernández-Kranz, D., Rodríguez-Planas, N., 2011. The part-time pay penalty in a segmented labor market. Labour Economics. 18(5): 591–606.

Fitzenberger, B., Sommerfeld, K., Steffes, S., 2013. Causal effects on employment after first birth — A dynamic treatment approach. Labour Economics. 25, 49–62.

Fortin, N.M., Lemieux, T., 1998. Rank regressions, wage distributions, and the gender gap. Journal of Human Resources, 610–643.

Fortin, N.M., Lemieux, T., 2000. Are womens wage gains mens losses? A distributional test. American Economic Review Papers and Proceedings, 90(5): 456–460.

Fortin, N.M., Huberman, M., 2002. Occupational gender segregation and women's wages in Canada: an historical perspective. Canadian Public Policy. S11—S39.

Fortin, N.M., 2005. Gender role attitudes and the labour market outcomes of women across OECD countries. Oxford Review of Economic Policy, 21(3), 416—438.

Fortin, N.M., Lemieux, T., Firpo, S. 2011. Decomposition Methods, in O. Ashenfelter and D. Card (eds.) Handbook of Labor Economics, Vol. 4A, Amsterdam: North-Holland, Chap. 1,

1–102.

Frühwirth-Schnatter, S., Pamminger, C., Weber, A., Winter-Ebmer, R., 2014. When is the best time to give birth – Career effects of early birth decisions (No. 10132). CEPR Discussion Papers.

Gabaix, X., Landier, A., 2008. Why has CEO pay increased so much? Quarterly Journal of Economics, 123(1), 49–100.

Gladman, K., Lamb, M., 2013. GMI ratings: Women on boards survey 2013, EGS Reseach.

Gneezy, U. and Pietrasz, A., 2013. When half of the men are more competitive than all women. Unpublished manuscript.

Goldin, C., 2013. A pollution theory of discrimination: Male and female differences in occupations and earnings. In Human capital and history: The American record, Boustan, L.P, Frydman, C. and Margo, R.A. (eds.) Chicago: University of Chicago Press.

Goldin, C., 2014. A grand gender convergence: Its last chapter. American Economic Review, 104(4), 1091–1119.

Guryan, J., Hurst, E. and Kearney, M., 2008. Parental education and parental time with children. Journal of Economic Perspectives, 22(3):23–46.

Guvenen, F., Kaplan, G., Song, J., 2014. The glass ceiling and the paper floor: Gender differences among top earners, 1981-2012. (No. w20560). National Bureau of Economic Research.

Hastings, P. (2013). Breaking the glass ceiling: Women in the boardroom, A study of major global exchanges.

Havnes, T., Mogstad, M., 2011a. Money for nothing? Universal child care and maternal employment. Journal of Public Economics, 95(11), 1455–1465.

Havnes, T., Mogstad, M., 2011b. No child left behind: Subsidized child care and children's long-run outcomes. American Economic Journal: Economic Policy, 3(2), 97–129.

Havnes, T. Mogstad, M., 2015. Is universal child care leveling the playing field? Journal of Public Economics, 127, 100–114.

International Labour Organization (ILO), 2014. Annual indicators: Female share of employment in senior and middle management.

Jain, H.C., Sloane, P.J., Horwitz, F.M., 2003. Employment equity and affirmative action: An international comparison. ME Sharpe.

Karimi, A., Hotz, V.J., Johansson, P., 2016. Family friendly firms? Worker mobility, firm

attributes and wage trajectories of women and men. Discussion Paper.

Kleven, H.J., Landais, C., Sogaard, J.E., 2016. Children and gender inequality: Evidence from Denmark. Discussion paper, London School of Economics.

Kline, P., 2011. Oaxaca-Blinder as a reweighting estimator. American Economic Review, 101(3): 532–537.

Kopczuk, W., Saez, E., Song, J., 2010. Earnings inequality and mobility in the United States: evidence from social security data since 1937. Quarterly Journal of Economics, 125(1), 91–128.

Kunze, A. and Miller, A.R., 2014. Women helping women? Evidence from private sector data on workplace hierarchies (No. w20761). National Bureau of Economic Research. Forthcoming in the Review of Economics and Statistics.

Lefebvre, P. and Merrigan, P. 2008. Child-care policy and the labor supply of mothers with young children: a natural experiment from Canada. Journal of Labor Economics, 26(3), 519–548.

Lefebvre, P., Merrigan, P., Verstraete, M., 2009. Dynamic labour supply effects of childcare subsidies: Evidence from a Canadian natural experiment on low-fee universal child care. Labour Economics. 16(5), 490–502.

Malmendier, U., Tate, G., 2009. Superstar CEOs. Quarterly Journal of Economics, 124(4), 1593–1638.

Manning, A., Petrongolo, B., 2008. The part-time pay penalty for women in Britain. The Economic Journal, 118(526): F28-F51.

Matsa, D. A., Miller, A.R., 2013. Female style in corporate leadership? Evidence from quotas. American Economic Journal: Applied Economics, 5: 136-69.

Meyersson Milgrom, E.M., Petersen, T., Snartland, V., 2001. Equal pay for equal work? Evidence from Sweden and a comparison with Norway and the US. Scandinavian Journal of Economics, 103(4), 559–583.

Mincer, J., Polachek, S. 1974. Family investments in human capital: Earnings of women. Journal of Political Economy, 82(2, Part 2), 76–110.

Olivetti, C., Petrongolo, B., 2017. The economic consequences of family policies: Lessons from a century of legislation in high-income countries (No. w23051). National Bureau of Economic Research.

Pan, J., 2015. Gender segregation in occupations: The role of tipping and social interactions.

Journal of Labor Economics, 33(2): 365–408.

Piketty, T., Saez, E., 2003. Income Inequality in the United States, 1913–1998. Quarterly Journal of Economics, 118 (1): 1–41.

Piketty, T., Saez, E., Stantcheva, S., 2014. Optimal taxation of top labor incomes: A tale of three elasticities. American Economic Journal: Economic Policy, 6(1), 230–271.

Piketty, T., Saez, E., 2013. Top incomes and the great recession: Recent evolutions and policy implications. IMF Economic Review, 61(3), 456–478.

Rotz, D., 2016. Why have divorce rates fallen?: the role of women's age at marriage. Journal of Human Resources, 51(4), 961–1002.

Ryan, M.K., Haslam, S.A., 2005. The glass cliff: Evidence that women are over-represented in precarious leadership positions. British Journal of management, 16(2), 81–90.

Sofer, C., Thibout, C., 2016. Women's investment in career and household division of labor. Melbourne Institute Working Paper Series, Working Paper No. 38/16.

Wilde, E.T., Batchelder, L. Ellwood, D.T., 2010. The mommy track divides: The impact of childbearing on wages of women of differing skill levels (No. w16582). National Bureau of Economic Research.