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# The Evolution of Gender Gaps in Industrialized Countries

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## ABSTRACT

### **The Evolution of Gender Gaps in Industrialized Countries\***

Women in developed economies have made major inroads in labor markets throughout the past century, but remaining gender differences in pay and employment seem remarkably persistent. This paper documents long-run trends in female employment, working hours and relative wages for a wide cross-section of developed economies. It reviews existing work on the factors driving gender convergence, and novel perspectives on remaining gender gaps. The paper finally emphasizes the interplay between gender trends and the evolution of the industry structure. Based on a shift-share decomposition, it shows that the growth in the service share can explain at least half of the overall variation in female hours, both over time and across countries.

JEL Classification: E24, J16, J31

Keywords: female employment, gender gaps, demand and supply, industry structure

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# 1 Introduction

Women have made major inroads in labor markets throughout the past century, resulting in clear convergence in human capital investment and employment prospects and outcomes relative to men (Goldin, 2006). However, there are remaining gender differences in pay and employment levels, as well as in the types of activities that men and women perform in the labor market (OECD, 2002; Goldin, 2014a). Women's progress in the labor market has been the focus of a vast and still growing literature on its causes, characteristics and consequences, as well as on the incomplete convergence with respect to men. The existing literature has indicated a number of supply-side explanations for gender trends, including human capital investment, medical advances, technological progress in the household, and the availability of child care. Recent lines of research also emphasize the role of social norms regarding women's work in shaping observed gender outcomes, and gender differences in preferences and psychological traits potentially related to labor market success.

This paper presents long-run trends in gender outcomes in employment, hours and wages for a large sample of high-income countries, reviews the literature on the rise in female labor force participation during the postwar period, and discusses existing views on the remaining disparities with respect to men. In our discussion we devote special emphasis to the role played by long-run changes in the industry structure and its cross-country variation.

The evolution of female employment is traced using an unbalanced panel of nineteen high-income countries between 1850 and 2008, including the United States, Canada, Australia, Japan, and a large cross-section of European economies. The historical perspective reveals that, while being a major 20th century development, the increase in female labor market participation is more markedly a postwar phenomenon. The post-war period increase in female participation is even more striking if contrasted with the secular decline in men's labor force participation rates, which, in most of the countries in our sample, accelerated after 1950. We further our analysis of the postwar period by illustrating how the rise in female participation translated into a substantial increase in the female share of total hours worked in the economy, and was associated to the narrowing of gender gaps in earnings. Despite convergence in gender trends in most countries, women's economic progress seems to have stalled in Japan and Korea.

We then provide a closer perspective on gender trends by looking at the role of structural transformation, and in particular at the interplay between the rise of the

service economy and the growth in female hours of work. The expansion of the service sector may create jobs whose characteristics better match female preferences and household roles, and at the same time may increase the relative demand for female work as long as women have a comparative advantage in the production of services. The labor demand element of the rise in the service economy is well positioned to generate gender convergence in labor market outcomes both in terms of employment and wages, a feature that could not be rationalized on the basis of labor supply mechanisms alone. Based on a shift-share decomposition analysis, we show that the growth in the service share can explain at least half of the overall variation in female hours, both across countries and over decades.

The rest of the paper is organized as follows. Section 2 describes long run trends in female employment, hours worked and the gender pay gap on our country sample. Section 3 reviews the existing literature on the rise in female participation and the lack of full convergence in labor market outcomes with respect to men. Section 4 takes a closer look at the interplay between changes in the industry structure and gender trends, based on a shift-share analysis for the growth in female hours. Section 5 concludes.

## 2 Long-run trends in female outcomes

Women’s labor force participation increased substantially over the course of the past century in all developed economies, but the increase has been uneven both over time and across countries. We document these trends using an unbalanced panel of nineteen high-income countries for the period 1850-2008.

The pre-WWII data on the economically active population and population counts by gender are from the International Historical Statistics (Mitchell, 1998), with the exception of the US. For this country data are from Goldin (1990, Table 2.1). The pre-war data are combined with similar post-war data from the International Labour Organization (ILO).<sup>1</sup> The labor force construct is defined as the number of women *aged 15 and above* who are employed, divided by the corresponding population. This is the only labor force definition that is available consistently across countries and over such long horizons. The final sample includes: Australia, Austria, Belgium, Canada, Den-

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<sup>1</sup>See Olivetti (2014, section 5.3.1 and Data Appendix), for details. Far from being perfect, these data are as close as possible to being harmonized in terms of the definition of the employment construct.

mark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom and United States. The start date for each country is the first year for which information is available. This goes as far back as the 1850s for Belgium, France, Netherlands and the UK. Starting in 1900, data cover all countries except Greece and Japan, for which 1920 is the first available data point. The data are available at 10- or 5-year intervals for most of the countries in the sample. From 1990 to 2005, data at 5-year intervals are available for all countries.

Figure 1 displays female employment rates by country. The female employment to population ratio for women aged 15+ in the US was 20% in the late nineteenth century, and surpassed 60% at the beginning of the current century. In other OECD countries the rise in female employment only started in the postwar period, reaching similar or higher levels than in the US, Canada, Australia, the UK, the Netherlands and Scandinavian countries. Despite growing during at least five decades, by the end of the 20th century the female employment rate in other European countries remained below the 60% mark, and especially so in Mediterranean countries, where the current level of female employment is similar to that observed in the US or the UK during the 1970s. Japan seems to be the one country in which female employment stagnated around 50% throughout the postwar period.

On average, female employment increases between the mid-19th century and the first decade of the 21st century by about a tenth of a percentage point per year. However, and this is perhaps less well known, this increase did not happen monotonically. There are large cross-country differences in the evolution of female employment between 1850 and 1950. While female employment grows monotonically in the US and Canada, in most of the remaining countries one can detect important declines in female employment during these hundred years, either throughout the period (for instance in Belgium, Netherland and Portugal), or after an initial rising phase (for example in the UK, Italy, Spain, Austria and most notably France).<sup>2</sup> In fact, Goldin (1986, 1990) argues that even for the US, more inclusive measures of labor supply that cover both paid and unpaid work of married women, deliver a U-shaped pattern, whereby female labor force participation declines during the 19th century, reaching the bottom sometimes in the 1920s, before starting its steady rise during the rest of the 20th century.<sup>3</sup> On average, female employment declined very slightly by 0.05 of a percentage point per

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<sup>2</sup>Costa (2000, figure 2) document the same pattern for France using a different data source.

<sup>3</sup>Possibly the same issue may be affecting estimates of female employment for other countries, e.g. Canada.

year during 1850-1950. Large gains in female employment were thus not a historical necessity, but mostly a feature of the postwar period. Except for Japan, where female participation is essentially flat, women's employment rates increase post-1950 in all countries, accelerating around 1980. On average, female employment grows by half a percentage point per year between 1950 and 2005.

In what follows we zoom on more recent decades, and provide evidence on labor market indicators that are unavailable for a large set of countries for longer time spans. We first study the post-war evolution of employment rates of *working age* women in Figure 2. These are defined as the ratio of the number of economically active women aged 15 to 64 to the total population in this age group.<sup>4</sup> Comparing the series in Figure 1 and 2, we note that the working age employment figures in the most recent years are about 10 to 15 percentage point higher than the corresponding figures for women aged 15+. This is due to high rates of retirement among women 65 and above at the same time as the size of this population share grew thanks to improvements in health conditions and life expectancy. By year 2008 the employment rate for working age women reaches the 70% mark in the US, the UK, Australia, Germany and Portugal, and surpasses it in the Netherlands, Finland and Canada, reaching 77% in Denmark, Norway and Sweden. The employment rate is lowest in Italy (52%) and Greece (55%). On average, female employment among working age women grows by 0.6 percentage points per year between 1947 and 2008.

We next move on to the evolution of working hours, encompassing both intensive and extensive margins of participation. We use information on labor inputs by gender and country from the EU KLEMS database,<sup>5</sup> which covers a relatively large cross-section of countries from 1970 onwards. Data are at the annual frequency, and the last year for which the labor construct is available consistently for all countries in our sample is 2005. Labor input data by gender are unfortunately not available for all the countries included in Figure 1, and namely Norway, Sweden, France, Greece,

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<sup>4</sup>According to the ILO definition, the economically active population comprises all persons of either sex who furnish the supply of labour (paid or unpaid) for the production of goods and services during a specified time-reference period. In general, the data on economically active population do not include students, persons occupied solely in domestic duties in their own households, members of collective households, inmates of institutions, retired persons, persons living entirely on their own means, and persons wholly dependent upon others. National practices vary between countries as regards the treatment of groups such as armed forces, the definitions used and groups covered, but also by differences in the methods of collection, classification and tabulation of the data by age and other dimension. See <http://laborsta.ilo.org/applv8/data/c1e.html> for details.

<sup>5</sup>The database is publicly available at <http://www.euklems.net>. See O'Mahony and Timmer (2009) for a description of the methodology employed in constructing the database.



Ireland, and Portugal. Thus we augment the EU KLEMS sample whenever possible using a variety of data sources. For Greece and Portugal we use the Integrated Public Use Microdata Series, International (IPUMS-I), available for 1971-2001 and 1991-2001, respectively. For France we use data from the French Labour Force Survey for 1981-2005.<sup>6</sup> We also add Korea to the sample, which was not covered in our historical data but is covered by EU KLEMS. Using the various data sources we build an unbalanced panel of 17 countries.

Figure 3 displays the evolution of the female share of total hours for our sample. In most countries this increases substantially between 1970 (or the first year available) and 2005. In the early 1970s, female hours represented less than one third of total labor inputs, with important differences between the UK and Scandinavia (around 40%), the US, Canada, Japan and Italy (around 30%), and Korea and Greece at the other extreme (22% and 15% respectively). By 2005, female hours represent more than 45% of the total in the UK, Scandinavia and Germany, and around 40% in all other countries except Japan, Korea, the Netherlands and southern Europe, where they remain below the 40% mark. On average, the female share in total hours was growing at a quarter of a percentage point per year. Growth rates are lowest in the UK and Scandinavia, and highest in southern Europe, as well as Australia, implying some mild convergence in the female hours share across countries. The two Asian countries represent an exception to the broad convergence pattern, as both their female hours share and its growth are relatively low.

Trends in the share of female hours (0.25 percentage points per year on average) are on average weaker than trends in female employment over the same period (0.5 percentage points per year during the same period). This difference clearly reflects the diffusion of part-time work among women during the past few decades. On the other hand, trends in the share of female hours are also affected by the slight fall, in several countries, of male employment (Blundell and MaCurdy, 1999).

We finally look at closing gender gaps in wages in Figure 4, plotting median female/male earnings ratios for our sample of developed economies.<sup>7</sup> For some countries the data go as far back as the 1970s, while in most cases gender earnings differentials

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<sup>6</sup>Unfortunately, we could not obtain comparable data for Ireland, Norway and Sweden who are thus not included in our analysis.

<sup>7</sup>These are time series collected by the OECD, calculated as the ratio between median earnings of men and women. Data are on gross earnings of full-time employees. The series is available at <http://www.oecd.org/els/emp/onlineoecdemploymentdatabase.htm#earndisp>. The version we use is updated 11 February, 2015. See link for definitions and sources by country.

are only available starting in the 1990s. The figure shows clear evidence of gender wage convergence in most countries. On average, the female/male earnings ratio increased by approximately 0.4 percentage points per year between 1970 and 2010. Around 2010, median female earnings are at or above 80% of median male earnings in most countries, reaching 90% in Belgium, Denmark, Ireland and Mediterranean countries. In Japan and Korea, by contrast, female earnings are only 73% and 63%, respectively, of male earnings.

Overall, the series presented in this Section clearly illustrate gender convergence in employment, hours and earnings in a large sample of high-income countries, at least since the mid-20th century. Progress in wages and hours was also accompanied in most countries by women's entry into professional and managerial occupations, and consequently reduced occupational segregation by gender (see Goldin, 2006, 2014b, for historical evidence for the US, and OECD, 2002, Section 3, for cross-country evidence). Positive co-movements between quantities (whether employment rates or hours) and wages is indicative of the presence of net demand forces underlying gender convergence. In other words, the evidence presented would not be consistent with pure supply forces, and one should bear this in mind when considering existing theories, discussed in the next Section.

## **3 A review of the literature**

### **3.1 Gender convergence**

Women's entry in the labor market during the post-war period has been accompanied by remarkable progress in the economic literature on gender, studying women's changing role in the economy and its driving forces, and identifying the factors behind the remaining disparities with respect to men. Most historical studies on gender developments are for the US, but in recent decades the availability of comparable labor market data for most high-income countries has quickly prompted interest in similar questions for other contexts and international comparisons. Latest empirical developments, based on the availability of rich administrative and experimental data, have further expanded economists' perspective on gender issues.

The economic literature on gender has developed across a wide range of approaches. Most studies on the long-run evolution of female employment are based on calibrations of macroeconomic models, typically encompassing a combination of factors such as

education, labor supply, marriage and fertility choices, and technological advances. Work on gender inequalities has increasingly aimed at causal identification of the factors driving gender gaps in various contexts, relying on variation from institutional design or field and lab experiments.

Goldin (1990, 2006, 2014a), Blau, Winkler and Ferner (2014, Ch. 2) and Greenwood, Guner and Vandenbroucke (2015) - among others - provide comprehensive overviews of historical trends in gender outcomes and their driving factors in the US, and Blau, Winkler and Ferner (2014, Ch. 17 and 18) offer a wider perspective on both high-income and developing countries. Several explanations have been proposed for the rising female involvement in the labor market. Medical advances have reduced fertility via the introduction of the contraceptive pill (Goldin and Katz, 2002; Bailey, 2006), as well as improved maternal health, thus reducing the incidence of post-birth disablement, and provided substitutes to maternal lactation (Albanesi and Olivetti, 2015). Technological progress in the household and greater availability of childcare have reduced the need of (mostly female) labor input in home production (Greenwood, Seshadri and Yorukoglu, 2005; Attanasio, Low and Sanchez-Marcos, 2008).

While these changes freed-up some of women's time from household tasks, the rise in female relative wages acted as a pull factor from the labor market. Wage convergence was in turn induced by a variety of causes, including, among other factors, equal pay legislation, technological changes, and evolving social norms. Technological progress in the workplace and faster capital accumulation have raised the value of non-manual or non-routine skills relative to manual/routine skills, thereby raising female relative wages and participation. In Galor and Weil (1996) the rise in women's relative wages raises the opportunity cost of childrearing, thereby reducing fertility and increasing female labor supply. Heathcote, Storesletten and Violante (2010) interpret the concurrent growth in relative female wages and hours as the consequence of a gender-biased labor demand shift, and in their model calibration such shift can explain the bulk of the rise in female hours in the US. Black and Spitz-Oener (2010) point at changes in occupational skill requirements, and in particular the increase in the non-routine component of work, as an important factor of rising female wages, and estimate that about half of gender wage convergence in Germany is accounted for by the changing structure of tasks. Similar driving forces are considered by Rendall (2010) in a calibrated model for the US economy, and Beaudry and Lewis (2014) estimate the impact of computerization and changing task structure on the gender wage gap by exploiting

variation in IT penetration across US metropolitan areas. A related strand of literature builds on the interplay between changes in the industry structure and the rise in female participation. The transition from the industrial to the post-industrial phase of economic development is everywhere associated with an expansion of the service sector. This leads to the creation of jobs particularly suited to women’s skills and preferences, resulting in rising female employment and facilitating changes in social norms (see, for example, Goldin, 1990, 2006; Olivetti and Petrongolo, 2014; Ngai and Petrongolo, 2015).

Further factors considered include the rise in the returns to experience, and the fall in “unexplained” gender differences in pay. Olivetti (2006) estimates that the pronounced rise in the returns to actual labor market experience can account for about half of wage convergence in the US, and the bulk of the increase in working hours for married women. Accumulation of actual experience would lead to wage convergence both directly, via human capital accumulation, and indirectly, via changes in employers’ beliefs and the decrease in statistical discrimination (Gayle and Golan, 2012). Goldin (2014b) argues that another dimension of declining discrimination against women was women’s entry into traditionally male occupations, which was aided, among other factors, by occupational licensing.

A recent and growing strand of work on the rise in female participation has emphasized the role of changing social norms, and in particular the revolution in social attitudes towards female work, in female labor market outcomes. This phenomenon has involved both changes in men’s attitudes towards married women working (Fernandez, Fogli and Olivetti, 2004), changes in women’s beliefs about the effect of maternal employment on children (Fogli and Veldkamp, 2011), as well as changes in women’s own sense of self (Fernandez, 2013). Gender stereotypes have been plausibly weakened by a stronger female presence in the labor market (see, for example, Fernandez, Fogli and Olivetti, 2004, for evidence on postwar US), and increasingly so in leadership roles in business or politics (see Beaman et al., 2009, for evidence on India). However, Alesina, Giuliano and Nunn (2011) find evidence of very persistent components of gender norms, dating as far back as pre-industrial agricultural societies.

## **3.2 Remaining gaps**

Despite the convergence in gender trends documented in the literature, the remaining gender gaps in wages, employment levels, as well as in the types of activities that men

and women perform in the labor market, seem remarkably persistent, even more so against the backdrop of reversing education gaps in most countries and stricter equal treatment legislation.

Gender inequalities may have roots in gender differences in productivity and/or preferences, or labor market discrimination. By the end of the 1990s, the state-of-the-art work on gender inequalities in the labor market, reviewed in Altonji and Blank's (1999) chapter in the Handbook of Labor Economics, had mainly investigated differences in human-capital accumulation and discrimination as the main sources of gender gaps in wages, hours and job allocation. At the same time, Altonji and Blank (1999) indicated that lack of direct evidence on gender preferences would frustrate attempts to separately identify the effects of these three forces.

More recently, the availability of richer evidence from both administrative data and experiments has enabled researchers to make substantial progress in all three areas (see Bertrand, 2011, for a comprehensive survey). It is often suggested that one of the main drivers of women's preferences as well as productivity - whether actual or perceived - is their dominant role in the provision of child care and home production in general and the consequent work-life balance considerations. Indeed, symmetric gender gaps in working hours in the household and the market point to a clear link between women's role as main providers of home production and their labor choices and constraints. Women's role in childbearing may disadvantage women in high-rewarding careers, often characterized by long, inflexible work schedules, and strongly nonlinear pay schedules with respect to time worked (Goldin, 2014a), and a few studies have found clear evidence of a negative impact of having children on women's relative earnings, especially among the highly-educated (Bertrand, Goldin and Katz, 2010; Kleven, Landais and Sogaard, 2015).

Theories of statistical discrimination also suggest that women's comparative advantage in home production may in turn feed into employers' beliefs, promotion standards and the gender structure of pay (Lazear and Rosen, 1990; Francois, 1998; Francois and van Ours, 2000; Albanesi and Olivetti, 2009), as well as shape general attitudes towards gender roles in society and gender identity. Gender identity considerations may affect women's decision to participate to the labor force, or to enter occupations that are male-dominated, over and above financial incentives to do so (Akerlof and Kranton, 2000; Bertrand, Kamenica and Pan, 2015). Cross-country evidence shows that progressive attitudes towards gender roles are clearly positively associated with more

equal gender outcomes in the labor market (Fortin, 2005). However, causal testing of the impact of gender norms is harder to achieve (see Bertrand, 2011, for a discussion of related work). A growing approach to identifying the economic impact of culture compares labor market outcomes across women from different immigrant groups residing in the same country. Immigrants presumably differ in their cultures but share a common institutional and economic environment. This approach allows one to isolate the impact of culture and social norms from institutional influences (Fernández and Fogli, 2009, Fernández, 2011).

The growing influence of the psychology literature on economic questions, as well as the development of the experimental approach in labor economics, have opened up novel perspectives on gender preferences (see Azmat and Petrongolo, 2014).<sup>8</sup> In particular, work based on lab experiments has found evidence of gender differences in psychological factors such as attitudes towards risk, competition, negotiation and altruism, which may be related to labor market success. A recurrent finding from lab evidence is that women are more risk-averse than men (see, among others, Croson and Gneezy, 2009), and, conditional on ability, they are less likely to both opt for performance pay (Niederle and Vesterlund, 2007) and to thrive in competitive environments (Gneezy, Niederle and Rustichini, 2003). Women also tend to be weaker negotiators (see Rigdon, 2013, and references therein), although their behavior is sensitive to both the gender of their opponent and to information concerning the bargaining behavior of other players. However, evidence on gender differences in pro-social behavior is far from clear-cut, whether one looks at sharing behavior (Croson and Gneezy, 2009) or at the willingness to contribute to public goods (Eckel and Grossman, 2008).

The economic consequences of differences in psychological traits beyond the lab are to date not entirely understood (Bertrand, 2011), and progress on the mapping between gender preferences and labor market outcomes is still at relatively early stages. Flory, Leibbrandt and List (2010) investigate workplace consequences of attitudes towards competition, and find that women are less likely than men to apply to jobs in which a large share of compensation is attached to relative performance. However, Lavy (2013) finds no evidence of gender differences in teachers' performance under competition. Leibbrandt and List (2014) find that women are not systematically less likely to initiate salary negotiations than men, but Card, Cardoso and Klein (2015) find evidence of

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<sup>8</sup>The experimental approach has also provided cleaner evidence on the extent of gender discrimination (or lack thereof, according to context) than previous studies based on survey data (Azmat and Petrongolo, 2014).

bargaining effects in matched employer-employee data for Portugal, whereby women appropriate only 90% of the firm-specific rents appropriated by men.

Despite a growing literature on the labor market consequences of gender differences in behavior and comparative advantages, evidence on their origin is thinner. Understanding nature and nurture components of gender differences in behavior is an issue with strong policy implications. On the nature side, differences between men and women related to childbirth and physical strength, as well as the brain structure and sex hormones, may have an impact on their labor market outcomes. Women's physical traits are likely to have a declining impact on their labor market involvement, due to medical progress in contraception, child rearing, and maternal health, and technological advances biased towards brain relative to brawn skills. Nevertheless, a few (non-experimental) studies have detected a significant correlation between exposure to sex hormones and gender behavior (see Bertrand, 2011, Section 2.7.2). On the nurture side, preferences may have roots in the education system, the household, or society at large, and there is now evidence of environmental influences in various contexts. Gneezy, Leonard and List (2008) compare attitudes toward competition in patriarchal and matrilineal societies in a lab experiment setting, and find that while men are more likely to compete in a patriarchal environment, the gender differential in competition is reversed in a matrilineal society. Carrell, Page and West (2010) provide evidence on educational influences, showing that instructor gender has a powerful effect on female students' performance in STEM subjects, especially at the top of the ability distribution, but little impact on male students. Booth and Nolen (2012a, 2012b) find that girls' attitudes towards competition and risk-taking differ between single-sex or mixed-gender school environments. Household influences may start at a young age through interaction with parents, or later in life through interaction with spouses. Using school-level surveys, Fryer and Levitt (2010) find no evidence of differential parental investment in girls' and boys' math skills, but there is little direct evidence in the economic literature on later influences, and in particular on the interplay between the spousal division of labor in the household and women's performance in the labor market.

While gender convergence has been a common feature of most OECD labor markets during the post-war period, some aspects of convergence and the remaining gaps differ widely across countries. Our previous work (Olivetti and Petrongolo, 2008) notes that countries in which the employment gap has closed faster display relatively larger gaps

in wages. The gender pay gap is typically higher in the US and the UK (around 30 log points) than in continental Europe, and especially in Scandinavia (around 15 log points) and Southern Europe (around 10 log points). These wage gap figures are negatively correlated with the corresponding employment gaps, ranging from 10 percentage points in the US, the UK, and Scandinavia, to 15–25 points in northern and central Europe, up to 30–40 points in southern Europe and Ireland.<sup>9</sup> This correlation is suggestive of selection effects in international variation in observed wage gaps. If working women tend to have relatively high-wage characteristics, low female employment rates become consistent with low wage gaps in so far as low-wage women are less likely to feature in the observed wage distribution. Thus countries with high employment gaps (typically southern Europe) tend to have lower wage gaps than countries with low employment gaps (e.g. the US and the UK), as the average working woman is more positively selected into employment than the average working man. Using alternative wage imputation techniques, Olivetti and Petrongolo (2008) conclude that selection correction explains nearly one half of the negative cross-country correlation between wage and employment gaps.

Blau and Kahn (1996, 2003) emphasize instead the role played by international differences in overall wage dispersion in shaping the gender pay gap. The idea is that a given disparity between the characteristics of working men and women translates into a wider gender wage gap the higher the overall level of wage inequality. Thus in countries with a more compressed wage distribution (for example Scandinavian countries) gender differences in pay are also more compressed than in countries with a wider wage distribution (for example the US and the UK).

More recently, Blau and Kahn (2013) and Cipollone, Patacchini and Vallanti (2013) discuss the role of international differences in family-friendly policies such as family subsidies, parental leave provisions and stress their impact in raising female labor force participation in a number of OECD countries. Although generous policies are in most cases associated with higher female participation, they may have unintended negative effects on women's earnings or job segregation by raising the relative cost of hiring women (Blau and Kahn, 2013). By accommodating shorter working hours or periods of leave from the labor market, some family-friendly policies may backfire by reinforcing employers' beliefs and social norms regarding women's comparative advantage in childcare and home production, with potential consequences on job segregation (Fran-

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<sup>9</sup>Data on gaps reported are from Olivetti and Petrongolo (2008) and refer to the sample period 1994-2001.



cois, 1998), differences in the incidence of high-powered labor contracts (Albanesi and Olivetti, 2009) and on-the-job training (Dolado, García-Peñalosa and de la Rica, 2013).

Finally, international differences in taxation have received growing attention in the literature on gender outcomes, in light of the impact of the tax system on the labor supply of secondary earners (Guner, Kaygusuz and Ventura, 2012; Guner and Kaygusuz, 2012; Alesina, Ichino and Karabarbounis, 2011.) Bick and Fuchs-Schundeln (2012) - among others - show that cross-country differences in labor income taxes and in the tax treatment of married couples can explain a considerable fraction of the variation in the labor supply of married couples across developed economies. In a policy experiment they show that moving to a system of strictly separate taxation would increase labor supply of married women considerably in a number of countries considered, though not in southern Europe, and conclude that taxes are among factors that explain the absence of gender convergence in some countries.

### **3.3 Gender and the rise in services**

The rest of this discussion will expand on the relationship between the industry structure and gender outcomes. Together with the rise in female participation, the 20th century has witnessed substantial reallocation of labor across the broad sectors of agriculture, manufacturing and services, also known as structural transformation. Between 1900 and 2000, the share of services in the US economy rose from less than one third to more than three quarters and similar trends are detected in the majority of OECD countries, although typically with some time lag with respect to the US.

We believe the perspective on the industry structure would bring important insight to the study of gender inequalities for two reasons. First, the interplay between the rise in services and gender outcomes may have both supply and demand components. That is, the expansion of the service sector may create jobs that are safer and cleaner and thus more “respectable” for women wishing to enter the labor market (Goldin, 1990, 2006), and at the same time may stimulate the relative demand for female work if women have a comparative advantage in the production of services (Ngai and Petrongolo, 2015). The labor demand element is appealing in so far as it has the potential to address gender trends in both quantities and prices. Indeed, Aguiar and Hurst (2007, p. 982) note that the rise in female hours at a time of rising female wages “places a strong restriction on theories explaining the increase in female labor force participation”. Second, while the share of services increased in all OECD countries, the uneven expansion of the service

sector across countries may contribute to explain the international variation in gender outcomes.<sup>10</sup>

The production of services is relatively less intensive in the use of “brawn” skills than the production of goods, and relatively more intensive in the use of “brain” and interpersonal skills. As women are less endowed of brawn skills than men, the historical growth in the service sector has created jobs for which women have a natural comparative advantage (Goldin, 1990, 2006; Galor and Weil, 1996; Rendall, 2010; Weinberg, 2000; Ngai and Petrongolo, 2015). While the brawn versus brain distinction has become less relevant in recent decades with the introduction of brawn-saving technologies, women may still retain a comparative advantage in services, related to the more intensive use of communication and interpersonal skills, which cannot be easily automated. The simultaneous presence of producer and consumer in the provision of services makes these skills relatively more valuable in services, and a few studies have documented the rising incidence of interactive tasks in general (Michaels, Rauch and Redding, 2013), and relatively more so for women Borghans et al. (2005), and highlighted gender differences in the endowment and use of such traits (Roter et al, 2002, Dickerson and Green, 2004, Borghans et al., 2005, 2008). Women’s comparative advantage in services is clearly reflected in the allocation of women’s work hours. Around 1970, the service sector absorbed about three quarters of women’s market work in the US, Canada, Germany, France and the UK, but only about one half of men’s market work. By creating jobs in which women are over-represented, the rise in services has consequences for the evolution of female work.

Another important element to the relationship between the rise in services and female work is the gender distribution of home production. Women have historically been the primary provider of home production. In 1965, women in US spent on average 38 hours per week in home production, while men only spent 11 hours. Available data for European countries are more recent, but show similar patterns. Around 1990, corresponding figures were 36 and 18 for Germany, 35 and 17 for the Netherlands,

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<sup>10</sup>While most of our discussion on gender and structural transformation hinges on the role of the rise in services, the relationship between economic development and female participation is typically not monotonic in a very long-run perspective. Goldin (1995) establishes a U-shaped relationship between female labor supply and GDP per head on a large cross-section of countries observed in the first half of the 1980s, whereby the declining branch of the U-shape is associated with a smaller agricultural sector. Subsequent work by Mammen and Paxson (2000), Lundberg (2010) and Luci (2009) provides additional evidence of a U-shaped labor supply based on larger panels of economies observed in the 1970s and 1980s, 2005, and for the years 1965 to 2005, respectively, and Olivetti (2014) detects a similar pattern for developed economies at the start of the twentieth century.

and 44 and 10 for Italy (Freeman and Schettkat, 2005; Burda, Hamermesh and Weil, 2008). Household work includes activities that have close substitutes in the market service sector. If the expansion of the service sector makes it cheaper to outsource these activities, female work is pushed out of the household and pulled into the market sector in which women have a comparative advantage.

While women's market hours would be boosted by both the rise in services and marketization of home production, men have been historically over-represented in the manufacturing sector, and their working hours mostly bore the burden of de-industrialization. Evidence for the US presented by Ngai and Petrongolo (2015) shows that the whole rise in female hours since the late 1960s accrued to the service sector, while female hours in manufacturing remained roughly unchanged; and the whole reduction in male hours depleted the manufacturing sector, while male hours in services stayed roughly constant.

There is a growing literature on the link between the industry structure and female participation, as well as on its interplay with marketization of home production. Early work by Reid (1934), Fuchs (1968) and Lebergott (1993) has suggested links between these forces, without proposing a unified theoretical framework. Goldin (1984, 1990) emphasizes the increased demand for clerical work since the late 19th century as one key factor leading to female employment gains throughout the first half of the 20th century, resulting in a shift of female work from manufacturing and the home to clerical employment.

A few recent papers have proposed multi-sector frameworks to model the interplay between the rise in services and female labor market outcomes, in which the impact of sector-specific shocks on gender outcomes are typically driven by gender comparative advantages (or simply baseline allocations) across production of goods and services, whether in the market or the home. Akbulut (2011), Buera, Kaboski and Zhao (2013) and Rendall (2014) emphasize marketization of home services as the driving force contributing to both the rise of female market work and the service share. Lee and Wolpin (2006, 2010), illustrate that the rise in services and female labor market outcomes are jointly driven by sector-specific technical change and exogenous shocks to the value of home time. Ngai and Petrongolo (2015) propose a model with uneven productivity growth, in which goods and services are poor substitutes, while market and home services are good substitutes. In their model, faster labor productivity growth in the goods sector reallocates labor from goods to services, resulting in structural transformation,

while slower labor productivity growth in the home sector reallocates hours of work from the home to market services, resulting in marketization. Due to women’s comparative advantage in services, structural transformation and marketization jointly raise women’s relative market hours and wages. Gender comparative advantages thus turn a seemingly gender-neutral shock such as the rise in services into a *de facto* gender-biased shock.

The relationship between the service share and female outcomes has been studied in an international perspective in a few papers that relate lower female employment in Europe to an undersized service sector relative to the US. Olivetti (2014) documents the relationship between structural transformation and gender outcomes since the late 19th century in a large sample of countries, and finds evidence of clear gender differentials in the historical process of sectoral reallocation. In particular, the share of agricultural work drops faster for women than for men, the share of manufacturing work exhibits a much flatter hump-shaped profile, while the share of service steadily rises. Olivetti and Petrongolo (2014) link the observed variation in gender gaps in both wages and hours across countries to differences in the industry structure. Their analysis decomposes the gender bias in labor demand into measurable within- and between-industry components, and find that the between-industry component explains more than eighty percent of the overall variation in labor demand between the U.S. and Western Europe, and roughly one third of the overall cross-country variation in wage and hours gaps. Finally, Rendall (2014) quantitatively assesses the impact of exogenously closing gender gaps on female employment and the consequent rise in services. She calibrates her model using US and German tax rates in turn and concludes that tax rates differentials account for the majority of differences in hours worked between the US and Germany.

## 4 Evidence on female hours and the industry structure

This aim of this Section is to provide unified evidence on the contribution of the industry structure to the variation in female hours, along both historical and international dimensions. We use data on the industry composition of employment from EU KLEMS, which allows for a 12-fold industry classification consistently defined across countries. The industries are: (1) Agriculture, hunting, forestry and fishing; (2) Mining, quarry-

ing and utilities; (3) Manufacturing; (4) Construction; (5) Wholesale and retail trade, hotels and restaurants; (6) Transport and storage; (7) Financial intermediation; (8) Business activities and real estate; (9) Public administration and defence; (10) Education; (11) Health and social work; (12) Other community, social or personal services, and private household services. We classify industries (1)-(4) as goods-producing, and the rest are classified as services.

Table 1 highlights both between- and within-industry components in the rise of female hours by showing evidence on sector shares and the share of female hours within each sector over time in 17 countries. Columns 1 and 2 report the share of goods and service hours at the start and at the end of the sample period, respectively, for each country, and column 3 reports their change over time. In all countries considered the share of services expands substantially. On average, the service sector grew at a rate of 0.64 percentage points a year across the country sample. The data also display some clear convergence pattern, whereby countries with a relatively lower service share at baseline experience the strongest rise in services, with continental Europe featuring predominantly in this group.

Table A1 in the Appendix gives further details on the average shares of 12 finer industries over the sample period, as well as their growth rate. Among goods-producing industries, agriculture and manufacturing are declining on average by a third of a percentage point per year across countries, while the share of the construction sector stays roughly constant in most countries. Most service industries are experiencing positive growth, except transportation and public administration, whose size remains overall constant. Service industries with highest growth are: trade, hotels and restaurant; business activities and real estate; health and social work; and other services. Despite common trends, the average size of industries varies importantly across countries. For example, Anglo-Saxon countries tend to have a relatively larger finance sector and a smaller manufacturing sector. Southern European and Asian countries have on average a larger primary sector, and smaller health and business activities sectors.

Column 4 in Table 1 reports the female intensity in goods and service industries at the start of the sample period, measured as the share of female hours in each broad sector. On average, the female presence in service industries (41%) is nearly twice as large than in good-producing industries (23%). The generalized rise in services is thus expected to boost female employment by expanding the sector in which women are over-represented. Over time, the female presence in goods-producing industries stays

roughly constant at 22% of total hours, while it rises in services from 41% to 48%. As noted above based on US evidence (Ngai and Petrongolo, 2015), the rise in female hours over the past few decades accrued entirely to service industries.

Figure 5 shows more detailed dynamics on the rise in services and female hours in the aggregate economy. Each line represents the joint evolution of the service share and female hours in each country over decades, with each marker representing a decade. Positively sloped trajectories imply that both indicators are rising over time. The cross-country dynamics also shows clear evidence of convergence in both the industry structure and female hours over time, with some countries still lagging behind. For example, Greece and Korea in 2005 have similar female and service shares as those observed in the United States in the 1970s.

#### 4.1 Shift-share analysis: Time series

We next quantify between- and within-industry components of trends in female hours by decomposing, for each country, the growth in the female hours share into a term reflecting the change in the share of each sector, and a term reflecting changes in gender intensities within a sector. Let's denote by  $l_{ft}$  the share of hours worked by women in the economy at time  $t$ . Using a standard shift-share decomposition, the change in  $l_{ft}$  can be expressed as

$$\Delta l_{ft} = \sum_j \alpha_{fj} \Delta l_{jt} + \sum_j \alpha_j \Delta l_{fjt}, \quad (1)$$

where  $l_{jt}$  denotes the share of hours in sector  $j$ ,  $l_{fjt}$  denotes the share of female hours in sector  $j$ , and  $\alpha_{fj} = (l_{fjt} + l_{fjt-1})/2$  and  $\alpha_j = (l_{jt} + l_{jt-1})/2$  are decomposition weights. The first term in equation (1) represents the change in the female hours share that is attributable to changes in the industry structure of the economy (between-industry component), while the second term reflects changes in the female intensity within sectors (within-industry component).

The results of this decomposition are reported in Table 2. Column 1 and 2 report the female hours share in the first and last year for which information is available, respectively, for each country. Column 3 reports its change over time. In most countries the female hours share increases substantially, as also shown in Figure 2. The next four columns present the results of the shift-share decomposition, based on twelve industries (columns 4 and 5) or two industries - simply goods and services - (columns 6 and 7). Columns 4 and 6 report between-industry components, i.e. the first term in equation

(1), and columns 5 and 7 report the within-industry component, i.e. the second term in the equation.

Based on the 12-fold industry decomposition (column 4), the between-industry component explains 52% of the overall rise in female hours in the whole sample (this is the ratio of the country-averages in the last row of columns 4 and 3, 3.9/7.5). In the UK, Germany, France, and Scandinavian countries it actually represents the whole observed variation or even more than that, revealing a negative within-industry component. The industries that - in virtually all countries - carry a relatively higher weight in the between-industry component are health and business services, followed by trade, hotels and restaurants; education; and other services. Bar a small number of exceptions, these patterns are extremely consistent across countries. Not surprisingly, women represent a relatively large share of labor inputs in these industries (and especially so in health and other services), and these industries all grew substantially during the sample period. Table A2 in the Appendix gives details of each industry's contribution to the between-industry component of the rise in female hours reported in Table 2.

When we aggregate industries into two broad sectors in column 6, the between-industry component still explains 48% of the overall variation (3.6/7.5). This is indeed because the pattern labor reallocation from goods-producing industries to the broad service sector is quantitatively much more important than labor reallocation across goods-producing industries or across service industries.

## 4.2 Industries and occupations

The literature on structural transformation and gender outcomes typically emphasizes gender comparative advantages, via the more intensive use of non-physical and interpersonal skills in the production of services rather than goods. However, tasks are more directly associated to labor inputs (e.g. occupations) rather than output (industries), and some sectors may tend to use female labor more intensively because they use more intensively occupations in which women have a comparative advantage. One should thus expect that the rise in female hours has an important between-occupation component.

Between-industry and between-occupation dimensions are clearly not orthogonal. As the distribution of occupations varies systematically across industries, a portion of the between-occupation component may be explained by the expansion of industries in which female-friendly occupations are over-represented. Between-occupation

changes that are not captured by changes in the industry structure would by definition be included in the within-industry component of our canonical decompositions (1). We therefore assess whether our shift-share analysis is missing an important between-occupation component of the rise in female hours, by splitting the within-industry component of (1) into within- and between-occupation components.<sup>11</sup> The full decomposition is

$$\Delta l_{ft} = \sum_j \alpha_{fj} \Delta l_{jt} + \sum_j \alpha_j \left( \sum_k \alpha_{fjk} \Delta l_{jkt} + \sum_k \alpha_{jk} \Delta l_{fjkt} \right), \quad (2)$$

where  $k$  indexes occupations,  $l_{jkt}$  is the share of occupation  $k$  in industry  $j$ ,  $l_{fjkt}$  is the share of female hours in occupation  $k$  and industry  $j$ , and  $\alpha_{fjk} = (l_{fjkt} + l_{fjkt-1})/2$  and  $\alpha_{jk} = (l_{jkt} + l_{jkt-1})/2$ . The first term in (2) represents the between-industry component, the second term represents the between-occupation component that takes place within industries, and the last term represents the component that takes place within industry  $\times$  occupation cells, and as such it would remained unexplained by either categorization.

We perform this decomposition for a subset of countries for which we can readily access household surveys or Census data ensuring a consistent classification of occupations over time. This subset includes the US, the UK, Canada, France and Greece. For the US, UK and France we use household surveys and, respectively, the Current Population Survey (1967-2008), the UK Labour Force Survey (1975-2008) and the French Labour Force Survey (1975-2006). For Canada and Greece we use census of population (1981-2001 and 1971-2001, respectively).<sup>12</sup> The choices of sample period are motivated by both data availability and broad consistency with the rest of our analysis. For simplicity we consider as simple dichotomous classification of industries (service versus good production), and a five-fold classification of occupations: (1) professionals and managers; (2) clerical occupations; (3) sales occupations; (4) service occupations; (5) manual occupations.<sup>13</sup>

The results of this further decomposition are reported in Table 3. Column 1 reports the total change in the female hours share between the start and the end of the sample

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<sup>11</sup>This type of shift-share analysis has been performed by Olivetti and Petrongolo (2014) for a cross-section of countries and by Ngai and Petrongolo (2015) for the US time series.

<sup>12</sup>Unfortunately, information on hours is not available in the 1971 Canadian Census.

<sup>13</sup>For France we use the major occupation group directly provided by the survey: agricultural managers; other managers; professionals; intermediate professions; white and blue collars.



period, based on country-specific data sources. Columns 2 and 3 report a simple between/within industry decomposition of this change with two broad sectors, and this mimics quite well the results obtained on EU KLEMS data, reported in Table 2. Columns 4 and 5 further decompose the within-industry component (column 3) into between and within-occupation components. Comparison of columns 4 and 5 shows that in none of the countries considered did the growth in the female hours share take place via the expansion of female-friendly occupations within sectors. In particular, in the US, Canada, France and Greece the between-occupation component is very close to zero. In the UK, it is actually negative, meaning that - within the service or goods sector - the change in the occupation structure has indeed moved in a way that was less favorable to female employment. The results of this Table show that the bulk of the growth in female-friendly occupations took instead place via the expansion of the service share.

### 4.3 Shift-share analysis: A cross-section of countries

We next turn to the contribution of the industry structure to the international variation of the female hours share, asking how much of international gender disparities can be explained by the size of female-friendly industries. We take the US as the reference country, and perform a shift-share decomposition similar to (1), where the  $\Delta$  terms represent differences between each country in the sample and the US, and the  $\alpha$  terms are averages (with equal weights) of each country's and US's indicators. The results obtained were not sensitive in any discernible way to alternative weighing.

Table 4 reports the results of the decomposition at two points in time, the 1980s and the 2000s. Column 1 reports the average female hours share over the 1980s, column 2 reports its difference with respect to the US, and columns 3 and 4 report the between-industry component of this difference, based on a 12-fold and 2-fold industry classification, respectively. Columns 5-8 report the corresponding values for the 2000s. Information for Germany and Portugal is not available before 1990. With the exception of Greece (1981, 2001) and Portugal (2001), the statistics are averages over the 1980s and the 2000s.

In the 1980s, females represented about one third of total hours on average (column 1). In southern Europe and the two Asian countries, the female share is far below that of the US, while in Scandinavian countries this is markedly above. On average, the female share in the US is about 3.3 percentage points higher than in the rest of

the sample (column 2). Column 3 confirms the importance of the between-industry component in the cross-section (12 industries). The between-industry component is everywhere negative, as a consequence of a larger service sector in the US, with the exception of Denmark, where the total differential to be explained is also positive. When averaging across countries, nearly 80% (2.6/3.3) of the cross-sectional variation in the female share is explained by international variation in the industry structure. Column 4 delivers a very similar picture, qualitatively, based on a binary goods/service classification, although the between-industry components falls in magnitude in most countries, averaging to about 60% (2/3.3) of the overall variation. Thus aggregation of hours into two broad sectors matters more in the cross-section than in the time-series variation. This is because, as discussed previously, the industries making up the two broad sectors vary considerably in size across countries, while they follow similar trends over decades.

By the 2000s, the female share has increased in all countries, with some cross-country convergence, whereby the average difference between the female share throughout the sample and the US has dropped to 2 percentage points (column 6). However, on average, the between industry component has fallen only very modestly (columns 7 and 8), implying that most of the cross-country convergence in the female share has taken place via a higher female intensity within industries. This evidence implies that while the service share was growing in all countries in the sample, it did not grow systematically faster in countries with relatively lower female hours, and it may thus be a factor hindering further convergence in gender outcomes.

#### **4.4 What drives variation in the service share?**

As the evidence presented above suggests that variation in the service share can absorb a large portion of the cross-country variation in the female share, factors that tend to shape the industry structure in a country may have consequences for gender inequalities in the labor market.

Several factors have been discussed in recent work. Work on structural transformation classifies the mechanisms that drive the rise in services into income and relative price effects (See Herrendorf, Rogerson and Valentinyi, 2013, for a recent survey, and references therein). With the first mechanism, income growth shifts the allocation of resources towards services as long as the demand for services is more elastic to income than the demand for goods (Kongsamut, Rebelo and Xie, 2001). With the second

mechanism, changes in relative prices alter the resource allocation when the elasticity of substitution between goods and services is not unity (Baumol, 1967; Ngai and Pissarides, 2007). Changes in relative prices may in turn be driven by inter-industry differentials in productivity growth, and specifically faster growth in manufacturing than service industries. As manufacturing output and services are poor substitutes in consumption, faster productivity growth in manufacturing reallocates labor from manufacturing into services. These hypotheses have been typically framed in a historical perspective to explain the secular rise in services, and similar intuition implies that international differences in productivity growth would map out into differential growth in the service share in a cross-section of countries.

While services produced in the market and manufacturing goods are poor substitutes in consumption, some market services tend to have close substitutes in home production activities like childcare, elderly care, cooking, house repairs, gardening etc. When such activities are outsourced to the market, home production hours are released to the market, and market services grow. Marketization of home production may respond to various driving forces. First, higher productivity growth in market services than in the home reallocates labor from the home to the market, as home and market services are relatively good substitutes. Second, institutional factors such as taxation or family policies may affect the speed of marketization. Finally, as women are the primary provider of home services, social norms about women's work in and out of the household may also have an impact on marketization of home production.

Freeman and Schettkat (2005) provide evidence on the marketization hypothesis, based on both time-use data and expenditure data across countries, and conclude that marketization contributes substantially to the hours gap across the Atlantic. In a similar vein, Rogerson (2008) relates the relatively poor performance of continental European labor markets to an under-marketized service industry. Marketization of services may in turn be hindered in continental Europe by a higher tax wedge, which distorts home-market substitution. Ngai and Pissarides (2011) and Ragan (2013) provide evidence on this mechanism for a number of OECD countries by showing that taxation and subsidies decrease and raise hours, respectively, in industries that have close home substitutes. Cortes and Tessada (2011) and Cortes and Pan (2013) study the impact of low-skill immigration on marketization of home production. This happens via the entry of low-skill immigrants in activities with close household substitutes, and the consequent fall in their market price.

Olivetti and Petrongolo (2014) explore cross-country characteristics that, according to the above hypothesis, are potentially related to the share of services. They find that countries with a higher tax rate for secondary earners have a smaller service sector (though the correlation does not hold for the overall tax wedge), while public provision of child care is associated with a larger service share. Among cultural indicators, the one that is significantly correlated to the share of services is the proportion of women believing that men are more deserving of work when jobs are scarce, while indicators of attitudes towards women’s role in the household are not significantly related to the service share. Elements of cross-country evidence detected by Olivetti and Petrongolo (2014) are broadly consistent with the marketization hypothesis, and indeed the observed growth in the share of industries such as hotels and restaurants, health and social care, early education, and other services, has expectedly absorbed home production in the same activities. On the other hand, marketization is unlikely to play a role in the growth in the whole business service sector, which grew noticeably in all countries considered and contributed significantly to the between-industry component of the rise in female hours.

## 5 Conclusions

This paper documents gender convergence in main labor market indicators for a large sample of high-income countries during the past few decades, using comparable data on employment, working hours and earnings. While levels of female participation differ widely across our country sample, most countries considered share similar trends in female outcomes, with clear signs of international convergence.

Despite women’s secular advancement in most dimensions of market work, there is no evidence of fully closing gaps with respect to men. The recent literature on gender disparities, while still acknowledging the importance of classical explanations of gender gaps based on differences in productivity or discrimination, has explored novel angles on gender disparities, based on gendered social norms and differences in preferences and attitudes in domains closely linked to labor market success. The role of these factors has received some support from latest empirical advances on richer data sources. As these factors evolve very slowly, one may expect remaining gaps to display a high degree of persistence, and one of the most active strands of research in this literature investigates policies that would accelerate change in social norms.

The paper then proposes a perspective on gender gaps that stresses the role of the industry structure. As women are over-represented in services, in most countries considered a substantial portion of the rise in female hours is associated with the reallocation of labor from manufacturing into services. By the same token, international variation in the service share is also associated with important variation in female hours across countries. While marketization of home services is a key force behind both higher female participation and the rise in market services, not all features of the rise in services are fully consistent with the marketization hypothesis, and a more detailed analysis of the dynamics of detailed industries would help shed light in this direction.

Causal links between the service share and female outcomes are of course harder to establish. Women may have a comparative advantage in producing services, and thus structural transformation stimulates demand for female labor inputs; and at the same time they may have a stronger preference for service jobs than men, thus the rise in female participation would stimulate the expansion of the sector that best accommodates women leaving the home. Research in this direction would surely enrich our understanding of the causes and consequences of gender disparities.

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**Table 1**  
**The share of services and female intensity within sectors (%)**

Country	Sector	Sector share			Female intensity		
		(1) Start	(2) End	(3) Change	(4) Start	(5) End	(6) Change
Aus (1982-2005)	Goods	38.6	27.9	-10.7	21.5	20.5	-1.0
	Services	61.4	72.1	10.7	40.0	49.9	9.9
Aut (1980-2005)	Goods	46.2	29.4	-16.8	31.3	27.1	-4.2
	Services	53.8	70.6	16.8	48.6	46.2	-2.4
Bel (1980-2005)	Goods	38.1	23.6	-14.5	19.1	19.6	0.5
	Services	61.9	76.4	14.5	44.2	50.7	6.5
Can (1970-2005)	Goods	40.1	26.2	-13.8	16.7	20.3	3.5
	Services	59.9	73.8	13.8	37.3	48.9	11.5
Dnk (1980-2005)	Goods	35.4	25.1	-10.3	23.9	22.8	-1.0
	Services	64.6	74.9	10.3	52.2	53.0	0.8
Fin (1970-2005)	Goods	59.5	33.4	-26.0	26.2	24.0	-2.2
	Services	40.5	66.6	26.0	59.0	59.2	0.2
Fra (1982-2005)	Goods	41.4	28.5	-13.0	22.8	21.5	-1.3
	Services	58.6	71.5	13.0	47.2	50.5	3.3
Ger (1991-2005)	Goods	40.7	29.8	-10.9	26.1	24.2	-1.9
	Services	59.3	70.2	10.9	54.3	55.1	0.8
Grc (1971-2001)	Goods	55.8	36.3	-19.5	13.8	18.1	4.3
	Services	44.2	63.7	19.5	17.9	39.5	21.7
Ita (1970-2005)	Goods	60.3	32.7	-27.5	27.0	27.4	0.4
	Services	39.7	67.3	27.5	36.1	47.1	11.0
Jpn (1973-2005)	Goods	52.0	34.6	-17.4	25.9	23.1	-2.8
	Services	48.0	65.4	17.4	36.4	39.8	3.4
Kor (1970-2005)	Goods	66.1	35.2	-30.9	21.5	22.0	0.5
	Services	33.9	64.8	30.9	24.2	33.9	9.6
Nld (1979-2005)	Goods	36.2	24.4	-11.9	11.0	15.3	4.3
	Services	63.8	75.6	11.9	31.0	41.8	10.8
Prt (1991-2001)	Goods	53.2	42.5	-10.8	31.1	30.9	-0.2
	Services	46.8	57.5	10.8	47.5	51.8	4.4
Spa (1980-2005)	Goods	50.9	35.9	-15.0	19.7	17.8	-2.0
	Services	49.1	64.1	15.0	38.2	50.7	12.4
UK (1970-2005)	Goods	50.2	23.1	-27.1	32.0	21.4	-10.6
	Services	49.8	76.9	27.1	50.4	51.5	1.2
US (1970-2005)	Goods	36.8	23.1	-13.7	17.9	19.5	1.6
	Services	63.2	76.9	13.7	35.6	48.1	12.5

*Notes:* Sample periods for each country are in parentheses. Figures reported are shares of annual hours ( $\times 100$ ). Columns (1)-(3) report the sector hours share at the start and end of the period and its change. Columns (4)-(6) report the same statistics for the share of the female hours within each sector. The goods sector includes: (1) Agriculture, hunting, forestry and fishing; (2) Mining, quarrying and utilities; (3) Manufacturing; (4) Construction. The service sector includes: (5) Wholesale and retail trade, hotels and restaurants; (6) Transport and storage; (7) Financial intermediations; (8) Real estate; (9) Public administration and defence; (10) Education; (11) Health and social work; (12) Other community, social or personal services, and private household services. *Data Sources:* Greece and Portugal: IPUMS International (Minnesota Population Center, 2014). France: Enquête Emploi. For all the remaining countries data are from EU Klems, March 2008 release (available at <http://www.euklems.net/>).

**Table 2**  
**Decomposition of the rise in female hours by industry (%)**

Country	Gender Share			Decomposition			
				12 industries		Goods/services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Start	End	Change	Between	Within	Between	Within
Aus (1982-2005)	32.9	41.7	8.8	2.5	6.3	2.6	6.3
Aut (1980-2005)	40.6	40.6	0.0	3.0	-3.0	3.1	-3.1
Bel (1980-2005)	34.7	43.4	8.7	4.3	4.4	4.1	4.6
Can (1970-2005)	29.1	41.4	12.3	2.7	9.6	3.4	8.9
Dnk (1980-2005)	42.1	45.4	3.3	3.3	-0.1	3.0	0.3
Fin (1970-2005)	39.5	47.4	7.9	9.8	-1.9	8.9	-0.9
Fra (1982-2005)	37.1	42.2	5.1	4.7	0.4	3.4	1.7
Ger (1991-2005)	42.8	45.9	3.1	3.9	-0.8	3.2	-0.1
Grc (1971-2001)	15.6	31.8	16.2	2.5	13.7	2.5	13.7
Ita (1970-2005)	30.6	40.7	10.1	3.1	6.9	4.0	6.1
Jpn (1973-2005)	30.9	34.0	3.1	2.6	0.5	2.4	0.7
Kor (1970-2005)	22.4	29.7	7.3	4.6	2.7	2.3	5.0
Nld (1979-2005)	23.8	35.3	11.6	2.9	8.7	2.8	8.8
Prt (1991-2001)	38.8	43.0	4.2	1.7	2.5	2.0	2.2
Spa (1980-2005)	28.8	38.9	10.0	2.4	7.6	3.9	6.2
UK (1970-2005)	41.2	44.6	3.4	8.0	-4.6	6.6	-3.2
US (1970-2005)	29.1	41.5	12.4	4.4	8.1	3.2	9.3
<b>Average</b>	<b>32.9</b>	<b>40.4</b>	<b>7.5</b>	<b>3.9</b>	<b>3.6</b>	<b>3.6</b>	<b>3.9</b>

*Notes:* Sample periods for each country are in parentheses. Figures reported are shares of annual hours ( $\times 100$ ). Columns (1)-(3) report the female hours share at the start and end of the period and its change. Columns 4 and 6 and columns 5 and 7 report the between-industry and within-industry component of the total change, respectively (obtained from equation (1)). Column 4 and 5 are based on a 12 sector classification (sectors are: (1) Agriculture, hunting, forestry and fishing; (2) Mining, quarrying and utilities; (3) Manufacturing; (4) Construction; (5) Wholesale and retail trade, hotels and restaurants; (6) Transport and storage; (7) Financial intermediations; (8) Real estate; (9) Public administration and defence; (10) Education; (11) Health and social work; (12) Other community, social or personal services, and private household services). Column 6 and 7 are based on the twofold sector classification defined in the notes to Table 1. *Data sources:* See notes to Table 1.

**Table 3**  
**Decompositions of the rise in the female hours share along industry and occupation dimensions (%)**

	(1)	(2)	(3)	(4)	(5)
	Change in female hours share	Between industry	Within industry	Between occupation	Within occupation
US (1967-2008)	15.3	5.2	10.1	0.7	9.4
Canada (1981-2001)	6.8	2.2	4.6	0.2	4.4
UK (1975-2008)	4.9	5.8	-0.9	-5.5	4.5
France (1975-2006)	8.7	4.8	3.9	-1.5	5.4
Greece (1971-2001)	13.9	1.2	12.7	-0.3	13.0

*Notes:* Sample periods for each country are in parentheses. Figures reported are shares of annual hours ( $\times 100$ ). Column (1) presents the total change in female hours share from start to end of period. Column (2) and (3) report the between-industry and within-industry component, respectively, of the total change (obtained from equation (1)). The decomposition is based on the two-sector classification defined in the notes to Table 1. Column (4) and (5) further decompose the within-industry component in column (3) into a between-occupation and within-occupation component (from equation (2)), respectively. We consider the following five-fold classification of occupations for all countries except France: professionals and managers; clerical occupations; sales occupations; service occupations; manual occupations. For France we use the major occupation group directly provided by the survey: agricultural managers; other managers; professionals; intermediate professions; white and blue collars. *Data Sources:* United States: Current Population Survey (King et al., 2010); United Kingdom: UK Labour Force Survey; France: Enquête Emploi; Canada and Greece: IPUMS International (Minnesota Population Center, 2014).

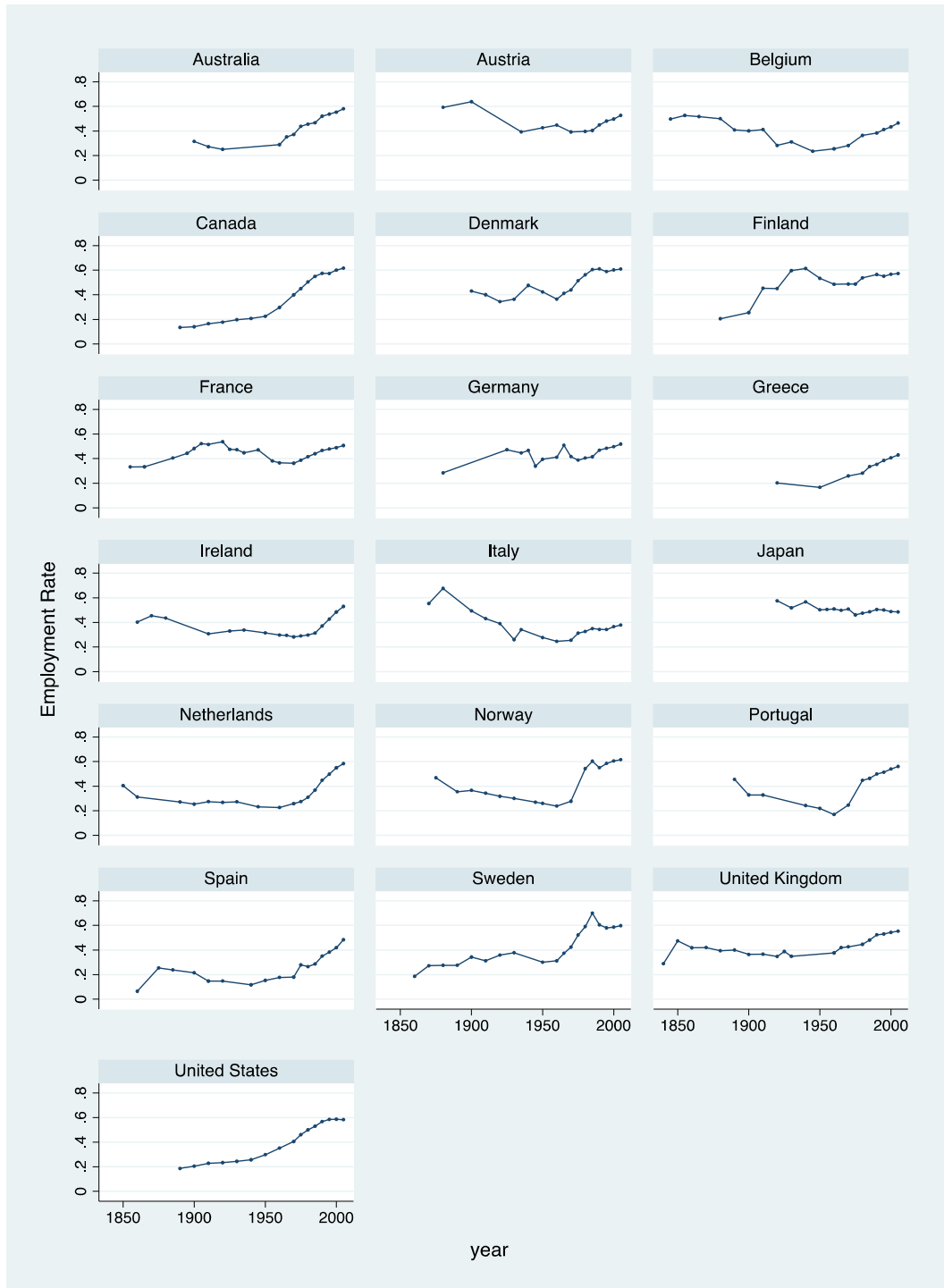


**Table 4**  
**Decomposition of the change in female hours by industry relative to the US: 1980s and 2000s**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1980s				2000s			
Country	Share	Difference w.r.t. US	Between		Share	Difference w.r.t. US	Between	
			12 sect.	2 sect.			12 sect.	2 sect.
Aus	34.7	-2.8	-1.3	-1.0	42.6	0.7	-1.9	-1.3
Aut	40.2	2.7	-2.7	-2.4	40.6	-1.3	-1.9	-1.5
Bel	36.2	-1.3	-1.4	-0.8	42.4	0.5	-0.9	-0.3
Can	36.6	-0.9	-0.8	-0.4	41.0	-0.9	-1.0	-0.7
Dnk	43.6	6.1	1.6	-0.6	45.1	3.2	1.3	-0.8
Fin	44.3	6.7	-5.1	-4.5	47.0	5.1	-2.8	-3.4
Fra	38.1	0.5	-2.3	-1.8	42.2	0.3	-1.0	-1.4
Ger	-	-	-	-	45.1	3.2	-1.8	-2.1
Grc	18.9	-18.6	-7.2	-3.4	31.8	-10.1	-5.4	-3.0
Ita	33.0	-4.5	-2.9	-2.3	39.2	-2.7	-2.7	-2.3
Jpn	31.6	-5.9	-3.3	-2.2	33.6	-8.3	-3.1	-2.6
Kor	25.3	-12.2	-5.5	-3.3	29.1	-12.8	-4.7	-2.6
Nld	26.0	-11.5	-0.3	-0.6	34.3	-7.6	-0.6	-0.4
Prt	-	-	-	-	43.0	1.1	-5.9	-4.5
Spa	29.7	-7.8	-3.6	-3.1	37.6	-4.3	-5.4	-3.7
Uk	41.2	3.6	-2.2	-1.7	44.6	2.7	-1.0	-0.4
Usa	37.5	-	-	-	41.9	-	-	-
Average	34.3	-3.3	-2.6	-2.0	39.9	-2.0	-2.4	-1.9

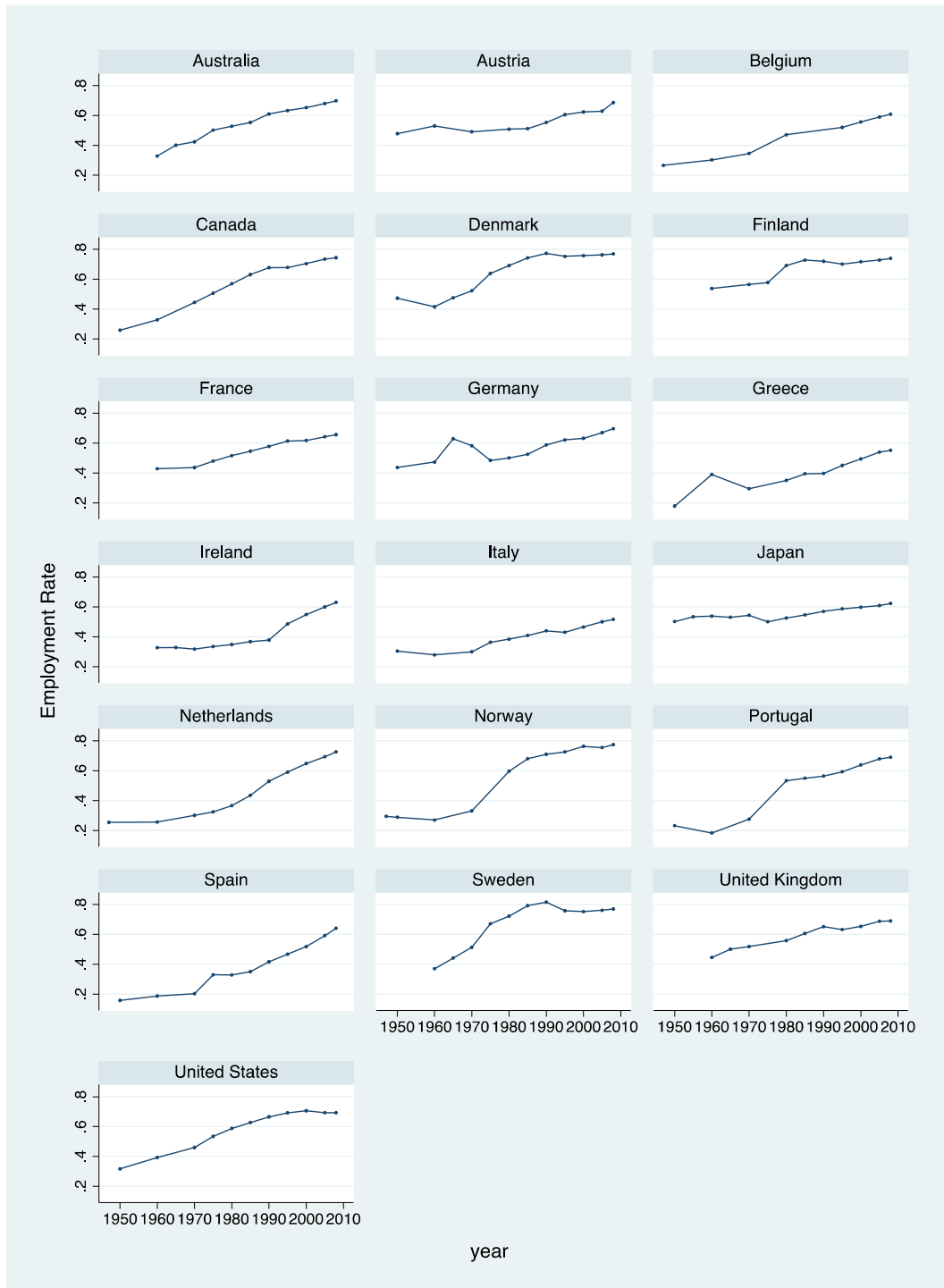
*Notes:* Figures reported are shares of annual hours ( $\times 100$ ). Column (1) reports the average female hours share over the 1980s, column (2) reports its difference with respect to the US, and columns (3) and (4) the between-industry component of this difference, based on a 12-fold and 2-fold classification, respectively. Columns (5)-(8) report the corresponding values for the 2000s. See notes to Table 2 for additional details. *Samples:* Greece: 1981 and 2001; Portugal: 2001. For all remaining countries: averages over the 1980s and the 2000s. *Data sources:* See notes to Table 1.

Figure 1: Trends in Female Employment (age 15 and above), 1850-2005



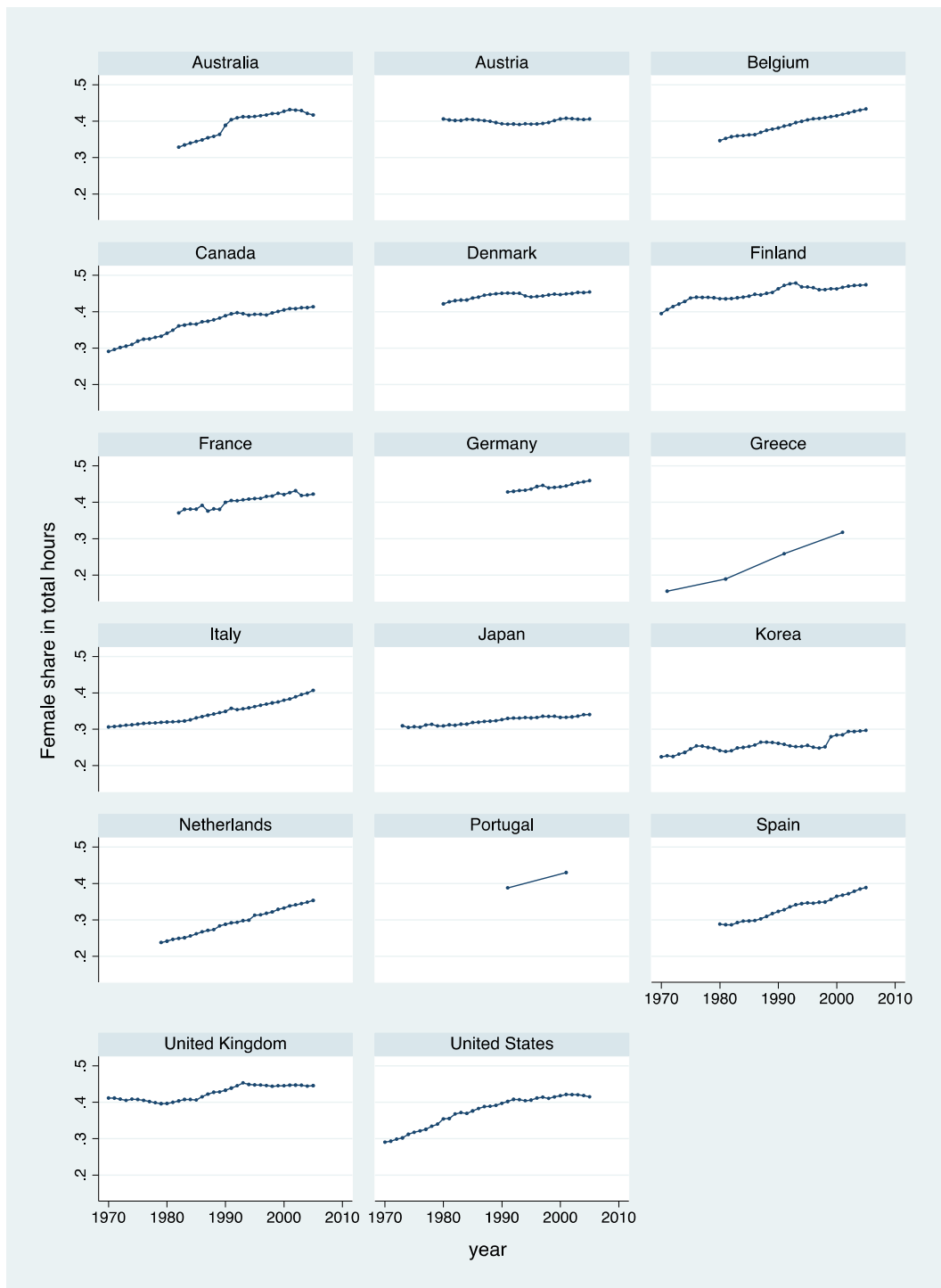
Notes: Figures report employment rates defined as the fraction of women aged 15 and above who are “economically active” according to the International Labour Organization (ILO) definition. Pre-1980 data are available at 10 or 5-year intervals. Post-1980 we use centred 5-year averages of all the available data points. Data sources: International Historical Statistics (IHS, Mitchell, 1998a, 1998b and 1998c), Goldin (1990) and ILO. See Olivetti (2014) for details on the construction of the data set.

Figure 2: Trends in Employment of Working Age Women, 1947-2008



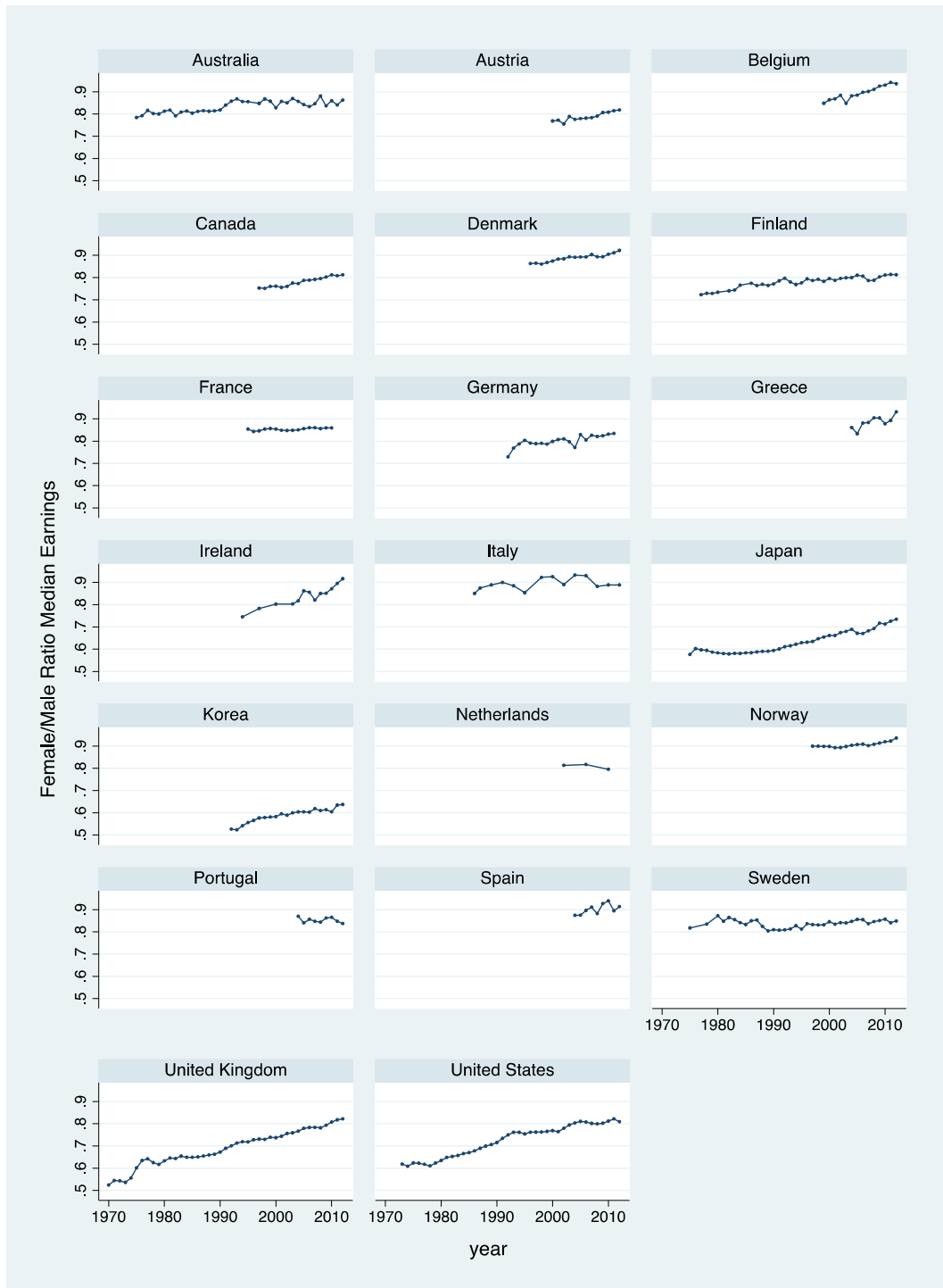
*Notes:* Figures report employment rates defined as the fraction of working age women (aged 15-64) who are “economically active” according to the International Labour Organization (ILO) definition. Pre-1980 data are available at 10 or 5-year interval. Post-1980 we use centred 5-year averages of all the available data points, except for 2008 based on single year (the last available). United Kingdom data for 1995, 2000 and 2005 are also single year. *Data sources:* ILO. For the United Kingdom 1995, 2000, and 2005 data are from the Labour Force Survey. This is because the working age figure cannot be calculated from ILO data.

Figure 3: Trends in Female Hour Shares, 1970-2005



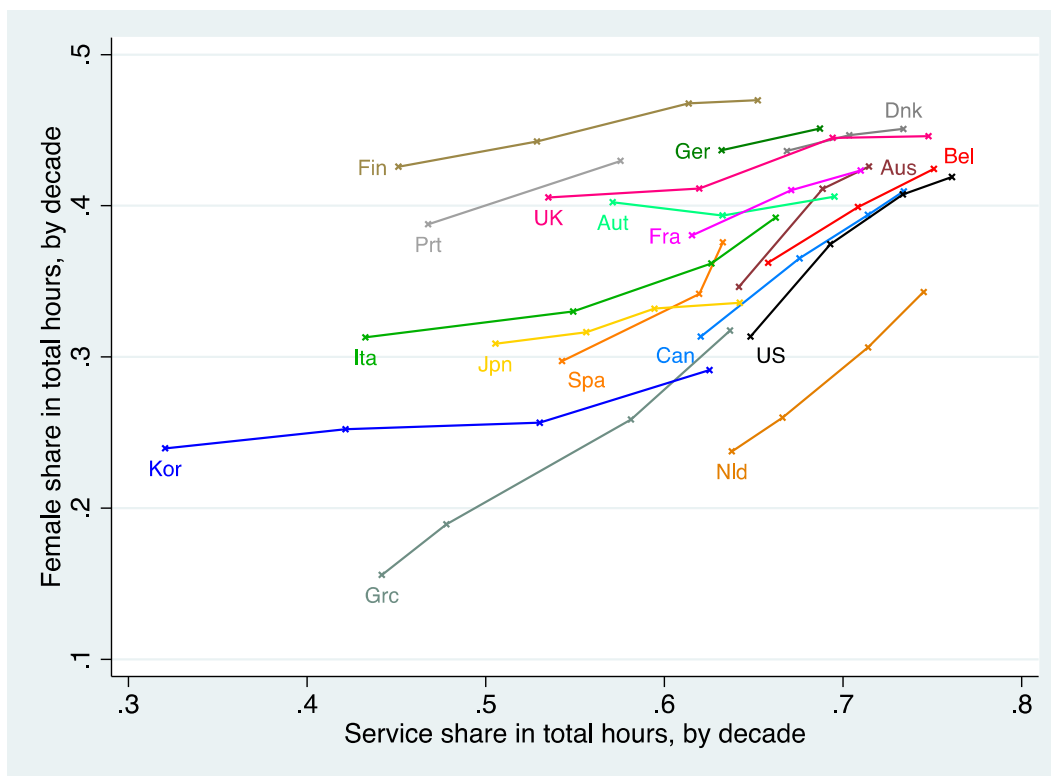
Notes: Figures reported are female shares of annual hours. Data sources: See notes to Table 1.

Figure 4: Trends in Female/Male Median Earnings Ratio, 1970-2010



*Notes:* Figures report the female/male ratio of median gross earnings of full-time employees.  
*Data source:* Organization for Economic Co-operation and Development (OECD) “Time series on gender wage gap” (11 February 2015 update) available at:  
<http://www.oecd.org/els/emp/onlineoecdemploymentdatabase.htm#earndisp>. See the link for definitions and sources by country.

Figure 5: Convergence in Female Hours and the Size of the Service Sector



Notes: The Figure reports the service sector share (x-axis) and the female share (y-axis) of annual hours by decade. Each marker represents a decade, and the corresponding values are decade-long averages (1970-79, 1980-89, etc.). See notes to Table 1 for sample periods and data sources.

**Table A1**  
**Average sector shares and growth rates for 12 industries and 17 countries.**

		1	2	3	4	5	6	7	8	9	10	11	12
Aus	level	6.3	2.6	15.1	8.0	23.1	7.3	4.0	9.3	4.4	6.5	7.9	5.4
	growth	-0.16	-0.07	-0.28	0.09	-0.05	-0.04	-0.01	0.33	-0.01	0.05	0.08	0.08
Aut	level	9.1	1.2	20.1	7.3	21.8	7.0	3.0	7.4	6.5	5.0	7.3	4.3
	growth	-0.25	-0.02	-0.39	-0.01	0.05	0.01	0.01	0.34	0.04	0.01	0.15	0.07
Bel	level	2.4	1.2	20.3	6.2	17.1	8.1	3.9	9.9	10.9	6.6	7.8	5.6
	growth	-0.06	-0.05	-0.40	-0.02	-0.04	-0.03	-0.02	0.49	-0.03	0.00	0.17	-0.01
Can	level	5.4	2.0	17.6	6.9	23.3	6.2	4.0	5.9	8.0	5.6	6.7	8.2
	growth	-0.13	0.00	-0.24	-0.04	0.12	0.02	0.04	0.14	-0.07	-0.03	0.05	0.15
Dnk	level	5.1	0.8	18.1	6.3	17.6	7.4	3.1	8.1	6.7	7.1	14.8	4.7
	growth	-0.17	-0.01	-0.18	0.00	0.03	0.00	-0.02	0.24	-0.03	0.00	0.06	0.07
Fin	level	14.6	1.2	20.2	8.9	15.9	7.3	2.0	5.8	6.5	4.5	9.8	3.3
	growth	-0.50	-0.01	-0.18	-0.06	0.00	0.05	0.00	0.23	0.08	0.09	0.22	0.07
Fra	level	2.1	2.3	22.3	7.1	15.2	7.9	5.9	5.9	11.4	6.5	8.3	5.2
	growth	0.08	-0.05	-0.51	-0.09	0.15	-0.15	-0.20	0.57	0.03	0.01	0.30	-0.14
Ger	level	3.4	1.4	21.9	8.0	18.9	6.1	3.4	10.0	7.7	5.1	8.6	5.6
	growth	-0.12	-0.06	-0.40	-0.17	0.09	-0.08	0.01	0.47	-0.09	0.08	0.19	0.09
Grc	level	16.7	1.7	18.8	9.4	18.1	9.6	2.1	4.0	6.0	4.4	3.5	5.6
	growth	-0.38	-0.03	-0.27	-0.01	0.43	-0.15	0.05	0.15	-0.09	-0.03	0.10	0.24
Ita	level	12.1	0.9	24.2	7.2	21.7	6.1	2.1	5.6	5.4	4.1	4.5	6.3
	growth	-0.50	-0.01	-0.28	-0.06	0.15	0.06	0.03	0.30	0.00	0.05	0.06	0.19
Jpn	level	9.5	0.6	22.4	10.2	24.4	6.1	2.7	6.9	3.5	2.8	4.5	6.3
	growth	-0.34	-0.01	-0.17	0.03	-0.02	0.02	0.01	0.25	-0.01	0.00	0.15	0.08
Kor	level	22.9	0.8	23.9	6.6	22.4	5.1	2.1	3.3	2.6	4.3	1.4	4.5
	growth	-1.22	-0.02	0.04	0.14	0.37	0.08	0.09	0.26	0.05	0.08	0.04	0.08
Nld	level	5.4	0.8	16.8	7.0	19.8	6.7	3.7	12.2	7.7	4.8	9.6	5.5
	growth	-0.09	-0.02	-0.33	-0.02	0.04	0.00	-0.01	0.48	-0.13	-0.04	0.07	0.05
Prt	level	9.3	0.8	25.5	12.2	20.3	4.7	1.9	4.4	7.2	4.6	4.5	4.6
	growth	-0.68	0.00	-0.53	0.14	0.50	-0.01	0.01	0.29	-0.03	0.18	0.18	-0.04
Spa	level	11.0	1.0	19.1	9.7	22.1	5.9	2.4	5.8	7.4	4.3	4.8	6.7
	growth	-0.52	-0.03	-0.20	0.20	0.16	-0.01	-0.02	0.29	0.02	0.03	0.09	0.00
UK	level	3.1	2.1	22.6	8.4	19.9	6.9	3.4	10.9	5.7	5.1	7.5	4.5
	growth	-0.05	-0.11	-0.57	-0.03	0.13	-0.02	0.05	0.35	-0.03	0.07	0.12	0.10
US	level	4.1	1.5	18.2	5.9	22.8	4.6	4.3	9.7	9.2	5.9	7.4	6.4
	growth	-0.09	-0.03	-0.33	0.04	0.01	0.00	0.03	0.27	-0.10	0.04	0.10	0.06

Notes. The “level” variable denotes the time average of the industry share of total hours for each country. The “growth” variable denotes its annual growth rate. All figures are in percentage points. Industries are: (1) Agriculture, hunting, forestry and fishing; (2) Mining, quarrying and utilities; (3) Manufacturing; (4) Construction; (5) Wholesale and retail trade, hotels and restaurants; (6) Transport and storage; (7) Financial intermediation; (8) Business activities and real estate; (9) Public administration and defence; (10) Education; (11) Health and social work; (12) Other community, social or personal services, and private household services. See notes to Table 1 for sample periods and data sources.

**Table A2**  
**The contribution of each industry to the between-industry component of the change the female hours share**

	Change in female hours share	Between industry component	1	2	3	4	5	6	7	8	9	10	11	12
Aus	8.84	2.54	-1.22	-0.22	-1.75	0.25	-0.37	-0.45	0.25	3.31	0.05	0.64	1.16	0.89
Aut	-0.03	2.96	-2.75	-0.08	-2.71	-0.10	0.84	0.04	0.13	3.41	0.26	0.21	2.81	0.91
Bel	8.70	4.30	-0.31	-0.13	-2.39	-0.13	-0.21	-0.18	-0.11	4.24	0.13	0.18	3.14	0.06
Can	12.27	2.66	-0.85	0.02	-2.05	-0.03	1.59	0.07	0.79	1.67	-0.92	-0.69	0.70	2.36
Dnk	3.26	3.31	-0.86	-0.03	-1.68	-0.04	0.08	-0.06	-0.17	2.69	-0.10	0.22	2.47	0.80
Fin	7.91	9.81	-4.62	-0.05	-1.64	-0.17	0.50	0.48	0.07	4.18	1.42	1.61	6.32	1.72
Fra	5.15	4.72	0.56	-0.21	-3.45	-0.14	1.37	-0.72	-1.67	4.74	0.31	0.56	4.46	-1.10
Ger	3.11	3.95	-0.53	-0.21	-1.94	-0.17	0.65	-0.33	0.09	3.28	-0.64	0.81	2.16	0.79
Grc	16.17	2.47	-1.49	-0.12	-2.04	0.00	3.10	-0.42	0.51	1.49	-0.81	-0.73	1.52	1.46
Ita	10.05	3.14	-6.30	-0.03	-2.62	-0.11	1.83	0.37	0.41	3.59	0.04	1.41	1.18	3.37
Jpn	3.09	2.63	-3.23	-0.04	-2.00	0.01	0.01	0.05	0.21	1.96	-0.02	0.18	4.43	1.06
Kor	7.26	4.61	-5.93	-0.07	1.64	0.49	2.55	0.55	0.48	2.13	0.46	0.96	0.68	0.68
Nld	11.56	2.91	-0.30	-0.05	-1.37	-0.05	-0.09	0.00	-0.07	2.95	-0.50	-0.19	2.09	0.50
Prt	4.19	1.70	-2.06	0.01	-2.35	0.08	2.25	-0.03	0.02	1.46	-0.09	1.36	1.38	-0.31
Spa	10.04	2.42	-3.26	-0.06	-1.63	0.17	1.62	-0.01	-0.12	2.62	0.29	0.66	1.47	0.68
UK	3.41	8.00	-0.51	-0.80	-7.06	-0.08	2.11	-0.18	0.89	6.27	0.00	2.14	3.27	1.94
US	12.44	4.35	-0.40	-0.08	-3.02	0.12	0.17	-0.04	0.53	3.07	-1.01	1.11	2.90	1.01

Notes. All figures are in percentage points. Industries are: (1) Agriculture, hunting, forestry and fishing; (2) Mining, quarrying and utilities; (3) Manufacturing; (4) Construction; (5) Wholesale and retail trade, hotels and restaurants; (6) Transport and storage; (7) Financial intermediation; (8) Business activities and real estate; (9) Public administration and defence; (10) Education; (11) Health and social work; (12) Other community, social or personal services, and private household services. See notes to Table 1 for sample periods and data sources.