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## Gender Gaps and the Structure of Local Labor Markets

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DISCUSSION PAPER SERIES

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# Gender Gaps and the Structure of Local Labor Markets

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## ABSTRACT

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# Gender Gaps and the Structure of Local Labor Markets\*

In this paper we discuss some strands of the recent literature on the evolution of gender gaps and their driving forces. We will revisit key stylized facts about gender gaps in employment and wages in a few high-income countries. We then discuss and build on one gender-neutral force behind the rise in female employment, namely the rise of the service economy, which is also closely related to the polarization of female employment and to the geographic distribution of jobs, which is expected to be especially relevant for female employment prospects. We finally turn to currently debated causes of remaining gender gaps and discuss existing evidence on labor market consequences of women's heavier caring responsibilities in the household. In particular, we highlight how women's stronger distaste for commuting time may feed into gender pay gaps by making women more willing to trade a steeper wage gains for shorter commutes.

**JEL Classification:** J16, J21, J31, J61

**Keywords:** gender gaps, industry structure, local labor markets

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# 1 Introduction

The twentieth century has witnessed a spectacular rise in women’s participation to the labor market. Around 1900, one in five women of working age was in gainful employment in the US. A hundred years later, the female employment rate had risen to two thirds of the working age population, accompanied by gradual gender convergence in wages and earnings, and the entry of women in occupations traditionally occupied by men (Goldin, 2006). Similar changes were taking place in all economically advanced countries, albeit with varying time lags with respect to the US experience.

These developments have generated a vast body of work, studying womens changing role in the economy and the underlying driving forces. A widely documented phenomenon is the female gain in human capital accumulation, leading to narrowing and then reversing gender gaps in college completion rates.<sup>1</sup> Meanwhile, medical advances have reduced fertility via the introduction of oral contraceptives, improved maternal health, and provided substitutes to maternal lactation. Another relevant factor is the introduction of antidiscrimination legislation in most countries, which was more recently accompanied by affirmative action aimed at removing entry barriers in male-dominated, high-income occupations (see Goldin, 2006, Bertrand, 2011, and Olivetti and Petrongolo, 2016, for a discussion of these forces and a survey of the literature). Besides these gender-specific trends, gender-neutral changes such as the rise in the service economy were creating cleaner and less physically demanding jobs in which women may have a comparative advantage, whether innate or acquired (Ngai and Petrongolo, 2017). Closely knit to these economic and institutional changes was the evolution of gender identity norms, which slowly but steadily reshaped women’s aspirations and societal perceptions about appropriate gender roles in the household and the labor market (Goldin, 2006; Bertrand, 2011). Women’s changing role in the labor market has also spurred – and was often reinforced by – government intervention and firm policies targeting families and in particular offering women the opportunity to combine careers and motherhood (Olivetti and Petrongolo, 2017).

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<sup>1</sup>While the gap in overall college graduation rates has reversed, women are still underrepresented in STEM fields, typically conducive to both higher earnings and aggregate growth. Thus female gains in human capital accumulation may be overstated by simple evidence on years of education (OECD, 2015).

Despite decades of progress, gender convergence has recently slowed down (most notably in the US), and sizable gaps remain in most indicators of gender success. Women in the US earn about 18% less than men (on an hourly basis) and their employment rates are 10 percentage points lower. In the UK, gender differences closely replicate the US picture, with a 20% wage gap and an employment gap of 9 percentage points. In most continental European countries wage gaps are narrower, but employment gaps are substantially larger. In all countries women are still under-represented in high-income, high-status occupations. Large and persistent gaps are especially remarkable in light of equalized education opportunities and equal pay legislation gradually adopted in most countries since World War II.

The causes of remaining gender inequalities are actively debated in current labor research. While traditional human capital factors such as education and experience can no longer explain earnings or employment differentials, other aspects of labor market attachment still seem to differ between men and women. A strand of the literature has highlighted gender differences in preferences and psychological traits, whether innate or shaped by social contexts, leading to women's underrepresentation in the upper part of the earnings distribution. Based on experimental evidence from the lab and, more recently, from real-world settings, a large body of work has documented some gender differences in attitudes towards risk, competition and negotiation, which may interfere with labor market success whenever financially rewarding careers develop in highly-competitive environments, characterized by volatile earnings (see Croson and Gneezy, 2009, Bertrand, 2011, and Azmat and Petrongolo, 2014, for surveys). Among studies that directly relate such differences in attitudes to the gender gap in earnings, the portion of the earnings gap explained remains relatively modest (Blau and Kahn, 2017).

Another strand of work has mostly emphasized women's role of primary providers of childcare and home production, which sets limits to their labor market engagement. As a likely consequence of worklife balance considerations, women typically work shorter or more irregular hours than men, are more likely to take career breaks, and specialize in different occupations and industries. These work dimensions may only marginally contribute to differential accumulation of actual work experience, but could still contribute to gender gaps via differences in job search behavior and compensating pay differentials associated

to job characteristics especially favored by women, such as short or flexible hours, atypical work arrangements, or shorter commutes, to name a few (Goldin, 2014; Blau and Kahn, 2017; Bertrand, 2018). Indeed, childbirth drives large and persistent wedges between the earnings of mothers and fathers (Kleven et al, 2019a).

In this paper we discuss some strands of the recent literature on the evolution of gender gaps and their driving forces, expanding on our previous work on these topics and exploring avenues for future research.<sup>2</sup> We will start in Section 2 by revisiting a few stylized facts about gender gaps in employment and wages in a few high-income countries. Most of the evidence presented refers to the US and the UK, with a few comparisons with major continental European countries. Section 3 discusses and builds on one gender-neutral force behind the rise in female employment, namely the rise of the service economy, to the detriment of the manufacturing sector and home-produced services, and will describe how both mechanisms may be conducive to a rise in female employment. We will then relate the growth in service jobs to the polarization of employment, which in the US is much more pronounced for women than for men, and to the geographic distribution of jobs, which is predicted to be especially relevant for female employment prospects.

Section 4 will turn to currently debated causes of remaining gender gaps and discusses potential labor market consequences of women's heavier caring responsibilities in the household. In particular, we will highlight how women's stronger distaste for commuting time may feed into gender pay gaps by limiting women's job opportunities. Evidence for a few countries shows that women on average commute shorter distances than men, and that the age profile in the gender commuting gap closely mimics the age profile in the earnings gap. Relatedly, women gain less than men from job mobility in terms of earnings, but gain more in terms of vicinity to new workplaces, consistent with stronger willingness than men to trade off wage gains for shorter commutes. Section 5 concludes with summary views and open questions for future research.

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<sup>2</sup>By zooming in on a few topics of interest, this paper does not aim to provide a comprehensive survey of the literature on gender gaps in labor market outcomes. Recent, comprehensive overviews can be found in Blau and Kahn (2017) and Bertrand (2018), among others.

## 2 Evidence on gender gaps

Panel A in Figure 1 illustrates the growth in female employment in the US and the UK for the longest time span over which a consistent employment measure is available. For the US, we combine Census and ILO sources and, for the UK, we combine Census and ONS sources. At the end of WW2, about one third of US women aged 15-64 were in work, with their employment rate rising to two thirds at the turn of the century, and some slight reversal since then. Over the second half of the twentieth century, female employment in the US was growing on average by 0.72 percentage points a year, and most of this increase was driven by the participation of married women to the labor market (Goldin, 2006). The UK series shows a similar pattern, albeit with slightly slower growth before 2000, and virtually no reversal afterwards. Panel B shows corresponding (though more recent) trends in some large continental European countries. Except in Sweden, where the female employment rate stays between 70% and 80% during most of the sample period, female employment has been growing steadily over the past few decades, with some mild cross-country convergence.

While these trends have been documented in various country-level studies, something that is important to remark is that sustained gains in female employment were a distinctive feature of the post-war period rather than a historical necessity. Pre-WW2 data on participation assembled by Mitchell (1998a, b, c) and Goldin (1995) show important declines in female participation during 1850-1950 in several countries (see also Olivetti and Petrongolo, 2014, for overview evidence). The ensuing U-shaped relationship between female participation and development has been associated to the reallocation of labor across the broad sectors of agriculture, manufacturing, and services, known as structural transformation. At very low levels of economic developments, female participation is high and concentrated in agriculture and/or family businesses. At later stages of development, female participation falls due to both income effects and the expansion of modern manufacturing industries, in which women have been historically under-represented due to both social customs and comparative advantages (Goldin, 1995). The post-WW2 rise in female employment rates has been accompanied in all high-income countries by the rise in the service sector.

Gains in female employment over the past few decades have been accompanied by nar-



rowing gaps in earnings. Panel A in Figure 2 shows steadily falling gaps in median earnings of fulltime employees both in the US and the UK, from around 40 log points in the early 1970s, to below 20 points in recent years. This substantial decline in gender inequality stands in sharp contrast with most other dimensions of inequality, which were indeed growing over the same period (Acemoglu and Autor, 2011). In continental Europe (Panel B, Figure 2), wage convergence has been more modest, but overall gender gaps in earnings are markedly lower than in the UK and the US. Except in Sweden, an important portion of these international differences is explained by employment selection effects, whereby high employment gaps, especially in southern Europe, are reflected into low wage gaps whenever low-wage women are less likely to feature in the observed wage distribution (Olivetti and Petrongolo, 2008).

Table 1 shows more detailed evidence on raw and adjusted wage gaps on the latest data for the US and the UK, covering all employees. The raw wage gap in the US in 2017 was 18.4% (column 1), rising to 23.1% once age and education controls are included (column 2). Unsurprisingly, the inclusion of education controls implies a larger unexplained wage gap, as a consequence of the female advantage in college graduation rates for all cohorts born since the late 1950s. Controlling for 2-digit industries in column 3 explains about one fifth of the wage gap, and the combination of industry and occupation controls in column 3 explains about one third of the wage gap. The picture is qualitatively similar in the UK (columns 5-8), where industry and occupation controls jointly explain 44% of the wage gap. Understanding women’s sorting across industries and occupations is therefore key to explain an important portion of remaining gender gaps.

### **3 Gender gaps and the industry structure**

#### **3.1 Female employment growth and the rise in services**

The post-war rise in female participation to the labor market was accompanied by another salient economic transformation, namely the rise of the service economy. Figure 3 illustrates the steady rise in the share of services in the US and the UK, measured by the proportion of

weekly hours worked in all service industries combined. In the US, the share of services rose from about 50% to 77% of total hours between 1940 and 2017. In the UK, a similar rise in the service share took place over the second half of this period alone. In the US, the growth in services was accompanied by a fall in agricultural employment until about 1960, and a fall in manufacturing employment thereafter. During the (more recent) UK sample period, the whole growth in services happened to the detriment of manufacturing employment.

The rise in services is linked to both structural transformation, and specifically labor reallocation from agriculture and manufacturing into services, and marketization, which has outsourced to the market several services traditionally produced in the household (Ngai and Pissarides, 2008). There are important reasons why structural transformation and marketization can contribute to the rise in female market hours and relative wages. First, the production of services is relatively less intensive in the use of brawn skills than the production of goods, of which women are less endowed. Thus the rise in the service sector has created jobs for which women have a natural comparative advantage (see, among others, Goldin, 2006; Ngai and Petrongolo, 2017; Rendall, 2018). While the introduction of new technologies has progressively shifted labor requirements from physical to intellectual tasks – whereby largely compensating the female disadvantage in physically demanding jobs – women may retain a comparative advantage in services, innate or acquired, related to the more intensive use of communication and interpersonal skills, which are valuable in the provision of services and cannot be easily automated (Borghans, Bas ter Weel and Weinberg, 2008). Women’s comparative advantage in services is reflected in the allocation of women’s hours of market work. In 1940, the average working woman in the US was spending three quarters of her working time in the service sector, while the average working man was spending less than 45% of his time in it. As structural transformation expands the sector in which women are over-represented at baseline, it predicts an increase in female hours even at constant female intensity within each sector.

The second channel is related to women’s involvement in household work. Ramey (2009) estimates that, in 1940, women in the US spent on average 42 hours per week in home production, while men spent on average 7.7 hours. Household work includes child care, cleaning, food preparation, and more in general activities that have close substitutes in the

market service sector. Productivity growth in market services makes it cheaper to outsource these activities and would draw women’s work from the household to the market.

In a nutshell, while women were predominantly engaged in home production or employed in the service sector, and thus their market hours were boosted by the rise in services, men were predominantly working in goods-producing industries, and the trend in their working hours mostly reflected the process of de-industrialization. The series for US working hours plotted in Figure 4 gives support to these ideas. Panel A shows that the service sector, which was the main employer of female labor throughout the period, absorbed the whole (net) increase in women’s working hours since the 1940s, while female hours in goods-producing industries (including manufacturing, construction, utilities and primary sectors) were very low and quite stable for more than seven decades. Conversely, Panel B shows that the whole (net) decline in male hours over the same period took place in the goods sector. While overall male hours were falling, male hours in services were actually rising, and the service sector became the main employer of male hours during the 1960s. Corresponding and qualitatively similar trends for the UK are reported in Figure 5. As the rise in services was more recent in the UK than in the US, as of 1980 men in the UK were still working more hours in goods than services, before the heavy decline in UK manufacturing of the 1980s and 1990s.

We next quantify (in an accounting sense) the role of the growth of services in the evolution of female employment. Using a standard shift-share decomposition on two sectors (goods and services), the change in the female hours share between year 0 and year  $t$  can be expressed as

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

where  $l_{ft}$  denotes the share of female hours in the economy in year  $t$ ,  $l_{jt}$  denotes the hours share of sector  $j$ ,  $l_{fjt}$  denotes the share of female hours in sector  $j$ , and  $\alpha_{fj} = (l_{fj0} + l_{fjt})/2$  and  $\alpha_j = (l_{j0} + l_{jt})/2$  are decomposition weights. The first term in equation (1) represents the change in the female hours share that is attributable to changes in sector shares, at given female intensity within sectors, while the second term reflects changes in the female intensity within sectors. The results of this decomposition are reported in Table 2.

The first row in the Table gives evidence of the rise in female hours in each country.

In 1940, women represented 23% of total labor inputs in the US, and this figure nearly doubled by 2017. In the UK, the share of female hours rose from 0.31 in 1977 to 0.42 in 2017. As the US sample period is roughly double the UK sample period, the female share was growing at similar rates in the two countries. The rise in the female hours share was mostly driven by the absolute rise in female hours and, to a lesser extent, the fall in male hours (see Figures 4 and 5). The third and sixth entry in the first row give the left-hand side of equation 1 for each country. The second and third row report the intensity of the goods and service sector, respectively, in the use of female hours. In all data points the service sector was more than twice as intensive in female labor than the goods sector. The average of the female intensity between the start and the end of the sample period is used to obtain decomposition weights  $\alpha_j$ . The fourth row reports the share of services. The overall rise in services ( $\Delta l_{jt}$ ) was virtually identical in the two countries over the respective sample periods, which implies a twice faster growth in UK services during 1977-2017. The fifth row shows the between-industry component of the total increase in the female share ( $\sum_j \alpha_{fj} \Delta l_{jt} / \Delta l_{ft}$ ). This amounts to about one third in the US and almost twice as much in the UK.

While Table 2 is based on a coarse distinction between goods and services, finer disaggregations yield results that are both qualitatively and quantitatively very similar. For the US, a decomposition over 15 industries gives a between-industry contribution of 31%. For the UK, a decomposition over 8 industries gives a between-industry contribution of 57%. For a larger sample of 17 high-income countries, Olivetti and Petrongolo (2016) obtain an overall between-industry component of about 50%, whether on a two-fold or 12-fold industry classification of employment, and Olivetti and Petrongolo (2014) compute that the between-industry component of labor demand shifts explains roughly one-third of the overall cross-country variation in wage and hours gaps.<sup>3</sup>

Ngai and Petrongolo (2017) propose a three-sector model with uneven productivity growth to rationalize these facts. Their market economy has two sectors, producing com-

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<sup>3</sup>While the rise in services has contributed to rising female employment in the post-war period, going forward we should not expect much further progress in employment convergence due to structural transformation in the developed world. One important factor is that the rise in the service share observed in the second half of the 20th century is – as one would expect – flattening out in recent years, having surpassed 75% of total employment in several high-income countries. The other factor is the gradual gender convergence in the distribution of employment, which is going to erode women’s over-representation in the service sector.

modities – goods and services, respectively – that are poor substitutes for each other in consumer preferences, while the home sector produces services that are good substitutes to market services. Production in each sector involves a combination of male and female work, and women have a comparative advantage in producing services, both in the market and in the home. Uneven productivity growth reduces both the cost of producing goods, relative to services, and the cost of producing market services, relative to home services. As goods and services are poor substitutes in preferences, faster productivity growth in the goods sector reallocates hours of work from goods to services, resulting in structural transformation. As market and home services are good substitutes, slower productivity growth in the home sector reallocates hours from home to market services, resulting in marketization.

The combination of consumer’s taste for variety and uneven productivity growth imply that structural transformation and marketization jointly raise women’s relative market hours and wages. In other words, gender comparative advantages imply that a gender-neutral force such as the rise in services *de facto* produces gender-biased impacts. When the model is calibrated to the evolution of the U.S. labor market, marketization and structural transformation forces predict the entire rise in the service share between 1970 and 2006, 20% of the gender convergence in wages, one third of the rise in female market hours, and 9% of the fall in male market hours.

### **3.2 Female employment polarization and the rise in services**

The rise in services is also closely related to the polarization of employment, characterized by rising employment shares at the upper and lower ends of the occupational/skill distribution, and a decline in the middle (see, among others, pioneer work by Autor, Katz and Kearney, 2006, and Goos and Manning, 2007). Panel A in Figure 6 shows evidence of employment polarization in the US over 330 occupations that have been ranked on the horizontal axis according to their mean log hourly wage in 1980. The black line represents the well known polarization trend since 1980 for total employment (see Autor and Dorn, 2013), with circles representing the size of occupation cells. Something that has only been recently highlighted is the differential employment polarization across genders (Cerina, Moro and Rendall, 2018). The blue and red lines in Figure 6 decompose occupational employment growth into male

and female components, respectively, and show that most of the overall polarization pattern is driven by female employment dynamics. In particular, the rise in low-skill female employment fills up the whole left tail of the polarization graph, and the rise in high-skill female employment fills-up most of the right tail, with moderate declines in the middle. For men, the graph shows employment losses throughout most of the occupation distribution, with small gains only at the very top.

Autor and Dorn (2013) show that labor reallocation into low-skill service occupations – in turn driven by routinization of mid-skill tasks – has shaped most of the upward tilt in the left tail of the employment growth distribution. Here we illustrate how the association between tasks/occupations and sectors allows to relate polarization to sector shares. Panel B in Figure 6 illustrates the role of services – both low- and high-skill – in male and female employment dynamics, by plotting the (smoothed) service intensity of each occupation. This is obtained as the share of each occupation that is employed in the broad service sector in 1980, defined as in the notes to Figure 3. The service intensity is highest for low-pay occupations, whose growth is entirely driven by female employment, and – after declining for most of the occupation distribution – it rises again for highest-paid occupations, whose growth is driven by both male and female employment.

Cerina, Moro and Rendall (2018) rationalize these patterns in a multisector model with uneven productivity growth and skill-biased technical change. The market service sector is decomposed into high-end services, which are skill-intensive and typically do not have home-produced substitutes, and low-end services, which are low-skill intensive and tend to have close home-produced substitutes. The skill and gender dimensions bring further insights to the polarization story. While marketization of home production drives the growth in low-end services, skill upgrading drives growth in high-end services and both forces have female-friendly consequences via comparative advantages. Their model calibration to the US economy in 1980 and 2008 broadly replicates polarization patterns by gender.

Evidence for the UK is shown in Figure 7. The sample period starts in 1994, when information on hourly wage data becomes available in the UK LFS, and the need for a consistent classification on occupations over time restricts us to a coarser disaggregation into 55 categories. The main difference with respect to the US experience is that the polarization pattern

is very similar for men and women (Panel A), but similarly as in the US employment growth for either gender is concentrated in occupations with relatively higher service intensity.

### 3.3 Services in local labor markets

The facts discussed above highlight important synergies between the rise in services and female employment – over time, across countries, and in the context of employment polarization. We finally document a largely unexplored feature of most service industries, namely that they tend to be less geographically clustered than goods-producing industries. By producing output that is largely non traded, service jobs tend to be within closer reach from most residential locations. This may have consequences for female employment in so far as women have stronger preferences for shorter commutes, and we’ll show evidence on this in the next section.

To show evidence on the geographic concentration of jobs in various industries, we use administrative data for the UK, combining information on demographics and industry of employment for a 1% sample of employees from the Annual Survey of Hours and Earnings (ASHE, ONS 2019a)<sup>4</sup> with information on establishment location and industry affiliation for the universe of businesses from the Business Statistics Database (BSD, ONS 2019b).<sup>5</sup>

We first compute an index of employment clustering for each 2-digit industry (58 categories) across UK census wards:

$$C_j = \frac{1}{2} \sum_a \left| \frac{L_{aj}}{L_j} - \frac{L_a - L_{aj}}{L - L_j} \right|, \quad (2)$$

where notation  $L$  stands for employment and subscripts  $j$  and  $a$  denote industries and wards, respectively. There are about 9,400 wards in the UK, with an average population

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<sup>4</sup>The ASHE is an employer-based survey, covering a 1% sample of employee jobs in the UK, randomly selected from the HM Revenue and Customs’ Pay As You Earn records. The survey is carried out in April of each year, starting in 1997. It represents the main administrative data source on UK employees and contains information on personal and work-related variables, as well as fine-grained geographic identifiers for employees’ residences and workplaces.

<sup>5</sup>The BSD is an employer-based annual survey (1997-) that covers the near universe of business organizations in the UK. It combines data collected by HM Revenue and Customs via VAT and Pay As You Earn records and ONS business surveys. Relevant information is recorded at both the firm and establishment level. In our analysis we use establishment-level information on sector, size and location. A consistent 2-digit industry classification can be obtained in the BSD from 2006 onwards.

of 7,000. The intuition behind the geographic concentration index in equation (2) is that it indicates the share of workers in a certain industry who would need to spatially relocate for the industry to be equally represented in every ward. We compute  $C_j$  on the BSD, using averages of employment shares over the 2006-2018 period. The interesting stylized fact is that goods-producing industries are on average more geographically clustered than service industries: the respective average cluster indexes are 0.53 and 0.38, using industry employment as weights.

We combine this information with the share of female employment at the industry-level, obtained from ASHE over the same sample period. The two indicators are plotted against each other in Figure 8. Red dots represent service industries while blue dots represent goods-producing industries, and the fitted line has slope  $-0.62^{***}$  using unweighted industry observations, and  $-0.56^{***}$  using industry size as weights.<sup>6</sup> Figure 8 shows that industries where women tend to be over-represented are also more geographically dispersed, which means that service jobs are on average within shorter commuting distances from any given location. Shorter commutes are especially attractive to women, with potential consequences for gender gaps, as it will be discussed below.

## 4 Gender in local labor markets

### 4.1 The earnings penalties to work-life balance

A growing body of work on the causes of remaining gender inequalities in the labor market has brought the emphasis to work-life balance considerations and mothers' demands for family-friendly working conditions. Despite the long-run decrease in the time spent in home-production tasks, women remain the main provider of child care, as well as domestic work in general, and the literature has long suggested that women may especially value job attributes that make careers better compatible with domestic responsibilities (Polachek, 1981; Gronau, 1988). Preferences for such attributes may set limits to women's labor market involvement,

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<sup>6</sup>Based on the same clustering index, Benson (2014) highlights a negative correlation between occupation (rather than industry) clustering and the occupational female intensity and suggests that segregation of women into geographically dispersed occupations eases geographic relocation of two-earner households.



with a detrimental impact on their earnings in professions that reward a continuous labor market attachment and inflexible work schedules.

The key component of domestic work is related to the presence of children. A few studies have shown that childless women have similar earning trajectories to men, but parenthood drives sizable and persistent gaps in the employment rates, working hours and earnings of mothers and fathers (see Adda et al, 2017; Angelov et al, 2016; Kleven et al, 2019a,b). Over the past few decades, the earnings penalty associated to motherhood has remained remarkably stable, while other dimensions of gender inequalities, related to human capital differences or discrimination in hiring and pay, were rapidly falling. Hence the motherhood penalty currently captures the bulk of remaining earning gaps.

The detrimental impact of motherhood on earnings was hardly dented by a series of developments that would be expected to ease women’s work-life balance. Medical progress has reduced health complications around pregnancy and birth and provided substitutes to maternal lactation (Albanesi and Olivetti, 2016); time-saving technologies embodied in consumer durables have released labor from home production (Greenwood et al, 2005); and unskilled migration to most high-income countries has provided substitutes to female work in the household (Cortés and Tessada, 2011). Interestingly, Kleven et al (2019c) find that the motherhood penalty is largely unaffected by the duration of parental leave rights and the availability of subsidized childcare.

A plausible explanation for differential impacts of children on maternal and paternal earnings seems instead to be the influence of gendered norms, which may prescribe “appropriate” roles for men and women in the household and the labor market (Kleven et al, 2019a,b). In other words, if gender roles within the household were equalized, parenthood would not be any more detrimental to female rather than male careers. The role played by gender norms has attracted increasing attention in the study of gender gaps. Fortin (2005) highlights a clear, negative correlation between conservative gender norms and female employment rates across OECD countries, Bertrand et al (2015, 2018) and Bursztyn et al (2017) study the role of gender identity in the interplay between marriage and labor market opportunities and outcomes, and Ichino et al (2019) study their impact on the spousal division of childcare. While one may argue that different gender roles reflect at least in part gender differences

in preferences, the influence of prescriptive norms on behavior makes it hard to draw a clear distinction between preferences and constraints. In particular, preferences may mostly internalize prescriptive norms whenever group identity induce certain behaviors and choices (Akerlof and Kranton, 2000).

Gender differences in labor market attachment could act as mediators for the motherhood penalty. Several high-income, high-status jobs penalize the demand for flexibility and career breaks typically associated with parenthood and child care (Bertrand et al, 2010; Bertrand, 2018). Evidence from the US medical profession shows that women are less likely to enter specialties characterized by especially long hours, and that mandated reductions in weekly hours attract women disproportionately more than men into high-earnings specialties, thereby decreasing gender pay gaps among physicians (Wassermann, 2019). There is also evidence that women place a higher value on flexible work arrangements and the opportunity of working from home than men, to the detriment of pay (Mas and Pallais, 2017; Wiswall and Zafar, 2018), and professions that introduced greater flexibility in their organization have achieved greater reductions in their earnings gap than professions that have fostered a long-hour culture (Goldin, 2014). These mechanisms seem to impact female earnings via compensating wage differentials rather than the associated loss in the accumulation of actual labor market experience (Flabbi and Moro, 2012).

Another potential but under-explored channel of impact is women’s stronger preference for shorter work commutes. Commute is an important job attribute, which matters significantly for job satisfaction and subjective well-being in general (Clark et al, 2019), and a few studies have detected a positive and robust relationship between commuting and wages (Manning, 2003a, and references therein). If women take a larger share of caring responsibilities in the home, they are restricted in the distance they can travel to work, with potential consequences on their job search targets and earnings.

## **4.2 Gender gaps in commuting and pay**

Women have on average shorter commutes than men. For the UK, recently published evidence by ONS (2019c) shows that male and female employees spend on average 32.5 and 25 minutes, respectively, in their one-way commute to work and, while both male and female

commutes have been gradually rising over time, the associated gap has been fairly stable (see also Manning, 2003b, for further evidence on the UK, Le Barbanchon et al, 2019, for evidence on France and Hassink and Meekes, 2019, for evidence on the Netherlands). Evidence also shows that women are more likely than men to quit their job over a long commute (ONS, 2019c). If women are restricted in their search for higher-paying job opportunities, they may face more monopsonistic labor markets than men and, for given labor market conditions, they may be more willing to accept compensating wage penalties for shorter commutes.

Figure 9 plots estimates of gender commuting gaps (red plot) against wage gaps (blue plot) for the UK, during 2002-2019. Commuting distances are calculated in the ASHE data as the geometric distance between an employee's postcode of residence and their postcode of work.<sup>7</sup> The estimates plotted are obtained in separate regressions for (log) wages and (log) commuting distance, including interactions between gender and unrestricted age effects, as well as a set of worker and job covariates. Upon labor market entry, men and women have fairly similar commutes, but the gap in commutes rapidly grows throughout childbearing years, averaging 36 log points in the 40s and nearing 40 log points in the 50s.<sup>8</sup> Despite different overall levels, the life-cycle pattern of gender differences in commuting behavior closely resembles the life-cycle pattern of the gender wage gap, which starts close to zero and again widens up in correspondence of child-bearing years.

While the ASHE data does not provide information on childbirth, Kleven et al (2019b) show evidence of widening earning gaps in correspondence of childbirth for the UK and a few other countries. For commutes, UK data from the British Household Panel Survey (BHPS) contain longitudinal information on both childbirth and usual commuting times and Figure 10 illustrates that commuting duration starts to diverge for mothers and fathers around four years after the birth of their first child, with a long-run gender gap in commuting times

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<sup>7</sup>There are about 1.8 million postcodes in the UK, with an average of 15 living units in each. Information on the postcode of residence is recorded for the first time in the ASHE in 2002. The mean one way commute calculated across postcodes is 24.3 km for men and 15.7 km for women. Median commutes are 8.7 and 5.6 km, respectively. We drop observations with commuting distances above 313 km, which corresponds to the 99th percentile.

<sup>8</sup>The raw commuting gap follows the same pattern as the adjusted gap shown in Figure 9, but is higher at each point in the life-cycle: it starts off around 15 log points in the early 20s and peaks at 68 log points in the mid-50s. ONS (2019a) computes commuting times across UK postcodes using a trip planner app, and the results on commuting gaps based on travel time are very similar to those based on travel distance, reported here.

of about 24%. Ten years after birth, the estimated gap amounts to about 10 minutes in one-way commuting times.

Le Barbanchon et al. (2019) show comparable evidence on the age profile of wage and commuting gaps using administrative data on unemployed jobseekers in France. They combine self-reported information on acceptable wage offers and acceptable commutes during job search with information on post-unemployment outcomes in wages and commuting distances. Gender gaps in reservation wages, post-unemployment wages, acceptable commutes and realized commutes all widen with age, and an important portion of these gaps is related to the presence of children.<sup>9</sup> To interpret gender differences in job search targets and post-unemployment outcomes, the authors propose a job search model in which jobseekers value both wages and proximity to prospective workplaces. Men and women face the same arrival rate of job offers and wage offer distributions, but may differ in their respective valuations of wages and proximity. By comparing acceptable job characteristics with realized outcomes, they estimate that women have a higher distaste for commute, which implies they are willing to trade-off a higher portion of potential earnings for being able to work closer to their homes. Model calibration for men and women with different household compositions predicts that gender gaps in the distaste for commute explain around 10% of wage gaps, but such percentage does not vary systematically with household size.

Administrative data for the UK only cover people in employment and we are thus unable to combine job search targets with post-unemployment outcomes to estimate jobseekers' willingness to pay for shorter commutes. But insights on the trade-off between wages and commuting distances can be extended to job-to-job transitions, which are – to some approximation – observed in the ASHE. Whenever a worker voluntarily moves job, the utility in the new job is at least as high as the utility in the old job. By comparing wage and commute combinations in old and new jobs, we infer gender differentials in the willingness to pay for commuting distance.

Job moves are identified in the ASHE via information on the year and month in which the current job has started. As information is collected in April of each year, we classify an employee as being in a new job whenever the start date of the current job is later than

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<sup>9</sup>See also Lundborg et al. (2017) for evidence on the impact of motherhood on commuting behavior.

the previous April, i.e. during the previous 12 months. However, as the ASHE does not provide information on the end date of the previous job, some job transitions may involve an intervening unemployment spell, in which case job mobility may be involuntary, and there is no guarantee that the wage-commute combination in the new job dominates the wage-commute combination in the old job. We therefore also consider a more restrictive definition of job mobility, within 6 months of the previous survey date.

Table 3 shows evidence on gender differences in the returns to job mobility. The dependent variable in columns 1 and 2 is the change in log hourly wages between two consecutive jobs; in columns 3 and 4 it is the corresponding change in the log commuting distance. The sample in Panel A includes all cases of job mobility between two consecutive survey dates. Estimates reported in column 1 imply that women have very similar wage returns to job mobility as men, around 6.8%. In column 2 we control for worker and lagged job characteristics and the coefficient on the gender dummy stays virtually unchanged. Results from the (log) distance regression in column 3 show that job mobility is on average associated with longer commutes, but less so for women than for men. The gender differential in the change in distance widens markedly when we include controls in column 4. In Panel B we only include job transitions that take place within six months of the previous interview date. This should limit the incidence of intervening unemployment spells, and better identify cases of voluntary mobility, associated with preferred combinations of wages and commutes. As expected, on average job mobility is associated with larger wage gains and smaller distance increases than in Panel A (see columns 1 and 3, respectively). Upon changing job, women lose with respect to men in terms of wage growth, but gain in terms of proximity to work, consistent with the view that they attribute a higher value to short commutes than men.

We argued above that job mobility makes men and women strictly better off on average in terms of wages and distance combinations. We next attempt to estimate the marginal rate of substitution between wages and distance that would make them indifferent between one job and the next, adapting the unemployed search framework developed by Le Barbanchon et al (2019) to job-to-job transitions. Let's assume that indifference curves between wages and distance can be approximated by a log-linear relationship  $w = \alpha + \beta d$ , where  $w$  and  $d$  denote log wages and log distance, respectively, and  $\beta$  is the parameter of interest, measuring the

willingness to pay for proximity to work. Consider a worker  $i$  who is initially employed in Job 0, characterized by  $d_{0i}$  and  $w_{0i}$ , as represented in Figure 11. If the worker moves voluntarily to Job 1, characterized by  $d_{1i}$  and  $w_{1i}$ , the  $(d_{1i}, w_{1i})$  bundle should be located somewhere above a hypothetical indifference curve passing through  $(d_{0i}, w_{0i})$ , with an unknown positive slope  $\beta$ . The intercept  $\alpha$  is pinned down by the restriction that the indifference curve goes through  $(d_{0i}, w_{0i})$ , hence  $\alpha = w_0 - \beta d_0$ . This leaves one free parameter ( $\beta$ ) to be identified.

To identify  $\beta$ , we pool all cases of job mobility and let the wage-distance indifference curve rotate on the initial  $(d_{0i}, w_{0i})$  bundle, so as to minimize the distance from the curve of all newly-accepted bundles  $(d_{1i}, w_{1i})$  that would sit below the curve itself. This procedure minimizes ex-post utility losses from job mobility, which would not be consistent with the assumed framework.<sup>10</sup> Formally:

$$\hat{\beta} = \arg \min_{\beta} \sum_i D_{\beta, d_{0i}, w_{0i}}(d_{1i}, w_{1i})^2$$

s. to  $w_{1i} < w_{0i} + \beta(d_{1i} - d_{0i})$ ,

where  $D_{\beta, d_{0i}, w_{0i}}(d_{1i}, w_{1i})$  denotes the Euclidean distance between point  $(d_{1i}, w_{1i})$  and the line  $w = w_{0i} + \beta(d - d_{0i})$ , and the constraint identifies bundles that would sit below the line.

The intuition is as follows. Imagine that individuals value wage gains, but attach no value to shorter commutes. The job mobility data would contain a large mass of observations above the  $w_0$  line, not systematically to the right or to the left of the  $d_0$  line, as represented by the area shaded in light blue in Figure 11. The indifference curve that best represents these preferences is flat ( $\beta = 0$ ), so as to minimize the mass of observations below the  $w_0$  line, weighted by their distance to the curve. Consider now the opposite case, in which individuals value shorter commutes but are ambivalent about wage changes. One would expect a large mass of observations to the left of the  $d_0$  line, not systematically above or below the  $w_0$  line, as represented by the area shaded in yellow. Indifference curves that best represent these preferences are vertical ( $\beta \rightarrow \infty$ ), so as to minimize the mass of observations to the right of the  $d_0$  line. In the general case in which individuals value both wage gains and shorter

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<sup>10</sup>Such utility losses could only be rationalized by omitted factors, e.g. measurement error in reported wages and/or distance, or other relevant components of job utility that are not explicitly considered in this framework.

commutes, indifference curves are upward sloping, with  $\beta$  increasing with the value attached to shorter commutes relative to wage gains.

We estimate  $\beta$  separately for men and women, on workers paid more than 5% above the (age specific) minimum wage.<sup>11</sup> As wages and commutes vary systematically with other job characteristics that in turn vary by gender, we residualize log wages and distance with respect to the same controls indicated in the notes to Table 3. We obtain a 0.034 slope for men and a 0.040 slope for women, rising slightly to 0.037 and 0.043, respectively, when restricting our sample to job moves that take place within six months of the previous interview date. While the gender differences detected go in the expected direction, these numbers predict only small wage compensations for sizeable changes in distance on our sample of job movers.

There are reasons why these estimates may represent a lower bound for the wage-distance trade-off. First, travel becomes more efficient at longer distances, thus a given rise in distance may raise the time cost of commute less than proportionally. Second, these estimates are sensitive to the presence of distance outliers in our sample. To give an example, they rise to 0.060 and 0.070 for men and women, respectively, when dropping observations with commuting distances above the 95th percentile (corresponding to 152 km for men and 71 km for women). Conceptually, estimated slopes should capture the wage-distance trade-off for a set of workers who travel to work the same number of days per week. Otherwise, a given commute  $d$  would not entail the same “cost” to someone commuting to work every day as to someone who only commutes sporadically. If occasional commuters are oversampled among distance outliers, the slope estimates obtained on the 95% sample may better approximate the wage-distance trade-off among regular commuters. Further research is needed to investigate heterogeneous trade-offs along this and other dimensions.

## 5 Conclusions

This paper has discussed some of the leading views on the rise in female employment and wages, involving both gender-specific and gender-neutral forces, and the remaining gender gaps in most countries’ labor markets. Despite convergence in traditional human capital

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<sup>11</sup>For minimum wage workers the wage return to job mobility would be bounded at zero from below.

factors, there remain persistence gender differences in “employment location” – by occupation, industry and firm – as well as in job attributes that are considered important, such as work flexibility and distance to home. One prominent view is that most of these differences stem from women’s prevalent role in family responsibilities, which is at least in part related to gender identity norms and societal attitudes towards gender roles. While gender norms are indeed evolving in the right direction, their speed of change would be too low to predict closing gaps anytime soon.

One of the main stylized facts emphasized in this paper is that men and women differ markedly in their commuting patterns, whereby women’s stronger distaste for commuting distance may feed into gender gaps in earnings in so far as women are willing to consider lower pay in return for closer job opportunities. Consistent with this view, women gain less than men from job mobility in terms of earnings, but gain more in terms of vicinity to new workplaces. Indirect evidence on this is the fact that the age profile in the commuting gap closely resembles the age profile in the wage gap. However, despite sizeable gender differences in commuting and returns to mobility, a simple search model in which men and women face similar job offer prospects but differ in their willingness to pay for proximity to work delivers quantitatively modest compensating differentials.

Overall, these points speak to a currently debated issue, on the impact of new technologies in the labor market and the future of work. Organizational and technological change have enabled family-friendly workplace practices and broadened opportunities of working remotely. The growth in the gig economy is challenging conventional norms about where and when work is undertaken. These changes are expected to steer the structure of work in directions that are likely beneficial to female work, via a reduction in the cost of flexibility and declining significance of distance. One downside to be taken into account, however, is the potential specialization of women in low- or middle-tier occupations that are more permeable to non-standard work arrangements. This may in turn reinforce women’s comparative advantage in non-market work, with possibly negative consequences on gender norms and aspirations. These should be important avenues for future research.



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Table 1: Raw and adjusted wage gaps in the US and UK, 2017

	United States		United Kingdom	
Female	-0.184 (0.001)	-0.231 (0.001)	-0.154 (0.001)	-0.163 (0.011)
Age and age sq.		yes	yes	yes
Education		yes	yes	yes
Industry		yes	yes	yes
Occupation			yes	yes
No. observations	1,302,236	1,302,236	1,302,236	8,937
			8,937	8,937
				8,937
				8,937

Estimates reported are coefficients on a female dummy in log wage regressions that control for variables indicated in the first column. Education controls are dummies for high-school completed, higher education diploma, some college and college degree for the US, and high-school completed, higher education diploma and college degree for the UK. High-school dropout is the excluded category in each country. Industry effects are based on 85 categories for the US and 88 categories for the UK; occupation effects are based on 88 categories for the US and 91 categories for the UK. The coefficients on the female dummy are all significant at the 1% level and regressions are weighted using individual weights. Standard errors are reported in parentheses. Sample: employed individuals aged 18-65. Source: 2017 ACS for the US; 2017 LFS for the UK.

Table 2: Shift-share decomposition for the rise in female hours

	United States			United Kingdom		
	1940	2017	Change	1977	2017	Change
Share of female hours	0.23	0.44	0.21	0.31	0.42	0.11
Female intensity						
Goods	0.12	0.20	0.08	0.19	0.17	-0.02
Services	0.34	0.52	0.18	0.41	0.49	0.08
Share of services	0.51	0.77	0.26	0.52	0.77	0.25
Between-sector component		<b>0.33</b>			<b>0.62</b>	

The first row reports the share of female hours in the economy at the start and the end of the sample period and its change (corresponding to the left-hand side of equation 1). The second and third rows report the female intensity (as a share of total sector hours) in the goods and service sector, respectively. The average of start and end female intensities is used to obtain decomposition weights  $\alpha_j$ . The fourth row reports the share of services at the start and the end of the sample period and its change (corresponding to  $\Delta l_{jt}$ ). The fifth row reports the between-sector component of the rise in female hours as a fraction of the total ( $\sum_j \alpha_{fj} \Delta l_{jt} / \Delta l_{ft}$ ). Sample: employed individuals aged 18-65. Source: Census 1940 and ACS 2017 for the US; LFS for the UK.

Table 3: Gender differences in the returns to job mobility

<b>Panel A</b>				
Sample: Any job change between two consecutive survey dates				
	Change in (log) wages		Change in (log) distance	
	(1)	(2)	(3)	(4)
Female	-0.0026 (0.0020)	-0.0031 (0.0023)	-0.0259** (0.0102)	-0.0736*** (0.0118)
Constant	0.0683*** (0.0015)	0.1877*** (0.0289)	0.0812*** (0.0075)	0.0989 (0.1490)
Other regressors	No	Yes	No	Yes
No. observations	130,831	127,627	124,827	121,752

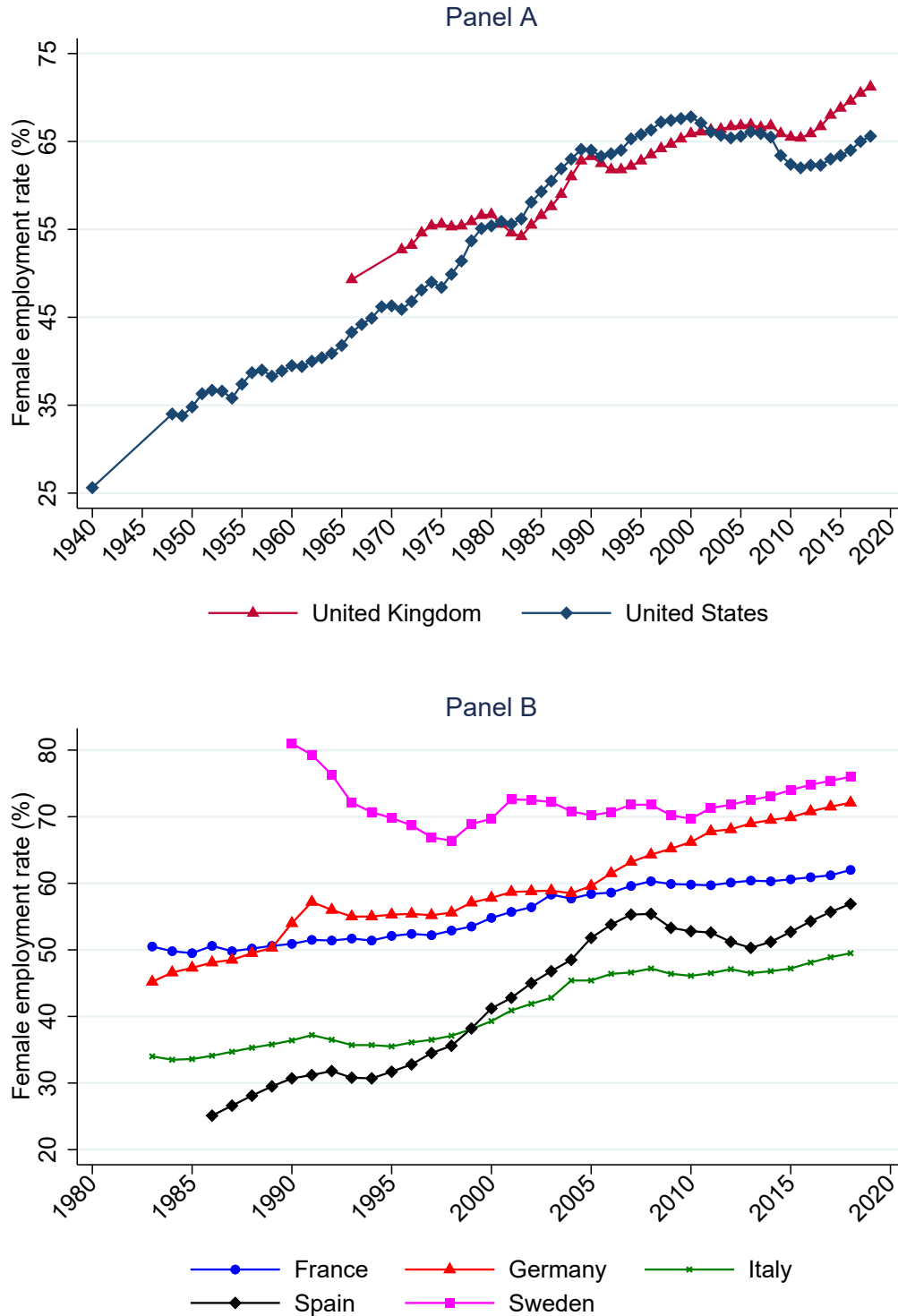
  

<b>Panel B</b>				
Sample: Any job change within 6 months of last survey date				
	Change in (log) wages		Change in (log) distance	
	(1)	(2)	(3)	(4)
Female	-0.0100*** (0.0025)	-0.0090** (0.0029)	-0.0225* (0.0132)	-0.0861*** (0.0151)
Constant	0.0888*** (0.0019)	0.1930*** (0.0365)	0.0540*** (0.0097)	0.1223 (0.1905)
Other regressors	No	Yes	No	Yes
No. observations	79,153	76,860	75,666	73,465

The dependent variable in columns 1 and 2 is the change in log hourly wages and in columns 3 and 4 it is the change in the log one-way distance between the postcode of residence and the postcode of work. Regressions in columns 2 and 4 also control for: age and age squared, lagged part-time status, lagged temporary contract status, lagged job tenure, lagged region (11 categories), 1-digit occupation (9 categories), 2-digit industry (58 categories), and year effects. Sample: employees aged 21-65, excluding multiple job holders. Source: ASHE, 2002-2019.

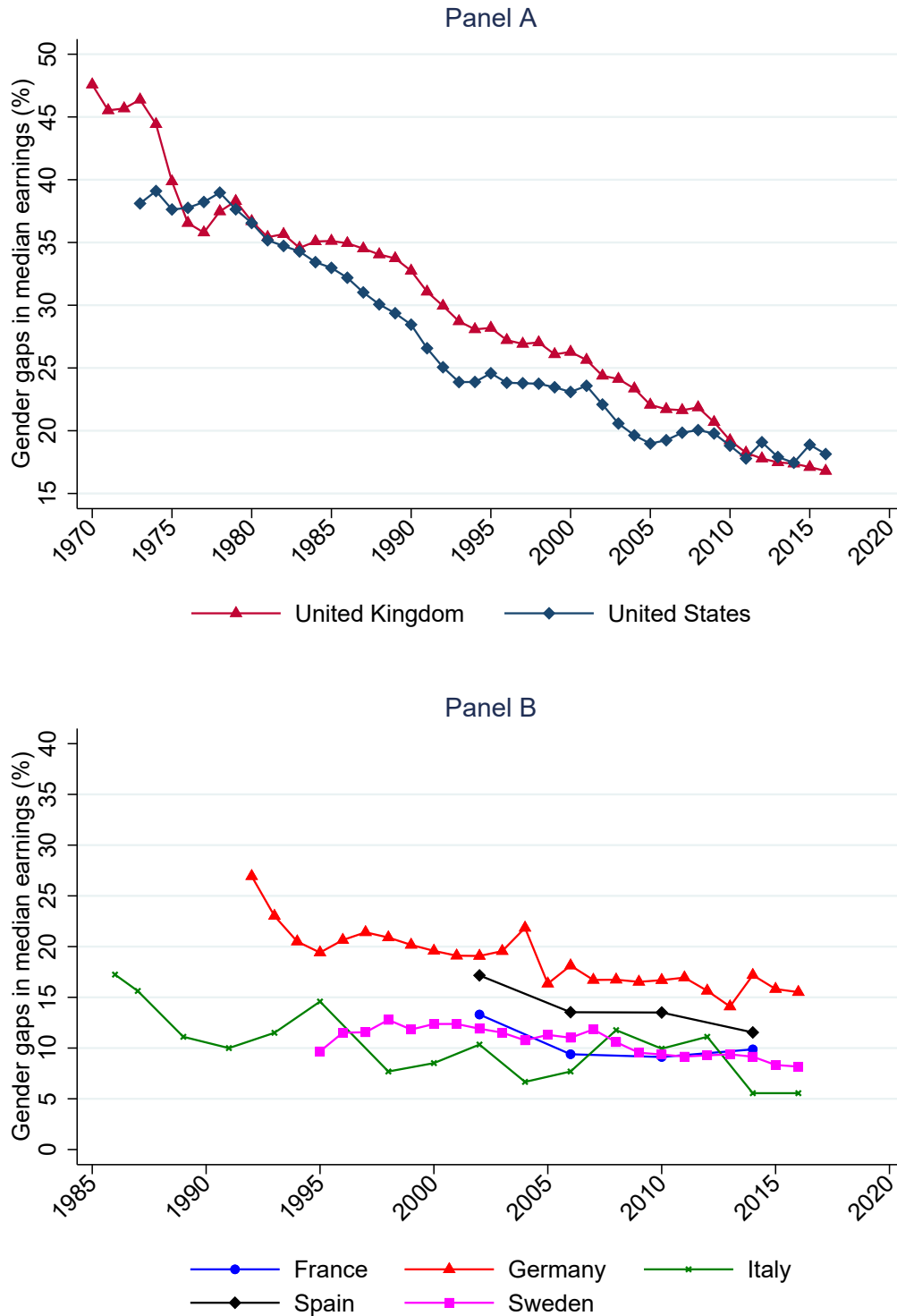


Figure 1: Female employment in the US and major EU countries



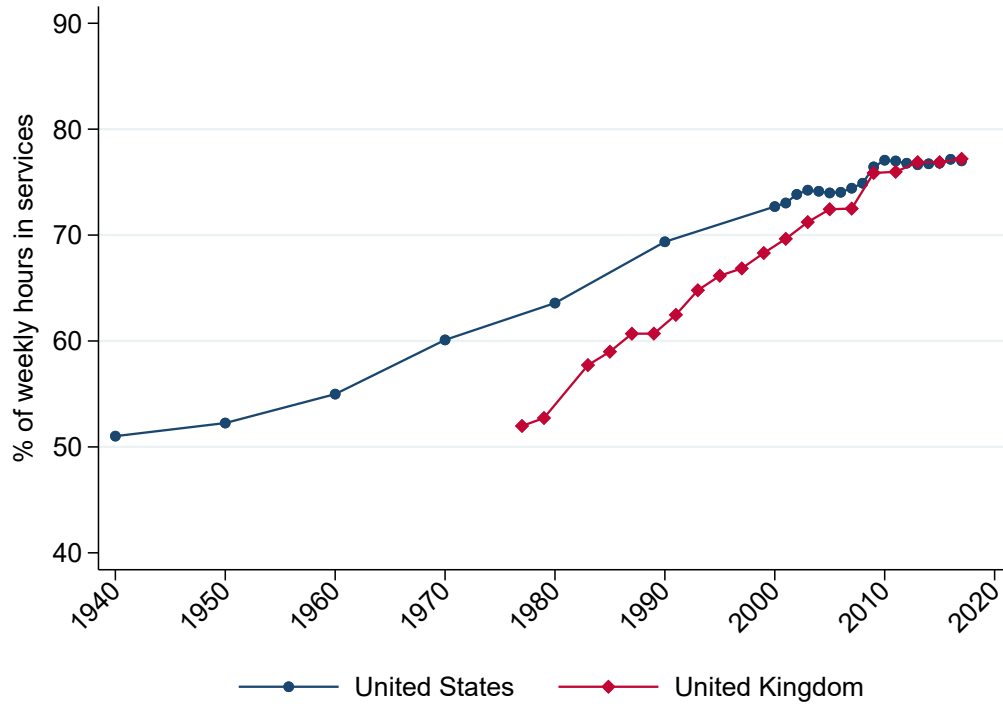
The Figure plots the ratio of female employment over the working age population in the US and six EU countries (aged 16-64 in the UK and 15-64 in all other countries). Source: UK – 10% Census (1966) and Office for National Statistics (ONS) estimates based on the UK Labour Force Survey (LFS, 1971 onwards); US – Census (1940) and International labor Organization (ILO) estimates based on the Current Population Survey (CPS, 1948 onwards); ILO estimates based on country-specific Labor Force Surveys for all other countries.

Figure 2: Gender gaps in earnings in the US and major EU countries



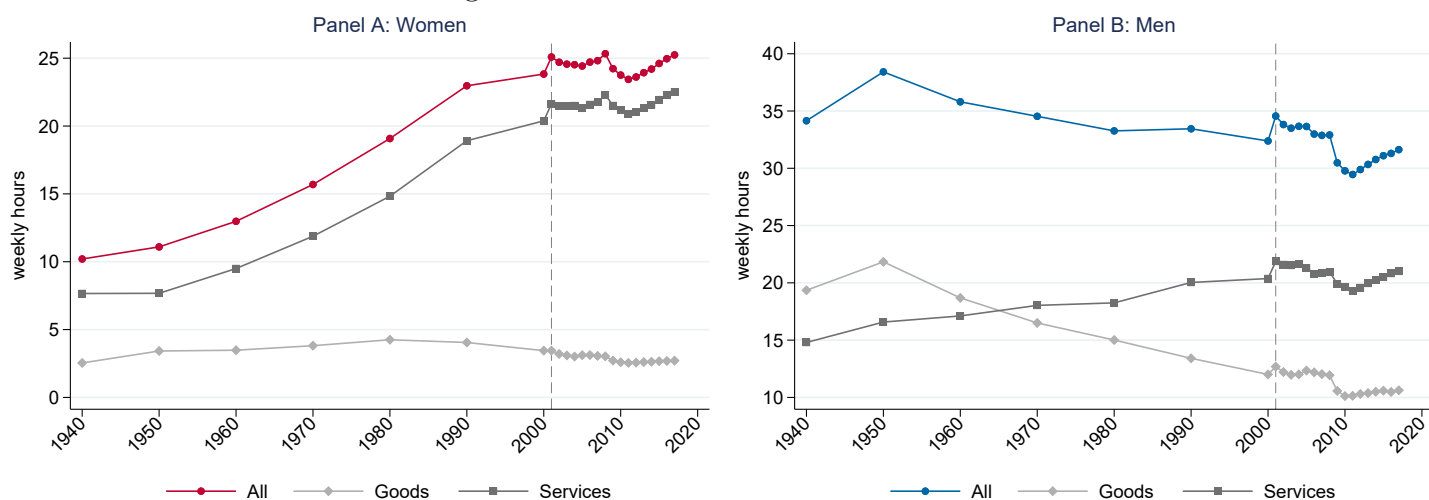
The Figure plots the difference between median earnings of men and women, relative to median earnings of men for full-time employees. Source: OECD (<https://data.oecd.org/earnwage/gender-wage-gap.htm>).

Figure 3: The rise in the service sector in the US and the UK



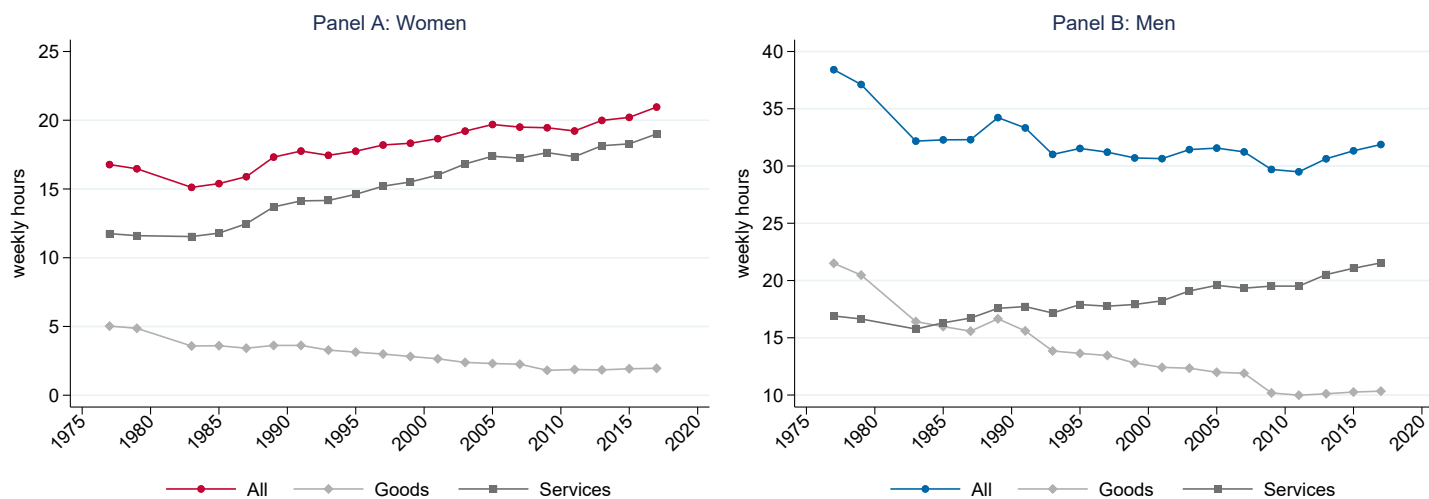
The Figure plots hours worked in the service sector as a share of total hours. The service sector includes: Transportation; Post and telecommunications; Wholesale and retail trade; Finance, insurance and real estate; Business and repair services; Personal services; Entertainment; Health; Education; Professional services; Welfare and no-profit; Public administration. The rest of the economy includes: Primary sectors; Construction; Manufacturing; Utilities. Sample: employed individuals aged 18-65. Source: Census (1940-2000) and American Community Survey (2001-2017) for the US; LFS (1977-2017) for the UK;

Figure 4: Gender and services in the US



Panels A and B plot usual weekly hours worked for men and women, respectively, as well as their sector components. Sample: individuals aged 18-65, excluding those in fulltime education, retired or in the military. Source: Census (1940-2000) and American Community Survey (2001-2017) (Ruggles et al, 2020). The dashed vertical line indicates the first observation on ACS data.

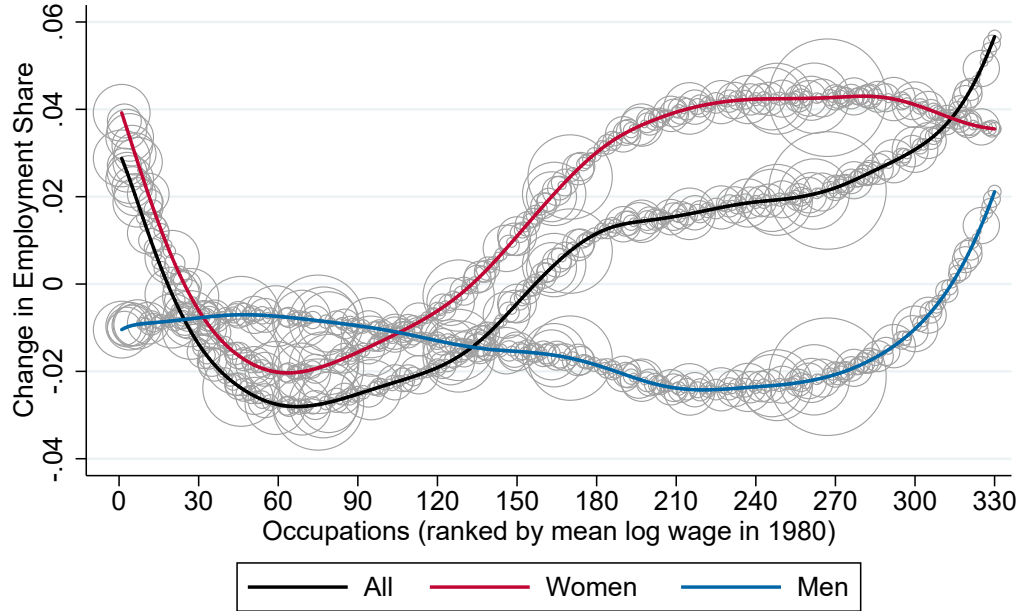
Figure 5: Gender and services in the UK



Panels A and B plot usual weekly hours worked for men and women, respectively, as well as their sector components. Sample: individuals aged 18-65, excluding those in fulltime education or retired. Source: UK LFS (1977-2017).

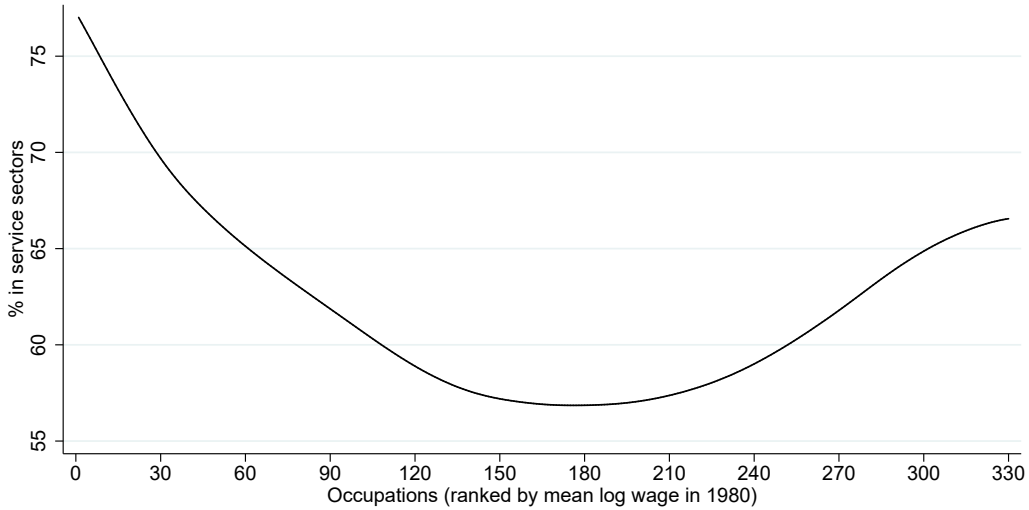
Figure 6: Gender and employment polarization in the US, 1980-2007

Panel A: Change in Employment Share by Occupation between 1980 and 2007



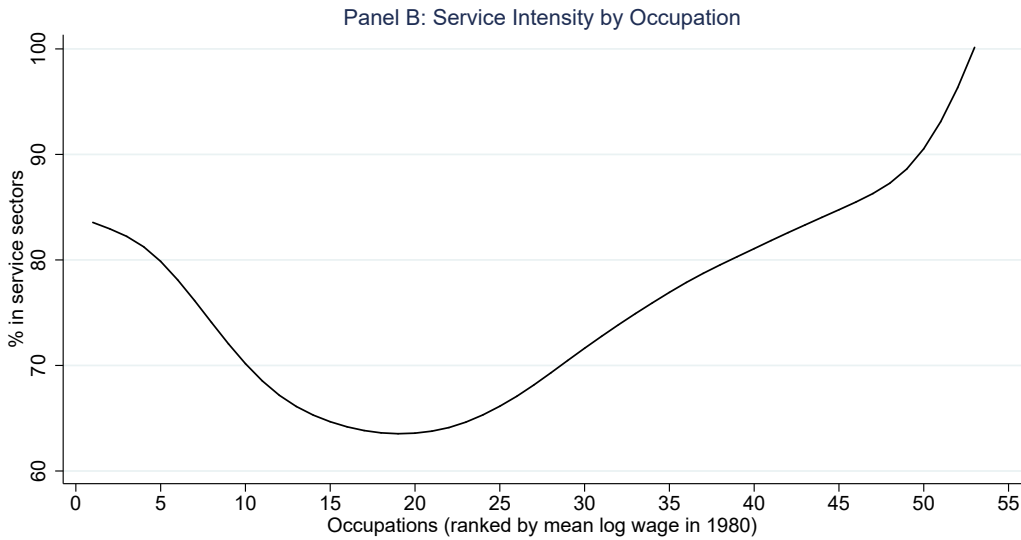
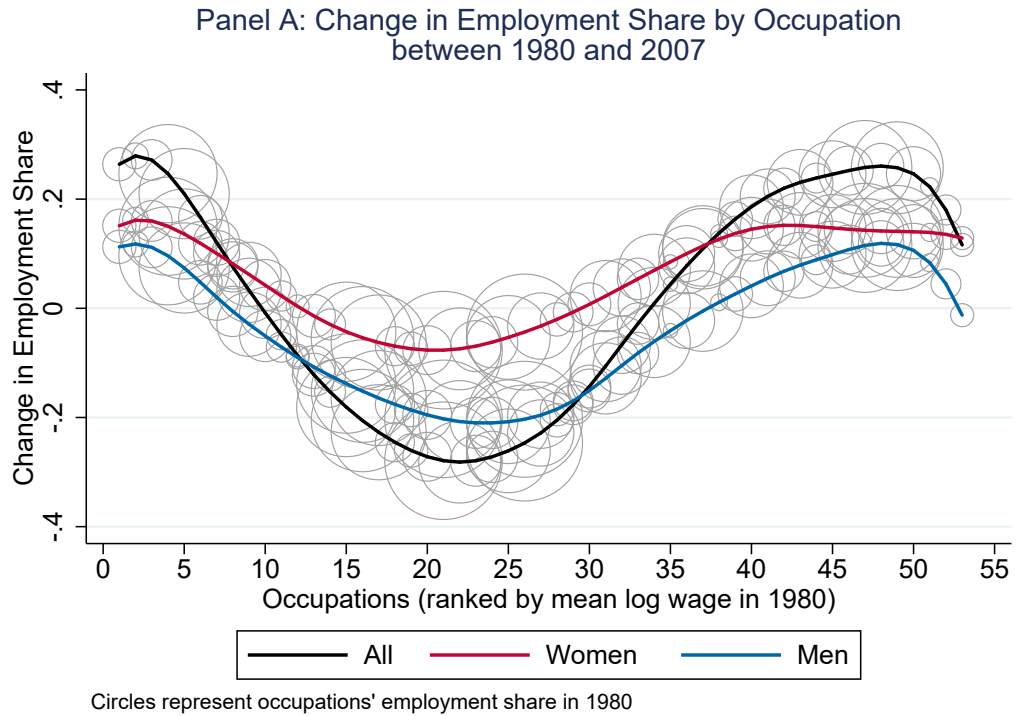
Circles represent occupations' employment share in 1980

Panel B: Service Intensity by Occupation



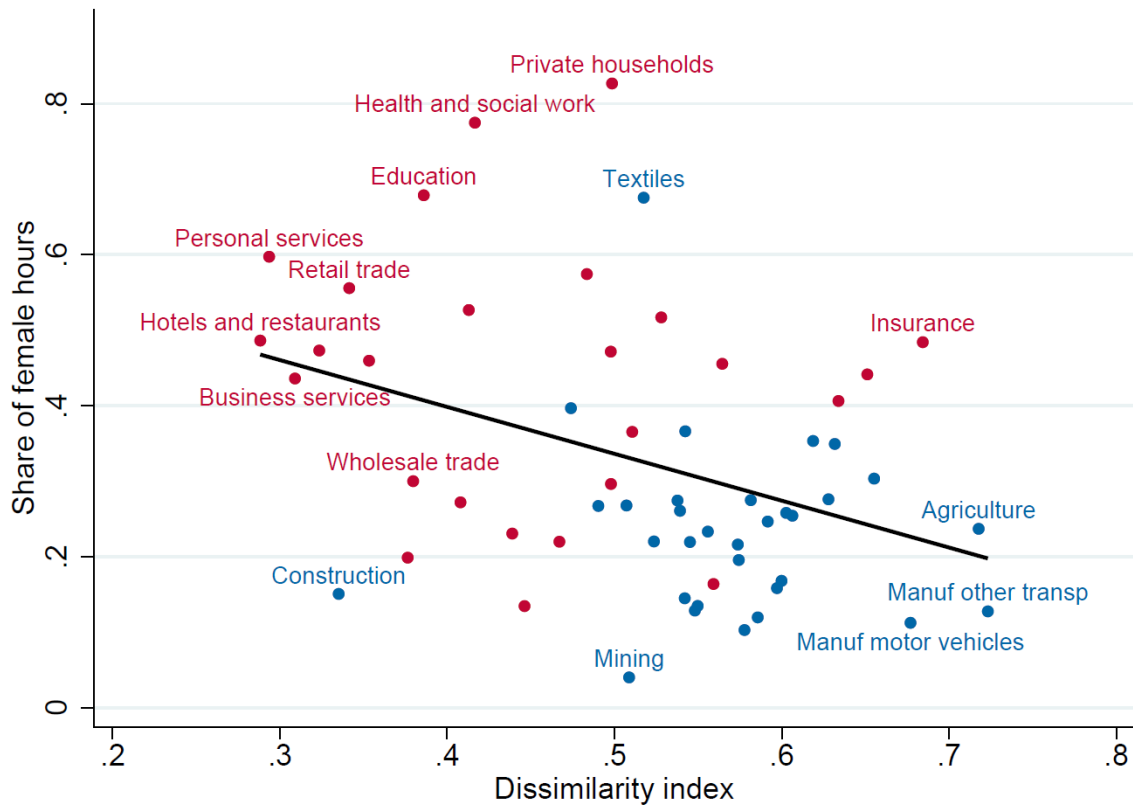
Panel A plots smoothed employment changes by occupation for all individuals and men and women separately. We use the balanced panel of occupations for the period 1980-2008 available on <https://www.ddorn.net/data.htm>. The occupations (330 categories) are ranked according to the mean log hourly wage of workers in each occupation in 1980. Panel B plots the smoothed service intensity by occupation, measured by the share of total occupation employment in all service industries combined in 1980 (see notes to Figure 3). Sample: employed individuals aged 18-65. Source: Census and ACS combined, 1980-2007.

Figure 7: Gender and employment polarization in the UK, 1994-2007



Panel A plots smoothed employment changes by occupation for all individuals and men and women separately. Occupations (55 categories) are ranked according to the mean log weekly wage of workers in each occupation in 1994. Panel B plots the smoothed service intensity by occupation, measured by the share of total occupation employment in all service industries combined in 1994 (see notes to Figure 3). Sample: employed individuals aged 18-65. Source: UK LFS, 1994-2007.

Figure 8: Gender and the geographic dispersion of jobs in the UK



The Figure plots the female hours share in 2-digit industries against an index of industry of geographic clustering (see equation 2). Source: UK ASHE and BSD, 2006-2018. The ASHE sample includes employees aged 21-65. The BSD sample includes all active establishments.

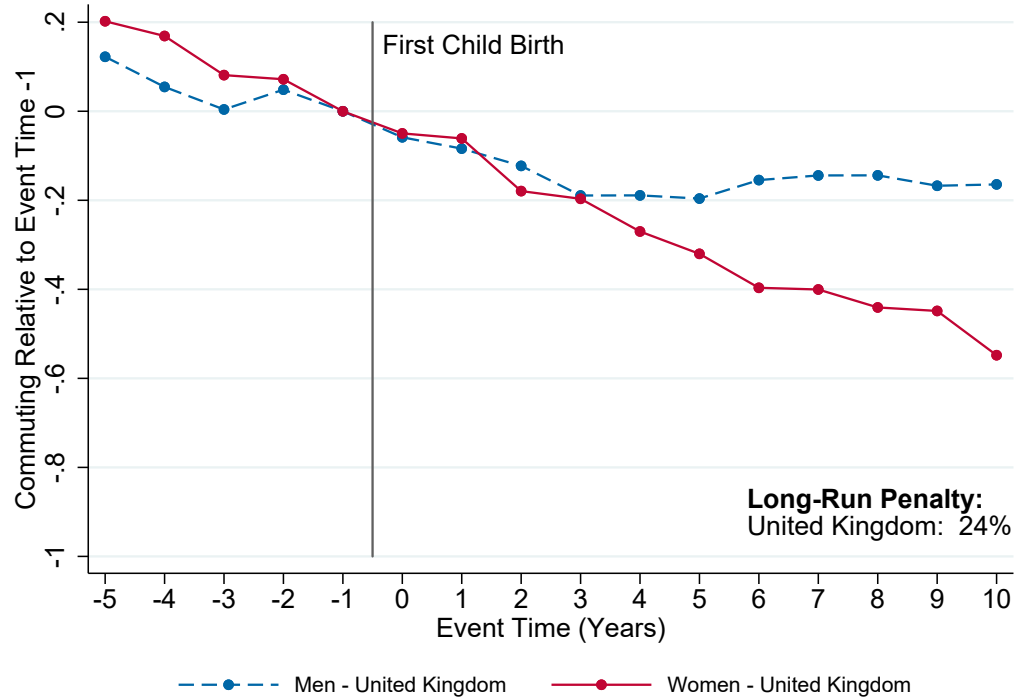
Figure 9: Commuting and wage gaps in the UK



The Figure plots estimates based on regressions for log commuting distances and log wages in turn, controlling for year effects, gender, unrestricted age effects and their interaction with gender, industry, occupation and region effects (61, 9 and 11 categories, respectively), a dummy for fulltime work and a dummy for permanent contract. Sample: employees aged 21-65. Source: ASHE, 2002-2019.

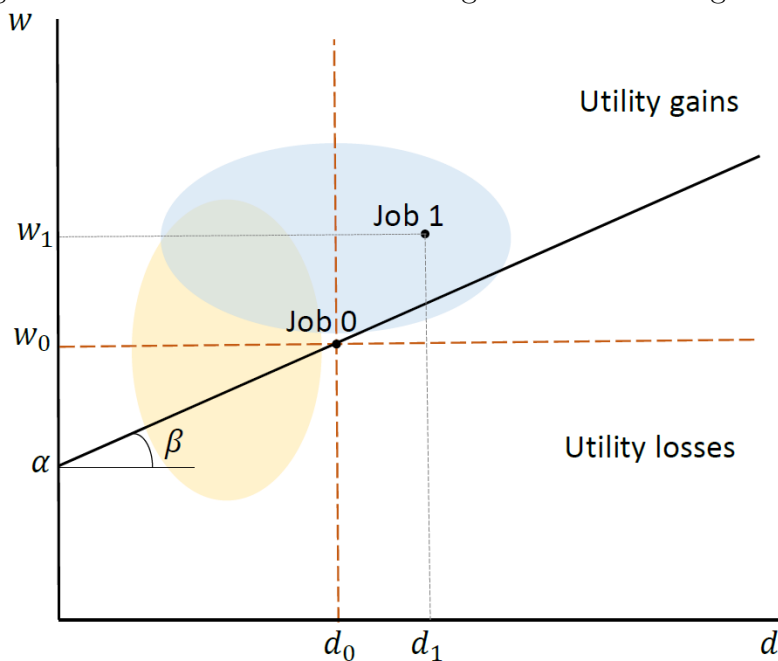


Figure 10: Parenthood and commuting gaps



The Figure plots the percentage change in commuting time of mothers (solid line) and fathers (dashed line) relative to the year before their first childbirth. The estimates are obtained in an event study that controls for age and year dummies. The event study coefficients for men and women are statistically different at the 5% level from event time 6 onward. The long-run penalty is obtained as the average penalty from event time 5 to 10. Sample: individuals who have their first child between 1992-2009 (aged 20-45) and who are observed in employment at least 8 times during the sample period. Source: BHPS..

Figure 11: The trade-off between wages and commuting distance



The Figure shows a hypothetical indifference curve between wages and commuting distance and illustrates the method to identify its slope.