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Extensive and Intensive Margins of Labour Supply: Work and Working Hours in the US, the UK and France*

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Abstract

This paper provides a new analysis of the main stylised facts underlying the evolution of labour supply at the extensive and intensive margins in three countries: the United States, the United Kingdom and France. We propose a definition of the extensive and intensive margins corresponding respectively to the employment rate and to hours when employed. This definition is robust to the choice of the reference period and we develop a new statistical decomposition that provides bounds on changes at these margins. We focus on longer-run labour supply changes over the period 1977 to 2007 and abstract from the shorter-run impact of recessions. Examining secular changes over this period, we show that both margins matter in explaining changes in total hours. We then provide a detailed analysis across countries and across time by demographic type. Given the large systematic differences

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we uncover in the importance of these margins by age and gender, it is unlikely that a single explanation will suffice to account for the macroeconomic evolutions in the three countries.

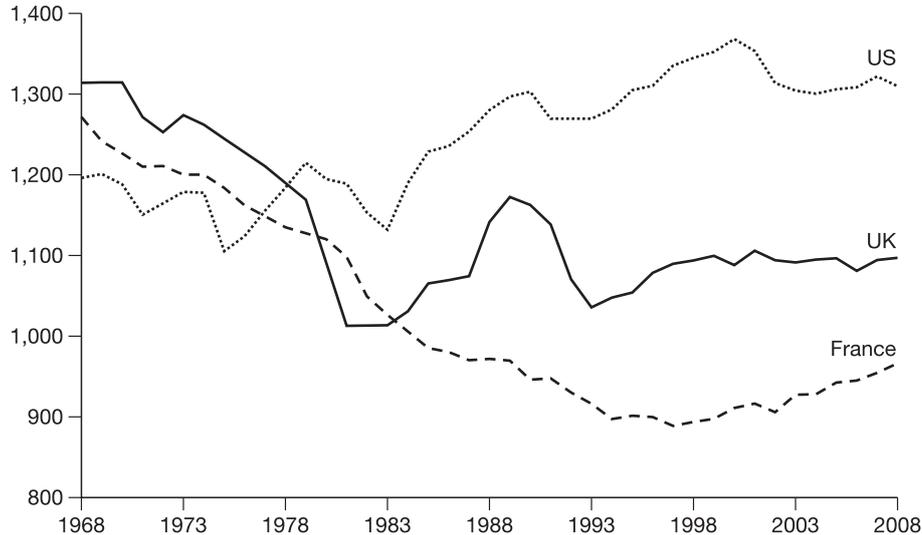
Policy points

- Total hours of work increased strongly in the US, were stable in the UK and fell back in France over the three decades up to 2007. This appears to have been driven by increasing participation and stable hours in the US, increasing participation and declining hours in the UK, and falling participation and hours in France. These changes highlight the potential importance of incentives in the tax and welfare system in explaining differences in hours worked and employment across countries.
- At older ages, men in the UK and the US exhibit very similar employment rates up to 65, when the British experience a larger drop than the Americans, whereas French male employment rates diverge from age 55. Incentives in pension and social security provisions are likely to play a central role in explaining differences across countries.
- Among 16- to 29-year-olds, France stands out with much higher non-employment rates than both the US and the UK. Much of the difference arises from the possibility of combining education and training with work. Young French people who are studying are generally not working, whereas young Britons and Americans are much more likely to be both working and in education. The balance between incentives to work and study is a key area for policy analysis.
- Our account of the secular changes in employment and hours in the UK, France and the US over the three decades up to 2007 shows some clear trends and points to some possible explanations, but it also raises a number of puzzles. The resolution of these puzzles calls for a detailed analysis of effective incentives in the tax and benefit system, how they have changed over time, and how individuals and families have responded. Given the large heterogeneity by age and sex that we document, it is unlikely that a single explanation will account for these evolutions.

I. Introduction

At the end of the 1970s, the total hours per working-age individual in the US, the UK and France stood at roughly the same level. Thirty years later, they looked quite different. Figure 1, from Blundell, Bozio and Laroque (2011b), documents this key piece of evidence on the aggregate hours worked across the three countries. The pattern of total hours per individual

FIGURE 1
Mean annual hours per individual aged 16 to 74



Note: Annual hours of work are measured using actual weekly hours of work from continuous surveys and averaging over the year. When continuous surveys are not available, we use annual surveys, making an adjustment to link the series. See the online appendix for details (http://www.ifs.org.uk/docs/fsmar13_blundelletal_appendix.pdf).

Source: Enquête Emploi, Labour Force Survey, Family Expenditure Survey and Current Population Survey.

shows a three-way split after 1980 in the evolution of total hours across the three countries. However, this simple description of total hours disguises some of the major differences between these three countries. It is these differences that are the motivation for this study.

To provide a better description of these changes, we split the overall level of work activity into the number of individuals in work and the intensity of work supplied by those in work. This reflects the distinction between whether to work and how much to work at the individual level, which are referred to, respectively, as the extensive and intensive margin of labour supply. At the aggregate level, the former is typically measured by the number of individuals in paid employment and the latter by the average number of working hours for those in employment.

The choice of the US, the UK and France is not coincidental. These three countries stand at the top, middle and bottom, respectively, of Prescott's (2004) table of labour supply flexibility. The UK provides an interesting comparison with the polar cases of France and the US. Over the period we consider, the UK has adopted many tax policies apparently similar to those

in the US,¹ while at the same time it has moved from a dominant position in the supply of total hours to one lying between the US and France.

We are certainly not the first to highlight the difference between the extensive and intensive margins of labour supply. It has been at the centre of recent research attempting to resolve differences between micro and macro responses of labour supply to tax reform. For example, Rogerson and Wallenius (2009), following the work of Prescott (2004), argue that the responsiveness of the extensive margin of labour supply to taxation plays a major role in explaining aggregate differences in total hours worked across countries. They show that an economy with fixed technology costs for firms and an inverted U-shaped life-cycle productivity for workers can produce large aggregate extensive labour supply responses driven by movements in employment at either end of the working life. This, they argue, can reconcile the small micro-based elasticities of hours worked with the large responses required if taxes and social security are to explain cross-country differences in total hours of work.

But what do we know about the importance of these margins for different types of workers? How well does the extensive margin explain changes in total hours over time and across countries? In this paper, we provide an answer through a detailed decomposition of the evolution of total hours of work into changes at the extensive and intensive margins. In our analysis, we find that neither margin dominates in explaining changes in total hours worked for these countries. Rather, the relative importance of the extensive and intensive margins is shown to differ systematically by age, gender and family composition.

The distinction between the extensive and intensive margins at a disaggregated level has long been recognised in microeconomic studies of labour supply.² For example, building on the insights of Gronau (1974) and Heckman (1974 and 1979), Cogan (1981) documented the importance of fixed costs of work in separating the link between responses at the employment and hours margins. His study found that earlier estimates of hours-of-work elasticities at the intensive margin for married women were biased upwards due to the omission of fixed costs. In subsequent empirical analyses, the size of the wage elasticities at these two margins has been found to differ significantly by gender, family composition and age.³ The relative size of labour supply responses at the intensive and extensive margins has also been a key parameter in the public economics literature on earnings tax design.⁴

¹Blundell and Hoynes, 2004.

²See Heckman (1993).

³Blundell and MaCurdy, 1999.

⁴See Diamond (1980), Saez (2002) and Laroque (2005).

Typically, the elasticity at the extensive margin has been found to be somewhat larger than the elasticity at the intensive margin. Over time, as labour force participation of women increased, the labour supply elasticities of men and women have, to some extent, converged.⁵ However, it is not only women with children for whom the extensive labour supply margin has been found to play a major role in understanding individual and family labour supply behaviour over the life cycle. ‘Early retirement’ behaviour has been found to respond systematically to participation tax rates implicit in social security systems.⁶

A related issue in the discussion of labour supply elasticities is the time horizon of behavioural responses. Many micro-based studies have focused on weekly hours of work, while macro-based analyses look at aggregate measures of annual hours of work. The measure and properties of the extensive (fraction of the period when employed) and intensive (average hours supplied by the workers) margins are sensitive to the length of the reference period. Furthermore, the labour supply elasticities are different when assessed at the steady state or when they incorporate intertemporal substitution effects.⁷

Section II first examines the definition and measurement of the intensive and extensive margins of work. It then goes on to describe the data used in the paper and provide an overview of the trends in aggregate hours worked since 1968 in France, the UK and the US. Section III highlights the importance of age and gender. In Section IV, we turn the focus to the life-cycle stages of work and examine the special features of work associated with younger workers, women with children and those approaching retirement. In Section V, we apply the framework developed in Blundell, Bozio and Laroque (2011b) to provide bounds on the empirical measures of the intensive and extensive margins and we draw out the key stylised facts. Section VI summarises our main findings and Section VII concludes.

II. Understanding the pattern of work

1. Defining the extensive margin

The total number of hours of work of individual i in period t , H_{it} , can be decomposed into an extensive component p_{it} and an intensive one h_{it} :

$$(1) \quad H_{it} = p_{it} \times h_{it}.$$

This decomposition has been widely used in the literature, but the respective notions of intensive and extensive margins have been relatively ill defined.

⁵Blau and Kahn, 2007.

⁶See, for example, Gruber and Wise (1999) and papers therein.

⁷Blundell and MaCurdy, 1999; Chetty et al., 2011.

The most common understanding of the extensive margin is whether an individual has been in work or not in the reference period (a dichotomous variable taking value 0 or 1), while the intensive margin is how many hours of work the individual was working in that period (a continuous time variable that is strictly positive). Thus defined, the extensive and intensive margins would depend heavily on the choice of the reference period: time spent on holidays would be part of the intensive measure if the reference period were a year but would be understood as part of the extensive margin if the reference period were a week. If we were to take life as the reference period, labour supply would all be about the intensive margin, while at the other extreme, if we were to take an hour as the reference period, it would all be about the extensive margin. Hence these definitions of extensive and intensive margins lack real economic substance.

We suggest a different definition of the extensive and intensive margins of labour supply. We believe that the key element behind the economic notion of extensive margin is the existence of a labour contract. We thus define the *extensive margin* of labour supply as the fraction p_{it} of the reference period when the individual is employed or self-employed. This definition is different from the more usual one, but it captures the standard notion of the extensive margin as a measure of employment.^{8,9} Perhaps more importantly, defining the extensive margin as a fraction of the reference period in employment, as opposed to a dichotomous variable, makes the distinction between extensive and intensive robust to the choice of the reference period.

From (1), it follows that the *intensive margin* of labour supply, h_{it} , is defined as the total number of hours worked in the reference period, H_{it} , divided by the fraction of the reference period in employment, i.e. by the measure of the extensive margin, p_{it} . This is a measure of the intensity of work when employed. Note that, with our definitions, periods of employment not worked, such as holidays and sick leave, will always appear as changes in the intensive margin.

It may be useful to develop a few examples. Consider worker A, who is employed during the entire reference year, working H hours in total during the year. Suppose that she works at a constant rhythm, $H/12$ every month. Her intensive margin is H and her extensive margin is 1. A part-time employee B, who works three-quarters of $H/12$ each month, also has an extensive margin of 1, but her intensive margin is $3H/4$. Consider now person C, who works at the same rhythm as A between January and June and October to December, while from July to September she is out of work, not on paid leave and without an employment contract. She works three-quarters

⁸Heckman, 1974; Killingsworth, 1983.

⁹Note that our measure of the extensive margin of labour supply does not incorporate the unemployed and should therefore not be equated with standard labour force participation measures.

of the year, so her extensive margin is equal to $3/4$, while her intensive margin equals H . Thus her total annual hours worked is $3H/4$, equal to that of B, but her intensity of work when employed is similar to A's.

The choice of the reference period is nonetheless important to capture movements in the extensive and intensive margins. Using the year as reference period misses seasonal – monthly or quarterly – and daily variations in the intensity of work. For a given number of hours worked per year, individuals might have very different timings for these hours. Although we do not focus in this paper on these variations – we use the calendar year as the reference period – we provide evidence in Blundell, Bozio and Laroque (2011a) of significant cross-country differences.¹⁰

2. Data

There are many different concepts of working hours that have been used in the labour statistics literature: normal hours, hours paid, usual hours or actual hours. Each varies depending on whether one includes overtime hours, time travelling to work, meal breaks, holidays, sick leave and many other periods that could be considered as paid work or not. In this paper, we use the concept of *actual hours of work*, excluding meal breaks, travel to work, holidays and sick leave but including short rests at the workplace.

The data used in this paper come from labour force surveys, which are the main source of information for measuring characteristics of labour force participation. More specifically, we use the Enquête Emploi (EE) for France, the Labour Force Survey (LFS) and Family Expenditure Survey (FES) for the UK and the Current Population Survey (CPS) for the US for the period from 1968 to 2008. There are a number of measurement issues,¹¹ but the main attraction of these data sources is that they offer long series of micro-data, which provide detailed information, every year, about employment patterns and hours of work, as well as precise demographics such as gender, age, educational attainment, marital status and number of children. No cross-country database is currently available with these detailed disaggregations.

The biggest challenge of measurement is the fact that these surveys have not always been continuous surveys (i.e. surveys that span the entire year and therefore capture seasonal variations in hours worked). In earlier years, labour force surveys were annual, spanning a few months, usually in the spring. In this paper, we make particular use of continuous surveys, which

¹⁰On the other hand, the choice of the reference period should not be confused with the choice of units, which is inconsequential: a division by 4 (or 52) of an hours-per-year number mechanically converts it into hours per quarter (or week), and must not be mistaken for a change in the length of the reference period.

¹¹Details on measurement issues, methods used in this paper and comparisons with other sources widely used can be found in the online appendix (http://www.ifs.org.uk/docs/fsmar13_blundellal_appendix.pdf).

are available in recent years for all three countries. Each quarter (or month), we observe individuals from a representative sample in a particular week. We know whether they are employed and how many hours they actually worked in that week.

With our definition of the extensive margin – i.e. the fraction of the reference period in employment or self-employment – and our choice of the year as the reference period, we should measure the extensive margin at the individual level as the fraction of the year an individual is employed or self-employed. If we define p_{itw} as the dichotomous variable denoting employment or self-employment status in reference week w for individual i in year t , our measure of the extensive margin of a given population of N individuals in year t is

$$(2) \quad p_t = \frac{1}{N} \sum_{i=1}^N p_{it} = \frac{1}{52} \sum_{w=1}^{52} \frac{1}{N} \sum_{i=1}^N (p_{itw} = 1).$$

Using continuous labour force surveys – where interviews are carried out uniformly in all weeks of the year – we obtain a good measure of the extensive margin as previously defined (i.e. the employment rate). When using annual surveys, this approach leads to a measurement error, likely to be bigger if large seasonal employment variations are present.

To compute the intensive margin, h_t , we use the *actual hours of work* in the reference week, h_{itw}^{ac} , for those employed or self-employed in that week and then average for each week of the year:

$$(3) \quad h_t = \frac{1}{N} \sum_{i=1}^N \sum_{w=1}^{52} (h_{itw}^{ac} | p_{itw} = 1).$$

Again, if the reference week is representative of the year in terms of pattern of work and if there is no bias in the response rate for those on leave, then this methodology yields a good estimate of actual annual hours per worker. The difficulty comes from the fact that this methodology is largely inadequate in earlier years, when only annual surveys are available. In this case, we use measures of *usual hours of work* in the reference week and we make adjustments between the two series.¹²

Before digging deeper into these movements in hours and employment, we should note that whereas the measure of employment rates across time and countries is considered fairly robust, the measure of annual hours of work is on much less firm ground, particularly in earlier years. This is

¹²See the online appendix for details (http://www.ifs.org.uk/docs/fsmar13_blundellletal_appendix.pdf). The adjustments are sizeable in the case of France, as the measure of actual hours of work in the continuous survey is markedly different from usual hours in the annual survey.

largely because only annual surveys are available for earlier years and these do not capture seasonal changes in hours worked.

3. Trends since 1968

Figure 1 highlighted the starting point of our analysis, charting the evolution of the average annual hours of work per individual aged 16 to 74 from 1968 to 2008. But changes in total hours represent both the effect of changes at the extensive margin of labour (the employment rate) and the effect of changes at the intensive margin (the actual annual hours of work per person employed or self-employed). Figure 2 shows that underlying the trends in total hours are two key bifurcations which determine the pattern of employment and hours per worker between France, the UK and the US.

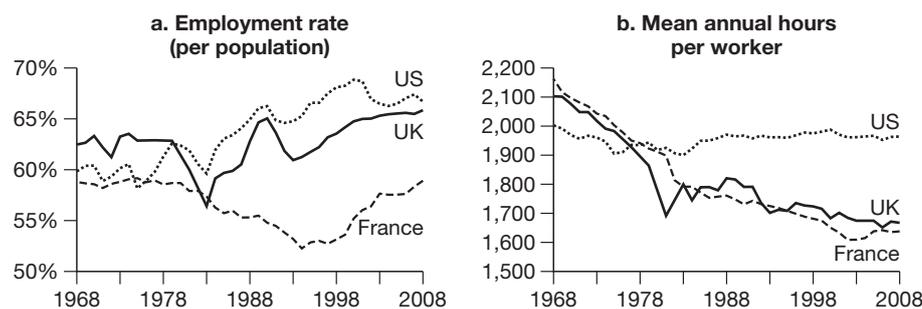
Overall employment rates in the UK and the US have moved somewhat in line with each other, showing an increase over this period. Employment rates in France have progressed very differently. Figure 2a shows a strong decline in employment in France until the mid-1990s, with recovery thereafter but leaving a large difference in current employment rates.

Changes in hours per worker tell a different story. Figure 2b shows the UK and France following each other, with strong declines over this period stabilising somewhat in the 2000s. In contrast, the US has retained a stable pattern of hours per worker since the mid-1980s.

Note that we are aggregating across all adult men and women aged 16 to 74 in these graphs. In the next section, we document further the key differences by age and gender.

FIGURE 2

Measures of market work for individuals aged 16 to 74



Note: Annual hours of work are measured using actual weekly hours of work from continuous surveys and averaging over the year. When continuous surveys are not available, we use annual surveys, making an adjustment to link the series. See the online appendix for details (http://www.ifs.org.uk/docs/fsmar13_blundelletal_appendix.pdf).

Source: Enquête Emploi, Labour Force Survey, Family Expenditure Survey and Current Population Survey.

III. The importance of age and gender

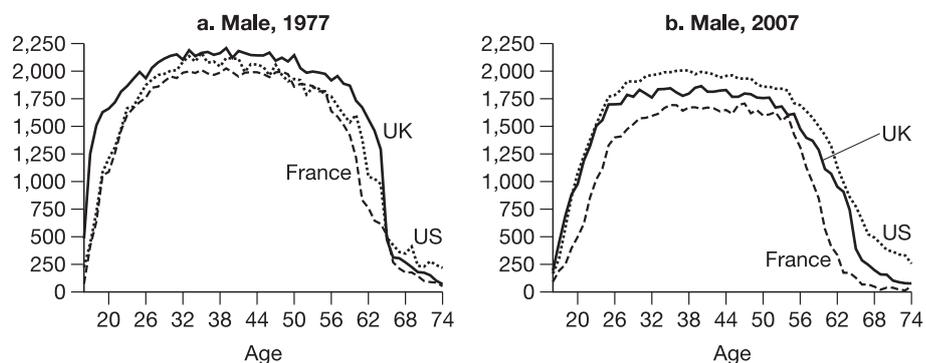
The trends in employment and working hours in Figure 2 tell only part of the story. Much of what is interesting is hidden beneath these aggregate trends. A lot more is learned from a decomposition by age and gender. To highlight the differences, we compare two years: 1977 and 2007. The first of these is before the disjuncture in the series noted in Figure 2 and allows us to use relatively comparable sources across the three countries (since the late 1970s, we are more certain as to the reliability of our data). The year 2007 is chosen as it is before the impact of the financial crisis was felt in the labour market and may reflect labour supply behaviour rather than shorter-term business-cycle concerns.

In Figure 3, we show total hours by age for men. The comparison between 1977 and 2007 emphasises the value in decomposing the changes in labour supply across age groups. In 1977, total hours of work were higher in the UK than in the other two countries (with the exception of the US at the older ages). In 2007, the American line describes the outer envelope, being significantly higher than the French at every age and the British (except at younger ages).

In Figure 4, we look more closely at the extensive margin for men. In 1977, the British men displayed high employment at young ages (between 16 and 22) and at older ages (between 55 and 65). All three countries exhibit strong declines in participation at the age of early eligibility for pensions (60 in France; 65 in the UK and the US). In 2007, the key differences in average male employment rates between the three countries come exclusively from the young and the old. For men aged 30 to 54, employment rates are almost indistinguishable. Moreover, British and American men have very similar employment rates at all ages up to 65, when the British rate drops markedly.

FIGURE 3

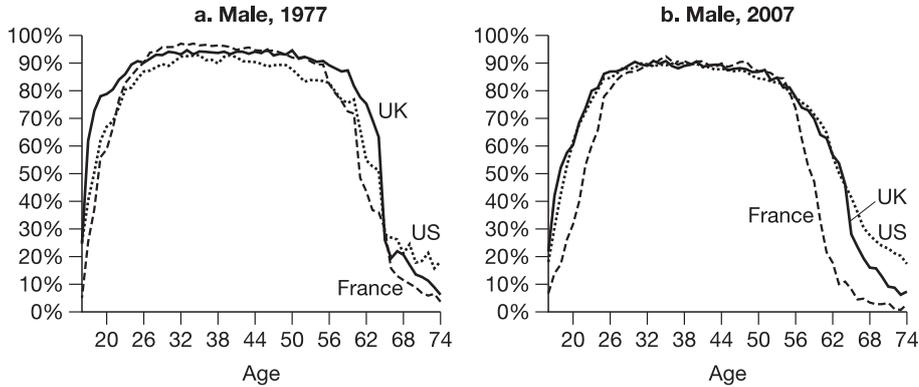
Male total hours per individual by age



Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

FIGURE 4

Male employment rate by age



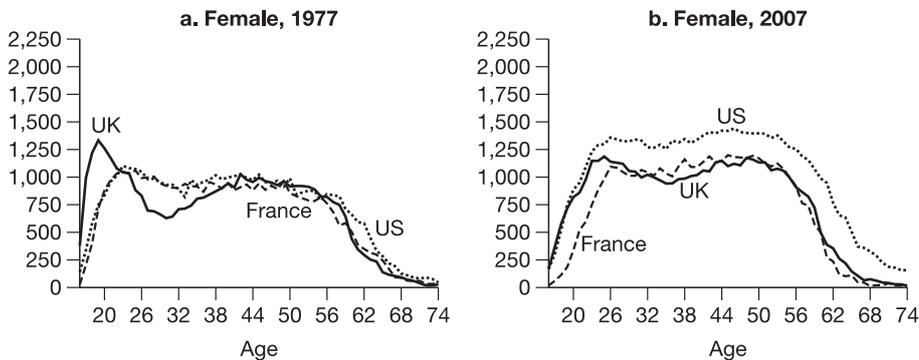
Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

The French drop in employment rate at older ages is much earlier, with a marked decline as soon as age 55 and a further drop before age 60. At age 61, there is a 41–43 percentage point difference in employment rates between French and British or American men. Past age 65, almost no French men are in work, while 20 per cent of American men are working at age 73!

Figures 5 and 6 show the corresponding changes for women. In 1977, women in France and the US hardly differed in their average hours, certainly up to their late 50s. Hours for women in the UK instead showed a distinct ‘M’ shape, with very high average hours in their late teens and then a strong decline in their early 20s reflecting, as we will see, childbirth. By 2007, hours look very different. Women’s hours of work in the US dominate those in the UK and France at every age (apart from being very similar to those in

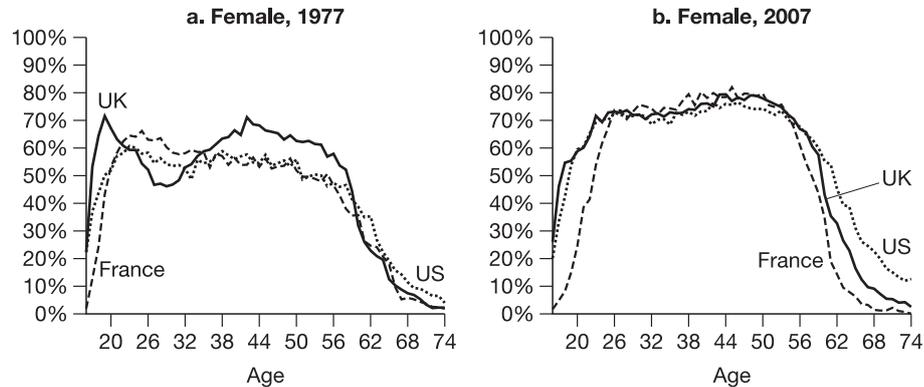
FIGURE 5

Female total hours per individual by age



Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

FIGURE 6

Female employment rate by age

Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

the UK for teenagers). In Britain, women maintain relatively high hours at younger working ages, but by 2007 the M shape is considerably more smoothed; throughout their 30s, 40s and 50s, the hours of UK women closely follow French women's hours.

Female employment patterns by age have also changed markedly over this period. Figure 6a shows that US and French women had similar patterns in 1977, with UK women again having the strongest M shape. Employment was high for the very young adult women, then dropped until the early 30s (when many women become mothers of young children), followed by an increase in participation as children age, and finally the decline in employment at older age but much earlier than for the British men. This M-shaped pattern does not appear to be as strong a feature in France or in the US.

By 2007, female employment rates had increased in all three countries. Unlike in the case of total hours, Figure 6b shows the British M shape has all but disappeared and the age patterns have tended to become closer to the ones for men. Employment rates in the three economies are almost identical for women from their late 20s to their mid-50s. At older ages, women in Britain show a lower employment rate than those in the US. Note that the state pension age in the UK is 60 for women and 65 for men. In France, the lower female employment rate seems to be almost entirely due to the low participation at young and older ages.

IV. The life-cycle stages of work

Here we focus in more detail on labour supply at three key stages of the life cycle: education and work; labour supply and children; and older workers and retirement.

1. Younger workers and education

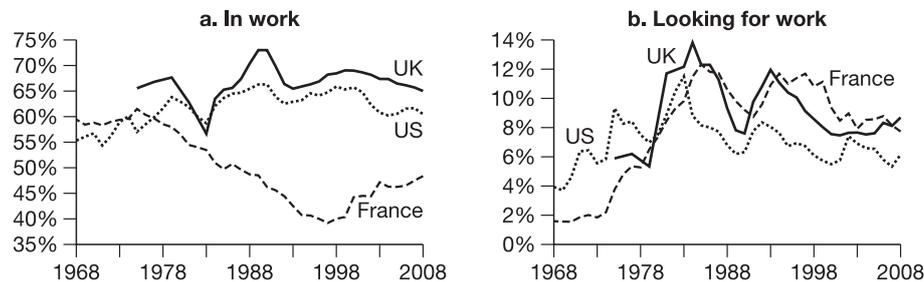
As we saw in Figures 4 and 6, one of the striking differences in employment rates between France, the UK and the US appears among the young, aged 16 to 26. In Figure 7, we present two apparently contradictory pictures of young workers: the share of the 16–29 group who are employed and the share who are actively looking for a job. At the end of the period, the employment rate is markedly lower in France than in the US and the UK. Figure 7b plots an unemployment rate, whose definition differs from the International Labour Organisation (ILO) rate in that we use total instead of active population for the denominator (i.e. the share of all 16- to 29-year-olds who are actively looking for work).

In all three countries, unemployment among younger people increased in the 1970s, peaked between 1983 and 1984, and then decreased more or less slowly. The level remains lower in the US than in both the UK and France, but the difference represents only 2–3 per cent of the entire population.

Most of the difference in the non-employment rates comes from the share of 16- to 29-year-olds who are in education and training but not in work. Figure 8 shows the proportion of this age group who are in education or training (Figure 8a) and the proportion of those in education and training who are in work (Figure 8b). Both graphs highlight the large increase in the proportion of young individuals following some form of education. At the

FIGURE 7

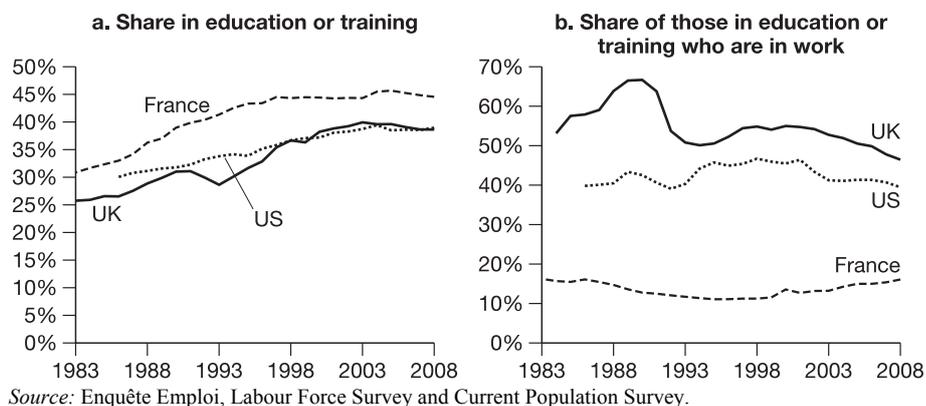
Share of the 16–29 population in work or looking for work



Note: Individuals looking actively for work are unemployed, in conformity with the ILO unemployment criteria. The difference from the official unemployment rate is the use of total population as denominator and not active population.

Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

FIGURE 8

Education and training for 16- to 29-year-olds

end of the period, 45 per cent of young French people aged 16 to 29 are in education, versus slightly less than 40 per cent in the UK and the US.

More strikingly, young French people who are studying are generally not working, whereas young Britons and Americans are much more likely to be both working and in education. This implies a much higher unemployment rate at younger ages in France using the standard ILO definition. In the late 1980s, almost two-thirds of young British people engaged in some form of education or training were working at the same time; this level drops to around 50 per cent in the early 1990s.

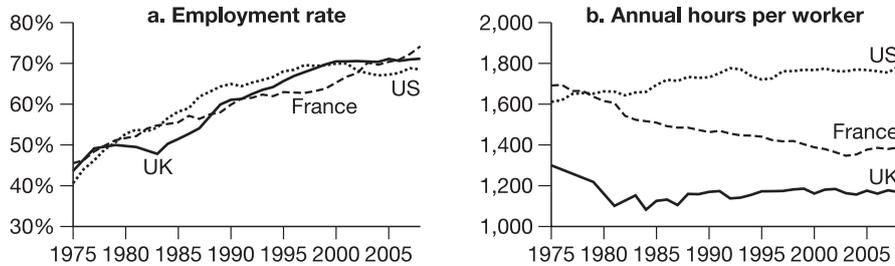
2. Women with children

The dramatic changes in female labour market participation have been accompanied by major changes to marital status as well as to the age when women have their first child. A detailed discussion of the causes of these trends is outside the scope of this paper. Here we simply point out the relationship between the (extensive and intensive) labour supply of women with children in the three countries.

Figure 9 presents the evolution of the extensive and intensive margins for mothers with partners (married or cohabiting) aged between 20 and 54. Although the rate of increase in female labour force participation has varied from year to year, the overall trend in employment rates is strikingly similar in all three countries: they have increased from about 40 per cent in 1975 to around 70 per cent in 2008, with the US leading the way until 2000. The intensive margin, on the other hand, offers a completely different picture. American married or cohabiting women have increased not only their participation but also their mean annual hours of work, while French women

FIGURE 9

Margins of labour supply for 20- to 54-year-old mothers with a partner



Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

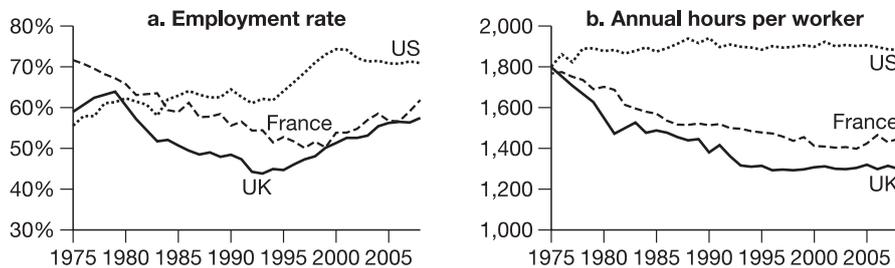
have seen their average hours decline markedly. The UK also stands apart, with married women’s hours of work below those of their French counterparts – 1,200 hours versus 1,400 hours – but also markedly below the 1,800 hours worked on average by American married mothers.

Lone mothers represent another interesting case. Figure 10 presents the extensive and intensive margins of labour supply for 20- to 54-year-old lone mothers.¹³ Contrary to the case of married or cohabiting mothers presented in Figure 9, the employment rate of lone mothers has been markedly different across the three countries. Although very similar at the beginning of the period, the employment rate of American lone mothers has increased from 60 per cent in the early 1990s to 70 per cent in 2002, while the rates in France and the UK fell to 50 per cent or below in the late 1990s and returned to about 60 per cent in 2008.

What has been less studied in the literature is the intensive margin of lone mothers. Whereas the large increase in participation in the US has not come along with any change in the intensive margin, mean hours have been regularly falling in France and the UK.

FIGURE 10

Margins of labour supply for 20- to 54-year-old lone mothers



Note: Lone mothers are defined as women, not married or cohabiting, with children.

Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

¹³Lone mothers are defined as women, not married or cohabiting, with children.

3. Older workers, pensions and increasing life expectancy

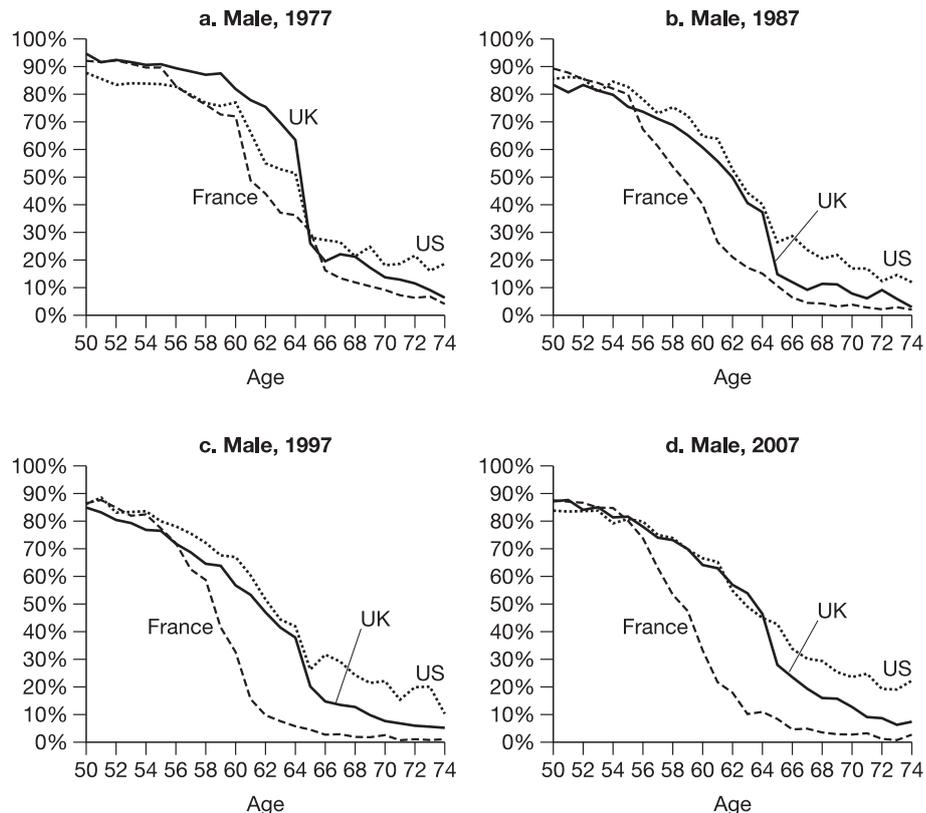
Another group for whom the extensive margin differs markedly between the three countries is older workers. Figure 11 presents the employment rate by age between 50 and 74 at 10-year intervals.

In 1977, the employment rates of older workers in the three countries were not too dissimilar. French workers experienced a drop in employment at age 55, when retirement was first available for certain public sector groups (police, nurses, teachers etc.), and again at age 60, when the rest of the public sector and some private sector workers (women with three children, people in early retirement schemes) were entitled to a full pension. At age 65, both the UK and the US experienced a large drop corresponding to eligibility to state pensions and social security benefits.

By 1987, all the countries have experienced a drop in employment rates at older ages, but France has much the most pronounced decrease. In 1979

FIGURE 11

Male employment rate at older ages



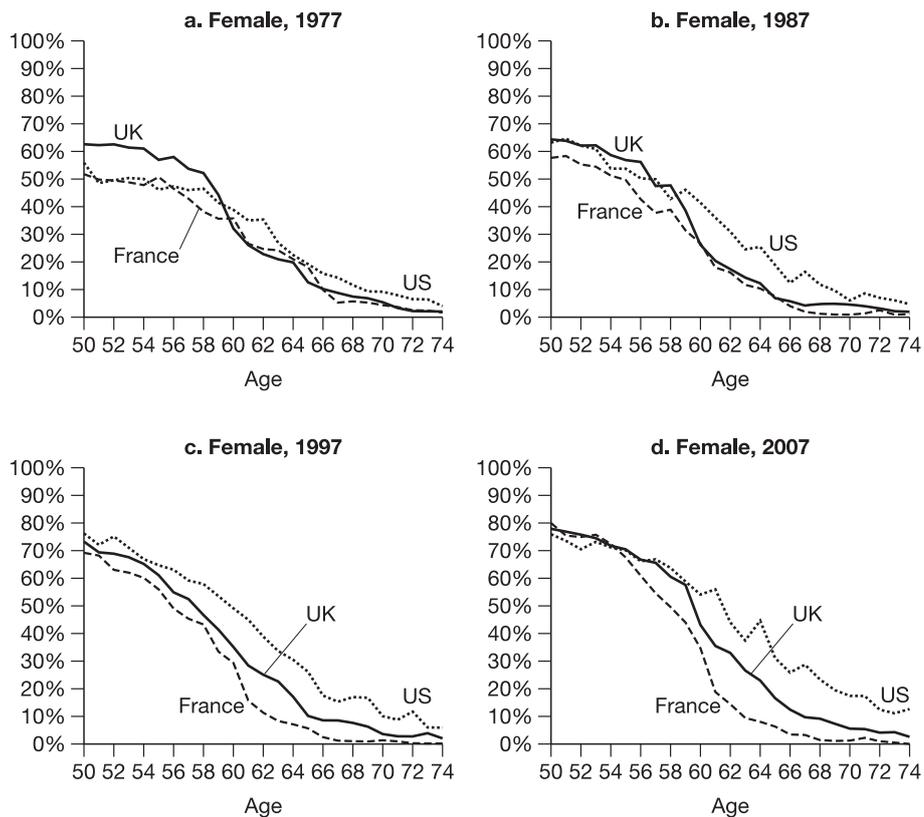
Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

and 1980, early retirement policies were expanded in France to a large group of 60- to 64-year-olds. These schemes were extended to the 54–59 group in 1981 and, since 1983, the main scheme of the private sector has offered a full pension from age 60 to those meeting the contribution length requirement. In 1987, the French male employment rate at age 61 dropped to 30 percentage points below the level of the UK and the US and, by 2007, the difference has reached 41 percentage points. After age 65, the American workers stand out, with much higher participation than their European counterparts.

One interesting element of these comparisons is the difference at the oldest ages (i.e. 65 to 74) between Americans on the one hand and British and French on the other. While today more than 20 per cent of American men are working at 74, only 7 per cent of British men are and not even 3 per cent of French men are still attached to the labour market at this age.

FIGURE 12

Female employment rate at older ages



Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

In Figure 12, we present similar graphs for women. One striking feature is that British women tend to have retirement patterns much closer to those of their French counterparts than the American ones. Even though the British women have higher participation rates than the French in their 50s, they tend to retire significantly at 60, when they can receive the Basic State Pension in full. The picture has slightly evolved in the last 20 years, when British women have experienced increased participation at all ages, while French women, like their male counterparts, exhibit significant drops in participation at 55 and 60.

V. Decomposing the change in labour supply

1. Bounds on changes at the extensive and intensive margins

The graphs in the previous sections point to important differences at the hours and employment margins by age and gender for each of these countries. But can we be more systematic about these comparisons? In this subsection, we develop a simple statistical decomposition of the changes in labour supply between extensive and intensive margins.¹⁴

We are interested in studying how the overall average hours worked H per person varies over time and across countries. Of course, this quantity differs according to a person's characteristics – age and gender, for instance. Suppose there are $j = 1, \dots, J$ broad categories. The overall statistic, H_t , is computed in any year t as an average of the category hours H_{jt} with weights equal to the population shares q_{jt} :

$$(4) \quad H_t = \sum_{j=1}^J q_{jt} H_{jt}.$$

Following formula (1), we decompose total hours of work H_{jt} as the product of hours per worker h_{jt} and participation in the labour market p_{jt} :

$$(5) \quad H_{jt} = p_{jt} h_{jt}.$$

When we observe a change in yearly hours worked per person, $H_t - H_{t-1}$, we would like to be able to know how much of the change is due to the intensive or extensive margin. We propose a statistical decomposition. First we define a structural effect S_t due to the change in the composition of the population:

$$(6) \quad S_t = \sum_{j=1}^J H_{jt} (q_{jt} - q_{j,t-1}).$$

¹⁴We follow here the decomposition approach outlined in Blundell, Bozio and Laroque (2011b).

Then we measure the change due to the behaviour of category j , holding the population structure constant as at date $t-1$, as in a Laspeyres index:

$$(7) \quad \Delta_{jt} = q_{j,t-1} (H_{jt} - H_{j,t-1}).$$

The total change across all J categories of workers is simply

$$(8) \quad \Delta_t = \sum_{j=1}^J \Delta_{jt}$$

and we have by construction

$$(9) \quad H_t - H_{t-1} = S_t + \Delta_t.$$

There is no obvious way to decompose the change in total hours experienced by category j into the sum of an extensive E_j and an intensive I_j component. It is, however, natural to suppose that any plausible measure I_j of the intensive margin would have the same sign as the difference in the hours worked per worker¹⁵ at dates $t-1$ and t : $\Delta h_j = h_{jt} - h_{j,t-1}$. Assuming linearity, we can then express the change Δ_{jt} as the sum of an intensive component $I_j = p_{ij} \Delta h_j$ and an extensive component $E_j = h_{Ej} \Delta p_j$. Supposing the fraction p_{ij} is in the interval $[p_{j,t-1}, p_{jt}]$, we get the intensive bounds:

$$I_j \text{ belongs to the interval } [p_{j,t-1} (h_{jt} - h_{j,t-1}), p_{jt} (h_{jt} - h_{j,t-1})].$$

From the identity $\Delta_{jt} = I_j + E_j$, the extensive bounds are given by

$$E_j \text{ belongs to the interval } [h_{j,t-1} (p_{jt} - p_{j,t-1}), h_{jt} (p_{jt} - p_{j,t-1})].$$

At the limits, the change in total hours for any category of workers reflecting changes at the intensive margin – hours per worker – and at the extensive margin – employment – satisfies two polar exact statistical decompositions:

$$(10) \quad \Delta_{jt} = q_{j,t-1} \{ (h_{jt} - h_{j,t-1}) p_{jt} + (p_{jt} - p_{j,t-1}) h_{j,t-1} \}$$

or

$$(11) \quad \Delta_{jt} = q_{j,t-1} \{ (h_{jt} - h_{j,t-1}) p_{j,t-1} + (p_{jt} - p_{j,t-1}) h_{jt} \}.$$

¹⁵Strictly speaking, one might want to treat separately the hours of the workers present at both dates and those of the workers only working at one of the dates, $t-1$ or t . The computation implicitly assumes that the difference, if any, between them can be neglected.

The first term on the right-hand side is the intensive margin, weighted in the top formula (10) by the final participation rate (as in a Paasche index) and in the bottom formula (11) by the initial participation rate (as in a Laspeyres index). The second term is the extensive margin (Laspeyres in (10), Paasche in (11)).

In the next subsection, we examine the evolution of h_{jt} and p_{jt} for different age and gender groups. We then use (10) and (11) to provide bounds on the importance of the intensive and extensive margins in the evolution of hours worked across these various groups.

Before turning to this, we note that the formula in levels relates naturally to the decomposition of the total hours elasticity into its intensive and extensive components as described in Blundell, Bozio and Laroque (2011a). Suppose we think of the decomposition (10) for small changes and write

$$(12) \quad \Delta H \approx \sum_{j=1}^J (\Delta h_j p_j + \Delta p_j h_j).$$

This expression can be rewritten in terms of the proportionate changes:

$$(13) \quad \begin{aligned} \frac{\Delta H}{H} &\approx \frac{1}{H} \sum_{j=1}^J \left(p_j h_j \frac{\Delta h_j}{h_j} + p_j h_j \frac{\Delta p_j}{p_j} \right) \\ &= \frac{1}{H} \sum_{j=1}^J p_j h_j \left(\frac{\Delta h_j}{h_j} + \frac{\Delta p_j}{p_j} \right) \\ &= \sum_{j=1}^J \frac{H_j}{H} \left(\frac{\Delta h_j}{h_j} + \frac{\Delta p_j}{p_j} \right) \end{aligned}$$

corresponding to the terms in the aggregate elasticity decomposition formula in Blundell et al. (2011a).

2. The decomposition of total hours for the US, the UK and France

In our discussion of Figures 2–6, we saw how an analysis of changes in total hours worked in an economy masks some key variations by age and gender. In this subsection, we apply the approach developed in the previous subsection to the decomposition of total hours for different subgroups of the population. We put the decomposition to work to pull together an overall picture of the facts about labour supply changes in the UK, the US and France.

Table 1 decomposes the overall change between 1977 and 2007 by sex and broad age groups. As already mentioned, the three countries have very

similar numbers of hours worked per person at the starting year (France: 1,148; UK: 1,212; US: 1,156), but their evolution differs: +165 hours for the US, -118 hours for the UK and -195 hours for France. The Δ rows of Table 1 show the contributions of the categories and the effect of demographic structure, according to equations (7), (8) and (9).

A first remark on these statistics is that the pattern of the overall country movements, with the US and France at the extremes and the UK in between, holds for nearly all the categories that we have considered. The contribution to aggregate hours worked by young and prime-aged men is negative in all the countries, with a larger decline in France than in the UK, which in turn has a larger decline than the US. Table 1 shows large declines in the number of yearly hours worked by these men in France and the UK: -544 and -488 hours for the French and British young men respectively and -371 and -331 hours for the French and British prime-aged men.

A second observation is that the increased participation of women in the labour market works against the general trend. This is particularly obvious for prime-aged women, who work more in each country in 2007 than in 1977, but appears also for the old and young women.

The graphical decomposition in Figure 13 serves to illustrate the striking differences across the three economies. For each country, the graph starts with the total hours in 1977, subtracts from that level the components

TABLE 1
*Decomposition of the evolution of hours of work between 1977 and 2007,
by sex and age group*

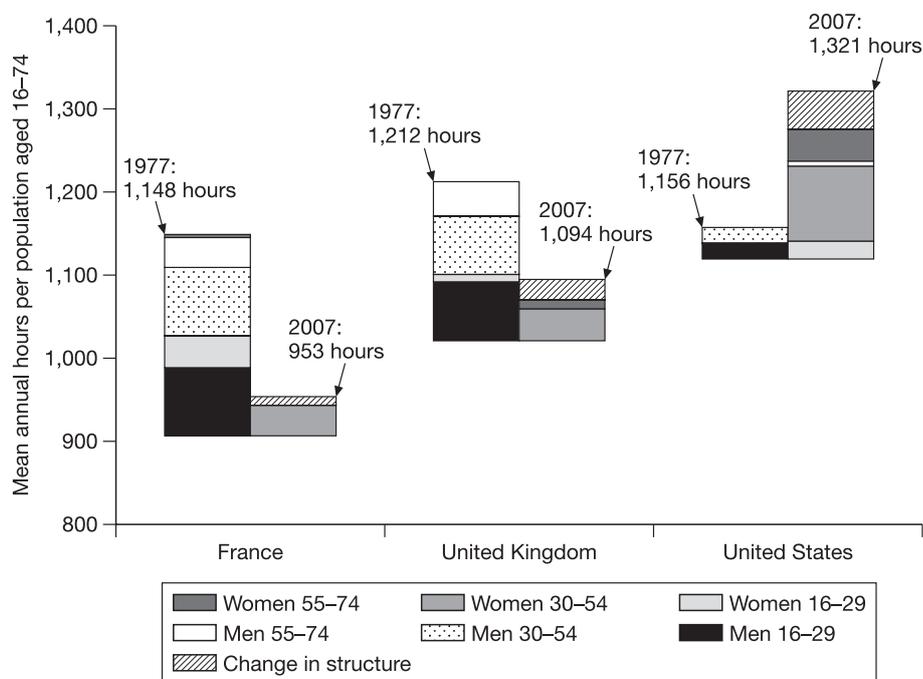
	<i>Youth (16–29)</i>		<i>Prime-aged (30–54)</i>		<i>Old (55–74)</i>		<i>Residual</i>	<i>All (16–74)</i>
	Men	Women	Men	Women	Men	Women		
<i>France</i>								
q_{1977}	0.15	0.16	0.22	0.22	0.11	0.14		
H_{1977}	1,402	871	2,010	951	827	367		1,148
H_{2007}	858	627	1,639	1,116	508	344		953
Δ	-82	-38	-82	36	-36	-3	10	-195
<i>UK</i>								
q_{1977}	0.14	0.14	0.21	0.21	0.13	0.16		
H_{1977}	1,707	938	2,117	873	1,107	323		1,212
H_{2007}	1,219	876	1,786	1,055	790	385		1,094
Δ	-71	-9	-70	39	-42	10	25	-118
<i>US</i>								
q_{1977}	0.18	0.18	0.20	0.21	0.10	0.12		
H_{1977}	1,344	835	2,018	947	1,025	447		1,156
H_{2007}	1,236	956	1,922	1,373	1,084	754		1,321
Δ	-19	22	-19	90	6	38	46	165

Note: Δ s are computed following equation (7).

Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

FIGURE 13

Decomposition of the change in total hours per population, 1977–2007



How to read: For each country, start from the top of the left-hand column, which represents the level of total hours in 1977; the column on the left represents the contribution of each category to the reduction of total hours, while the column on the right represents the positive contributions; the top of the right-hand column represents the level of total hours in 2007.

Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

leading to negative changes in hours (left column) and adds the components contributing to a positive change in total hours (right column) up to the 2007 total hours level. The key rise in female hours being so much stronger for all ages in the US, it is sufficient to reverse the correspondingly small declines for men. The change in the structure of the population then plays in the same direction, leaving the US at the top of the figure after a relatively weak start in 1977.

Using the statistical bounds framework developed in the previous subsection, we can go further and assign these changes to the extensive and intensive margins. This is what we report in Table 2. The indices examine what part of any overall change in hours is attributable to changes at the extensive or intensive margin for any particular subgroup of the population. The row [I-L,I-P] shows the bounds on the intensive margin, with L standing for Laspeyres (the change in hours being weighted by the initial participation rate) and P for Paasche (final participation rate). Similarly, the Laspeyres (respectively Paasche) index for the extensive margin, E-L (respectively E-

P), given by the second term in equation (10) (respectively equation (11)), is equal to the change in participation multiplied by average hours worked at the initial (respectively final) date. The theoretical framework presented in Blundell, Bozio and Laroque (2011a) suggests that the relative importance of these two margins should depend, for any particular subgroup of workers, on the distribution of fixed costs for that group and the proportion of that group in work.

As a concrete example, examine the first entry in the top left of Table 2, which is for French men aged 16 to 29. The impact on total hours for this group is -82 . The I-L index of -37 tells us that the intensive margin does a good bit, but not the majority, of the work in explaining total hours changes for this group. The E-L estimate of -54 confirms the relative importance of the extensive margin for this group. Again as suggested from our model, and as we might also expect in reality, both margins respond.

The actual changes for this subgroup, or any other subgroup we examine, will have come not only from changes in taxes, welfare and social security but also from many other changes in the labour market. Nonetheless, the indices in Table 2 give us an indication of where, and for which groups, each of the margins is likely to be important. The theoretical framework also enables us to speculate on what mix of changes to (after-tax) wages, income, fixed costs and benefits in each of the countries could explain the observed changes. We turn to this in the next section.

TABLE 2

Intensive and extensive margins between 1977 and 2007, by sex and age group

	<i>Youth (16–29)</i>		<i>Prime-aged (30–54)</i>		<i>Old (55–74)</i>		<i>All (16–74)</i>
	Men	Women	Men	Women	Men	Women	
<i>France</i>							
Δ	-82	-38	-82	36	-36	-3	-195
[I-L,I-P]	[-37,-28]	[-23,-19]	[-59,-56]	[-35,-49]	[-11,-8]	[-9,-10]	[-185,-183]
[E-L,E-P]	[-54,-45]	[-19,-16]	[-27,-23]	[85,71]	[-28,-25]	[7,6]	[-12,-10]
<i>UK</i>							
Δ	-71	-9	-70	39	-42	10	-118
[I-L,I-P]	[-42,-36]	[-23,-26]	[-48,-45]	[-2,-3]	[-22,-19]	[-6,-8]	[-161,-167]
[E-L,E-P]	[-35,-29]	[17,14]	[-25,-22]	[41,41]	[-23,-20]	[17,15]	[50,43]
<i>US</i>							
Δ	-19	22	-19	90	6	38	165
[I-L,I-P]	[-6,-6]	[1,1]	[-5,-5]	[14,19]	[3,3]	[3,5]	[15,17]
[E-L,E-P]	[-13,-13]	[21,21]	[-14,-14]	[72,77]	[3,3]	[33,35]	[148,150]

Note: I-P denotes the Paasche measure and I-L the Laspeyres measure of the intensive margin, while E-P and E-L denote the Paasche and Laspeyres measures of the extensive margin, as described by equations (10) and (11).

Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

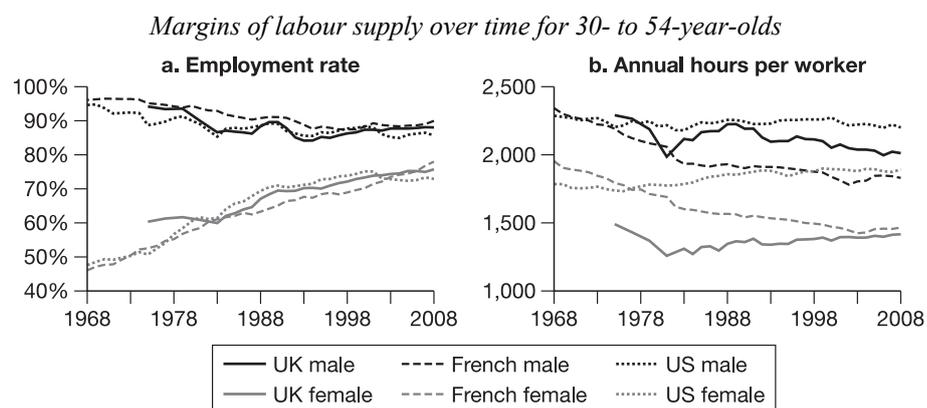
VI. Summary findings and some interpretations

The analysis in this paper has examined UK, US and French labour markets and, in particular, where these markets stood in 2007 and how they got there from the period three decades before.¹⁶ Here we highlight some key findings and contrasts, suggesting some explanations but also pointing to some remaining puzzles.

Turning first to prime-aged workers, Table 2 points to a strong decline in the *extensive* margin for prime-aged men in all three countries, with France and Britain recording the strongest declines. Indeed, from Figure 14a, we see that the overall secular decline in employment for this group has been quite similar across all three countries since the late 1970s.¹⁷ We also know, from Figure 4b, that these three countries stand in remarkably similar positions with regard to average employment among men in the 30–54 age group in 2007. Increases in relative employment costs or out-of-work benefits could explain the fall, but these have tended to be larger in France and Britain. Income and wealth effects may have played a role as individuals cut back on their overall life-cycle labour supply and their life-cycle real wages grew. However, the role of income effects would seem more likely at the intensive margin for this age group. For the extensive margin, one would expect income effects to concentrate at either end of the life cycle rather than during prime age.

At the *intensive* margin, the steep decline for prime-aged men in France, and to an extent in the UK, is striking. As we saw from Figure 3, by the end

FIGURE 14



Source: Enquête Emploi, Labour Force Survey and Current Population Survey.

¹⁶The year 2007 was chosen to focus on secular changes in labour supply since the 1970s and abstract from business-cycle fluctuations.

¹⁷Note that the choice of 1977 as the base year in Table 2 tends to lead to an underestimate of the decline in male employment in the US.

of this period the US dominated as the country with the highest average hours at all ages. Table 2 shows that the bounds are quite narrow for this group and leave little room for ambiguity. The changes represent an enormous shift in the relative position of these countries.

Increases in effective tax rates and/or the regulation of working hours could explain these patterns. However, Britain has seen much less hours regulation than France and yet has experienced similar changes, at least from the end of the 1980s onwards. Income effects could be part of the explanation of these changes at the intensive margin. There are two potential sources for these. First, as the economy grows, individuals may prefer to take some of the gains in real wages in terms of increased leisure, cutting back their hours of work. However, given that overall growth has been somewhat similar across all three countries, it would have to be that Europeans take more leisure than Americans in response to rises in income. A second source of income effect for prime-aged men is the increased participation of women. This is often termed the added-worker effect. Prime-aged women have certainly seen a strong increase in participation. Indeed, the bounds on the extensive margin changes in Table 2 for women aged 30 to 54 are the largest positive change to be found in any country–age cell and at any margin. But the largest overall increase in labour supply, when the intensive margin is taken into account, is for US women. Yet the decline in hours among prime-aged men is the least in the US. Again, responses would have to be different in Europe.

For prime-aged women, it is the increase at the extensive margin that is so extraordinary, especially in the US and France, where the bounds in Table 2 suggest very similar changes which are larger than the change experienced in the UK. Changes in hours per worker provide somewhat of a puzzle here, falling back strongly in France while growing in the US. Differences in hours regulation or effective marginal tax rates may explain these changes. However, once again, note that the level of hours per worker in France is pretty much identical to that in the UK by 2007.

We noted that the strong growth in employment of women has been accompanied by major changes to marital status as well as to the age when women have their first child. The tax system in each of the three countries treats differently earnings from second earners. In France, the income tax system provides an incentive to get married when the two spouses' incomes are different and discourages additional earnings from the second earner because of joint taxation. In the UK, individual taxation was introduced in 1979, and at first view the tax system is more favourable to second earners. However, the benefit system is heavily tilted in favour of part-time work, with special rules for working less than 16 and 30 hours per week.¹⁸ In the

¹⁸Brewer, Saez and Shephard, 2010.

US, there is joint taxation but the lower degree of progressivity¹⁹ reduces the relative disincentives on second workers in families.

Single mothers make up an important minority of working-age women in the UK and the US. For these women, too, there has been growth in employment, especially in the US. A significant part of the increase in lone-parent employment has been ascribed to the development of in-work benefits – in particular, the Earned Income Tax Credit (EITC) in the US and the Working Families' Tax Credit (WFTC) in the UK. Comparisons between the UK and the US of the expansion of these in-work benefits also provide an explanation for the relatively stronger growth in employment in the US. For example, Blundell and Hoynes (2004) note that the coincident expansion of out-of-work income support and the interaction of WFTC with other parts of the tax and benefit system tended to dampen work incentives in the UK scheme.

For older men and women, there is a significant decrease in hours per worker in the UK and in France. These two countries have also experienced even larger decreases at the extensive margin for older men, but increases for older women. These changes are surely linked to the strong increase in participation among younger cohorts of women. This phenomenon is replicated to some extent across all the countries and offsets the strong incentives to retire earlier in the UK and in France. The contrast with the US is stark. At both margins and for both genders, the bounds point to increasing work for older American workers.

Throughout the period, British and American men exhibit very similar employment rates at older ages up to 65, when the British experience a more important drop than the Americans. Incentives to retire are largely influenced by pension and social security provisions. In the UK, the state pension age has been fixed for men at 65 and occupational pension plans have often used that age for full entitlement. In the US since 1961, social security has offered an early retirement age of 62, while full entitlement is determined by the normal retirement age, of 65 for those born before 1938. In Figure 11, it is clear that the US curve bends at two points, at ages 62 and 65, when the social security system provides an incentive to retire.

Finally, for younger workers, changes in the pattern of schooling and work are key to understanding differences across countries. For example, standard measures of the unemployment rate, which show much higher youth unemployment in France than in Britain and the US in 2007, are misleading. The difference is largely due to the higher proportion of young people in France in education while not in work. In contrast, younger working-age people in education in the US are much more likely to work as well as attend school. When the percentage unemployed is measured relative to the size of the younger working-age population, including those in

¹⁹See Piketty and Saez (2007).

education, the differences across the three countries in 2007 largely disappear. The UK and France have very close unemployment rates using this definition, with the US slightly lower, as it has been since the early 1980s. This is not to say that there are not large contrasts in the labour market behaviour of younger working-age people across the three countries. Employment rates in France for this group are much lower. Over the three decades, France has seen the sharpest fall at the extensive margin for younger workers, with declines at the extensive margin even for women – something that has not occurred in the UK or the US. In the US, declines at both margins have been modest. Although differences in the minimum wage, schooling subsidies and the working of the tax and benefit system could help explain these differences, a complete analysis would also have to examine changes in the returns to education as well as changes in the pattern of fertility and marriage.

VII. Conclusions

In this paper, we have proposed a systematic way of decomposing the overall movements in total hours of work into extensive and intensive margins of labour supply. We have shown how informative bounds can be developed on each of these margins. We have applied this analysis to the evolution of hours of work in the US, the UK and France over the past 30 years. We have shown that the extensive and intensive margins both matter in explaining changes in total hours.

The analysis has highlighted some similarities and some key differences in behaviour at the intensive and extensive margins between these countries. For example, the overall trend in employment rates for prime-aged individuals is strikingly similar: the female employment rate has almost doubled between 1968 and 2008 in all three countries, while the male rate has decreased. The intensive margin, on the other hand, offers a completely different picture. American married mothers have increased not only their participation but also their mean annual hours of work, while French mothers have seen their average hours decline markedly. The UK also stands apart, with married mothers' hours of work below those of their French counterparts but also markedly below the hours worked on average by American married mothers.

The contribution to aggregate hours worked by young and prime-aged men is negative in all three countries, with a larger decline in France than in the UK, which in turn has a larger decline than the US. The steep decline at the intensive margin for prime-aged men in France and the UK relative to the US is striking. For this group, the bounds are quite narrow and leave little room for ambiguity. These changes represent an enormous shift in the relative position of these countries.

The changes among the young are sizeable and predominantly negative. In France and the UK, there have been large falls for young men at both the extensive and intensive margins. In France, these are associated with a much higher recorded unemployment rate for youth than that in the US. When we delve deeper into the employment patterns of the young, this appears to be related to differences in the relationship between education and work across the countries.

For older men and women, there is a significant decrease in hours per worker in the UK and in France, which encompasses a larger decrease at the extensive margin for older men but an increase for older women. The contrast with the US is stark. At both margins and for both genders, the bounds point to positive changes for older American workers.

Our account of the secular changes in employment and hours in the UK, France and the US over the three decades up to 2007 has shown some clear trends and pointed to some possible explanations, but it has also raised a number of puzzles. The resolution of these puzzles calls for a detailed structural analysis of effective incentives in the tax and benefit system, how they have changed over time, and how individuals and families have responded – much as suggested in Blundell, Bozio and Laroque (2011a). Given the large heterogeneity by age and sex that we have documented, it is unlikely that a single explanation will account for these evolutions.

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