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

Richard Blundell, Antoine Bozio and Guy Laroque*

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Abstract

This paper documents the key stylised facts underlying the evolution of labour supply at the extensive and intensive margins in the last forty years in three countries: United-States, United-Kingdom and France. We develop a statistical decomposition that provides bounds on changes at the extensive and intensive margins. This decomposition is also shown to be coherent with the analysis of labour supply elasticities at these margins. We use detailed representative micro-datasets to examine the relative importance of the extensive and intensive margins in explaining the overall changes in total hours worked. We also present some initial estimates of the broad distribution of implied elasticities and their implication for the overall aggregate hours elasticity.

*Blundell: University College London (UCL) and Institute for Fiscal Studies (IFS), 7 Ridgmount Street WC1E 7AE London United Kingdom, r.blundell@ucl.ac.uk. Bozio: UCL and IFS, a.bozio@ifs.org.uk. Laroque: UCL, IFS and INSEE-CREST, g.laroque@ucl.ac.uk. We thank Steve Davis and participants at the AEA session for comments, and the Data archive UK, INSEE and IUPMS for data access.

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1 Introduction

Forty years ago the Europeans (here French and British) used to work more than the Americans. They now work less. The aim of this paper is to provide a coherent picture of these changes. To do so 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 and is 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 later by the average number of working hours.

The difference between the extensive and intensive margins has been highlighted in recent research attempting to resolve differences between micro and macro responses of labour supply to tax reform. For example, Rogerson & Wallenius (2007), 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-shape 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.

The distinction between the extensive and intensive margins has long been recognised in microeconometric studies of labour supply (Heckman (1993)). For example, building on the insights by Gronau (1974) and Heckman (1974, 1979), Cogan (1981) documented the importance of fixed costs of work in separating the link between responses at the employment and hours margin. 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 (Blundell & Macurdy (1999)). 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 (Blau & Kahn (2007)).

It is not only women with children where the role of 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, see for example Gruber and Wise (1999) and papers therein.

The relative size of labour supply responses at the intensive and extensive margin has also been a key parameter in the public economics literature on earnings tax design, see Diamond (1980), Saez (2002) and Laroque (2005). A 'large' extensive elasticity at low earnings can 'turn around' the impact of declining social weights implying a higher transfer to low earning workers than those out of work, in turn providing an argument for lower tax rates at low earnings and a role for earned income tax credits. Participation tax rates (PTR) and effective marginal tax rates (EMTR) at low earnings remain very high in many current tax systems. This is carefully documented in the evidence to the Mirrlees Review, see Brewer et al. (2010) and references therein. In the UK effective marginal tax rates are well over 80% for some low income working families because of phasing-out of means-tested benefits and tax credits.

A related discussion in labour supply elasticities is the time horizon of behavioural responses. Many micro-based studies have focused on weekly hours of work while macro-based analysis look at aggregate measures of annual hours of work. The measure and properties of the extensive (no work at all vs. some positive work during the period) and intensive (average hours supplied by the workers) margins are sensitive to the length of the reference period. Furthermore, the labour elasticities are different when assessed at the steady state or when they incorporate intertemporal substitution effects (Blundell & Macurdy (1999), Chetty et al. (2011)).

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 a detailed decomposition of the evolution of total hours of work into changes at the extensive and intensive margin. We examine three key countries - the US, the UK and France. These three countries stand at the top, middle and bottom, respectively, of Prescott's 2004 table of labour supply flexibility. They are also countries where we can access nationally representative detailed microdata over a long period of time so as to examine the relationship between the extensive and intensive margin across different individual types. We study the forty year period up to 2008. The UK provides an interesting comparison with the polar cases of France and the US. Over this period the UK has adopted many of the same (or similar) tax policies as in the US (Blundell & Hoynes (2004)) 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.

This analysis, which complements the results presented in Blundell et al. (2011), finds that neither margin dominates in explaining changes in total hours worked for these countries, rather the relative importance of the extensive and intensive margin is shown to differ systematically by age, gender and family composition.

Section 2 provides an overview of the changes in aggregate hours worked over the last forty years. Section 3 presents a theoretical framework to decompose the aggregate labour supply elasticity into extensive and intensive sub-elasticities. Section 4 presents a statistical framework providing bounds on the empirical measures of the intensive and extensive margins. This framework is then applied in the case of France, the UK and the US. Section 5 presents detailed description of the labour margins for some specific demographic groups, i.e. the young, the mothers and the older workers. Section 6 presents preliminary results on elasticities at the extensive and intensive margins in the case of the UK. Section 7 concludes.

2 Working Hours in the US, the UK and France

2.1 Definitions and Data

Labour supply is a multi-faceted concept and can cover relatively broad definitions. Our interest is in market work but we shall not equate non-market work with "leisure", as it could include household production and voluntary work. Even if we might like to measure the amount of labour supply accounting for effort and productivity, we concentrate in this paper on a narrower definition of labour, i.e. *time spent in market work*.

There are many different concepts of market work (or hours worked) that have been used in the labour statistics literature: normal hours, hours paid, usual hours or actual hours.[1] Each varies depending whether one includes overtime hours, time traveling to work, meal breaks, holidays, sick leave and many other periods which could be considered 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.

To measure time spent in market work one needs to define a reference period. It is generally the week or the year, but it could equally be a day or a lifetime. The choice of the reference period is important, in particular to define the intensive and extensive

[1]Most of these concepts have been defined by the October 1962 International Labor Organization (ILO) "Resolution concerning statistics of hours of work". See Fleck (2009) for an overview.

margins. In this paper, we use the civil year as the reference period so that we define H_{it} as the total actual hours of market work of individual i in year t. The total actual hours can be decomposed into an extensive and intensive component:

$$H_{it} = p_{it} \times h_{it} \tag{1}$$

We define the *extensive margin* of labour 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, i.e. whether in or out of the labour market, in two respects. First it relies on the notion of employment, as opposed to positive hours worked, and thus captures the standard notion of the extensive margin as a measure of "participation" to the labour market (Heckman (1974) and Killingsworth (1983)).[2] Second, defining the extensive margin as a fraction of the reference period, 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, h_{it}, is defined as the total number of hours of work 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, like holidays or sick leave, will appear as changes in the intensive margin.

It may be useful to develop a few examples. Consider a 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, has also 1 as extensive margin but her intensive margin is $3H/4$. Consider now a person C who works at the same rhythm as A between January and June and October-December, while she is unemployed, out of work, not on paid leave, without a work contract in July-September. She works three quarters of the year so her extensive margin is equal to 3/4, while her intensive margin equal 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.

The choice of the reference period is nonetheless important to capture movements in the extensive and intensive margins. With the year as reference period, one misses seasonal variations in the intensity of work, for instance in the number of weeks worked per year,

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

or daily variations in the intensity of work, for instance in the number of hours worked per day or in the number of days worked per week. For a given number of hours worked per year, individuals might have very different timing for these hours. Although we do not focus in this paper on these variations, we provide evidence in appendix B of significant cross-country differences.[3]

The data used in this paper are 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.[4] There are a number of measurement issues but the main attraction of these data is to provide long series of micro-datasets, which provide detailed information, every year, about employment patterns and hours of work, as well as precise demographics like gender, age, education attainment, marital status, number of children etc. No cross-country database is currently available to make these detailed disaggregations.

Questions are comparable across countries as they follow ILO recommendations. We make a very large use of continuous surveys, i.e. surveys which span the entire year and therefore capture seasonal variations in hours worked. Each quarter, we observe individuals from a representative sample in a particular week. We know whether employed and how many hours worked in that week. We average over the year to get the employment and hours of a broad category. For earlier years we have to rely on annual surveys and we make adjustments between the two series.[5]

Before digging deeper into these movements in hours and employment, we should note that whereas the measure of the employment rates across time and countries is considered fairly robust, the measure of annual hours of work is on much less firmer ground, in particular in earlier years. This is largely due to the fact that only annual surveys are available for earlier years which are inadequate to capture seasonal changes in hours worked.

[3]On 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 a hours/year number mechanically converts it into hours/quarter (or week), and must not be mistaken for a change in the length of the reference period.

[4]Details on measurement issues, on methods used in this paper and comparisons with other sources widely used can be found in Appendix A.

[5]These adjustments are described in details in Appendices A.3, page 49.

2.2 Trends in Employment and Hours since 1968

Figure 1.A highlights the starting point of our analysis and the key piece of evidence used to motivate the debate on the changing trends in aggregate hours worked across countries. It charts the evolution of the average annual hours of work per individuals aged 16 to 74 from 1968 to 2008.[6] The pattern of total hours per individual shows evidence of 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.

Changes in total hours represent both the effect of changes at the extensive margin of labour (the employment rate) and at the intensive margin (the actual annual hours of work per person employed or self-employed). 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 1.B shows a strong decline in employment in France until the mid-1990s with recovery thereafter but leaving a large difference in current employment rates. Note that we are aggregating across all adult men and women aged 16 to 74 in these figures. Later we will document further key differences by gender and age.

Changes in hours per worker tell a different story. Figure 1.C shows the UK and France following each other with strong declines over this period stabilizing somewhat in the 2000s. In contrast, the US has retained a stable pattern of hours per worker over the entire period apart from a dip in the late 1970s and early 1980s.

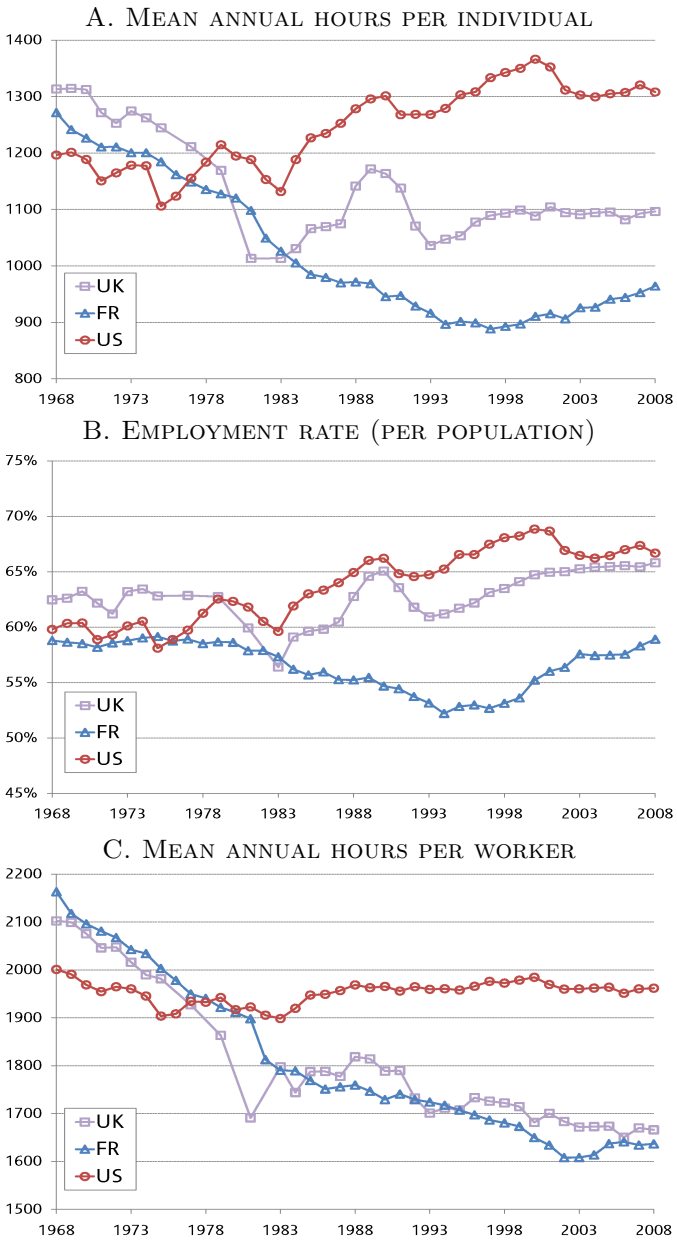
Partly as a reflection of our concerns with the measurement of hours in earlier years and partly due to the major changes occurring after this period, we focus the major part of our remaining analysis on the period since the late 1970s. For this period we are more certain as to the reliability of our data. 1977 is one of the earliest years available for all three labour force surveys and provides a key initial point for our study.

2.3 The Importance of Age and Gender

The trends in hours and employment in Figure 1 tell only part of the story. Much of what is interesting is hidden beneath these aggregate trends. A lot more is learned from

[6] Usually the working age population is defined as those aged 16 to 64. We extend this definition to age 74 in order to capture the sizeable increase in the employment rate of 65-74 year old in the US.

Figure 1: Measures of market work for individuals aged 16 to 74 (1968-2008)



Notes: 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 Appendix A for details.

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

the distinction between age and gender. To illustrate these differences we compare two years: 1977 and 2007. The first of these years is before the disjuncture in the series noted in Figure 1 and allows us to use relatively comparable sources across the three countries. 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 Figures 2 and 3 we show total hours and the employment rate, respectively, by age for men. The comparison between 1977 and 2007 highlights the interest in decomposing the changes in labour supply across age groups. In 1977 the employment rates were higher in the two European countries than in the US at most ages (with the exception of France at the very young and older ages), in 2007 the American rate describes the outer envelope. In 1977 the British males distinguish themselves with very higher employment at young ages (between 16 and 22) and at older age (between 60 and 65). All three countries exhibit strong decline in participation at the age of early eligibility for pensions (60 in France, 65 in the UK and the US).

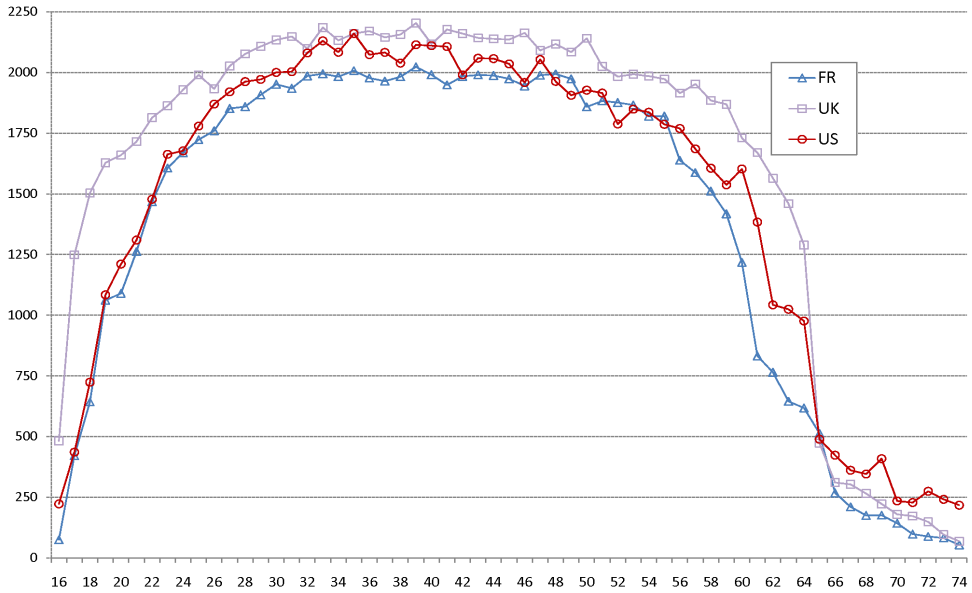
In 2007, the key differences in average male employment rates between the three countries come exclusively from the young and the old. For males aged 30 to 54, employment rates are almost indistinguishable. Moreover, British and American males have very similar employment rates at all ages up to 65 when the British rate drops markedly. The French drop in employment rate at older age is much earlier with a marked decline as soon as age 55 a further drop before age 60. At age 61 there is a 41-43 points difference in employment rates between French and British or American males. Past age 65, almost no French is working while 20% of American males remain in work at age 73!

Figures 4 and 5 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, child birth. By 2007 hours look very different. Women in the US dominate at every age. Women in Britain maintain relatively high hours at younger working ages but the M shape is considerably more smoothed and throughout their 30s, 40s and 50s UK women follow closely the hours of French women.

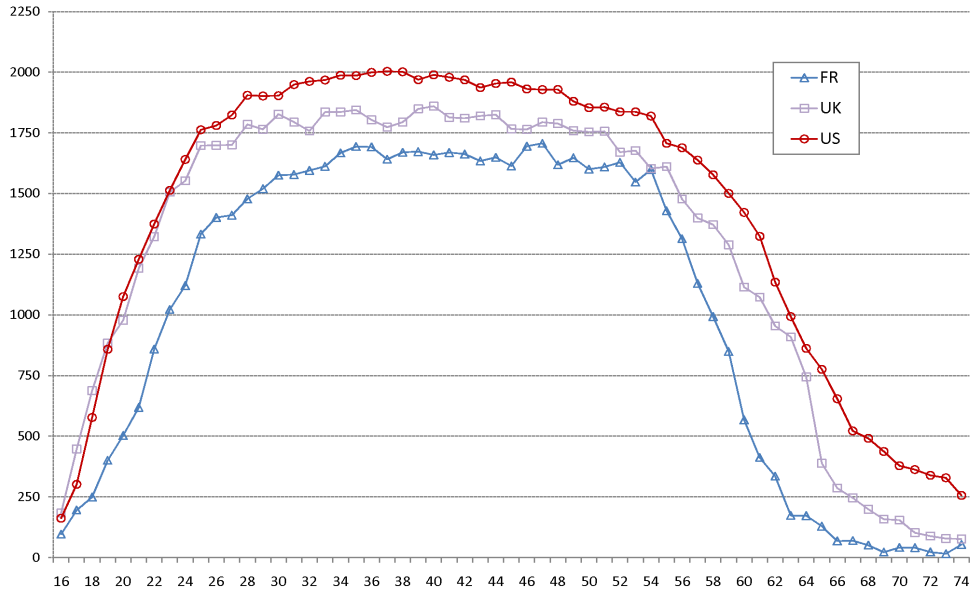
The employment pattern of females by age has also changed markedly during this period. In 1977, Figure 5.A shows US and French women had similar patterns with UK women again having the strongest M-shape. Employment was high for the very young adult

Figure 2: Male total hours by age (1977-2007)

A. Male 1977



B. Male 2007

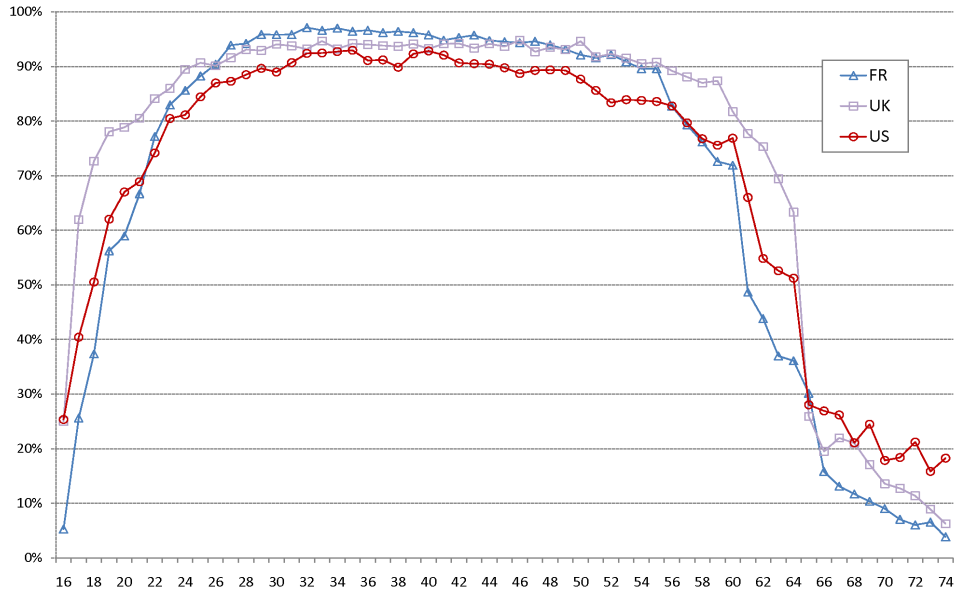


Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

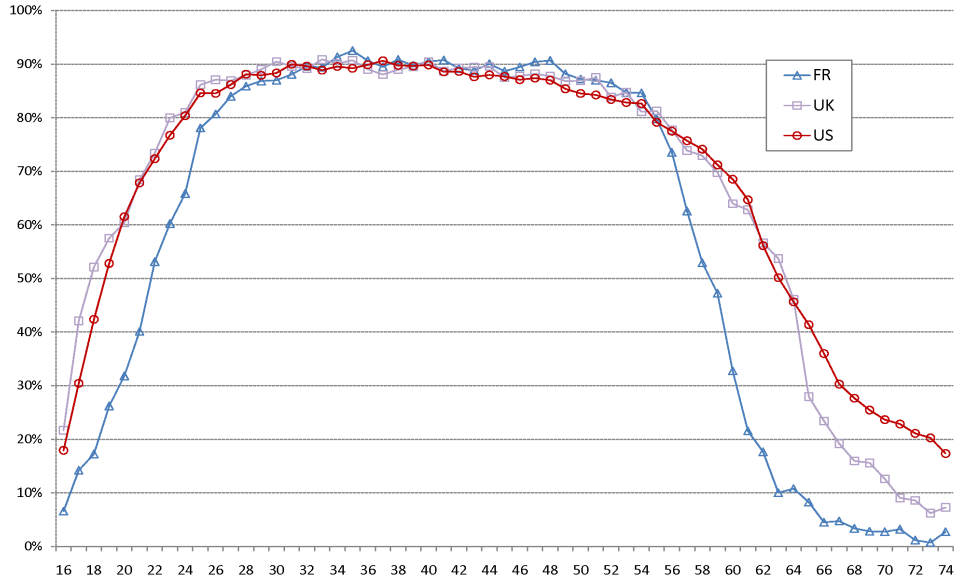
women, then a drop until the early thirties, when women become mothers of young children, then an increase in participation as children age and then the decline in employment at older age, but much earlier than the British males. This M-shape pattern does not appear to be as strong a feature in France or in the US.

Figure 3: Male employment rate by age (1977-2007)

A. Male 1977



B. Male 2007

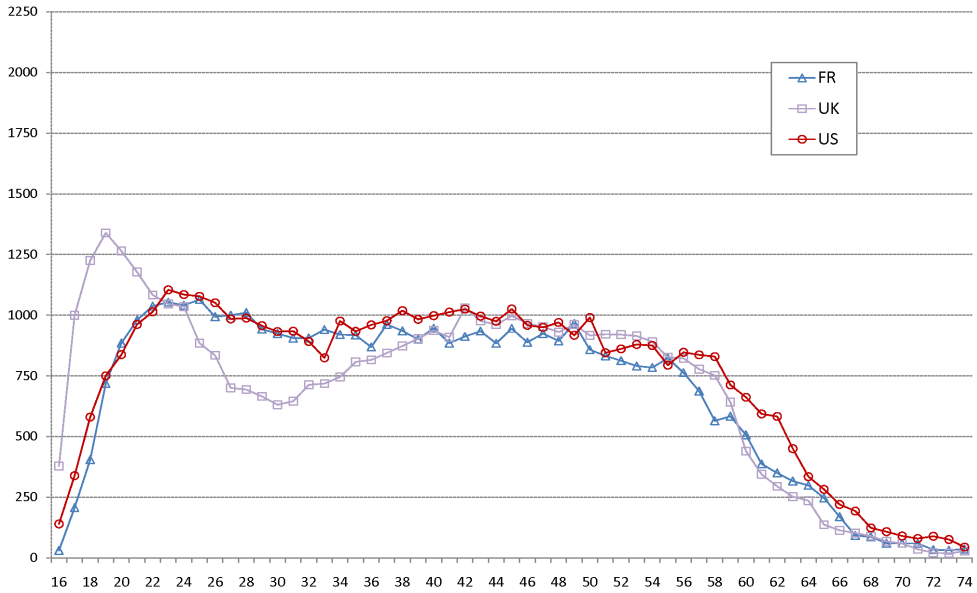


Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

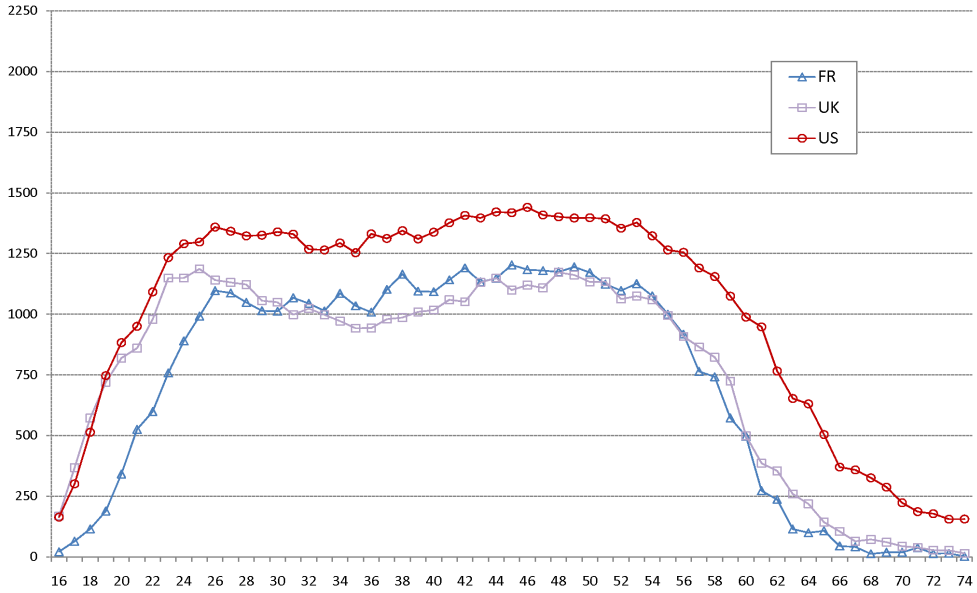
By 2007, female employment rates increased in all three countries. Unlike in the case of total hours, Figure 5.B shows the British 'M' shape has all but disappeared and the age patterns have tended to become closer to the one of males. Employment rates in the three economies are almost identical for women from their late 20s to their mid-50s. At

Figure 4: Female total hours per by age groups (1977-2007)

A. Female 1977



B. Female 2007

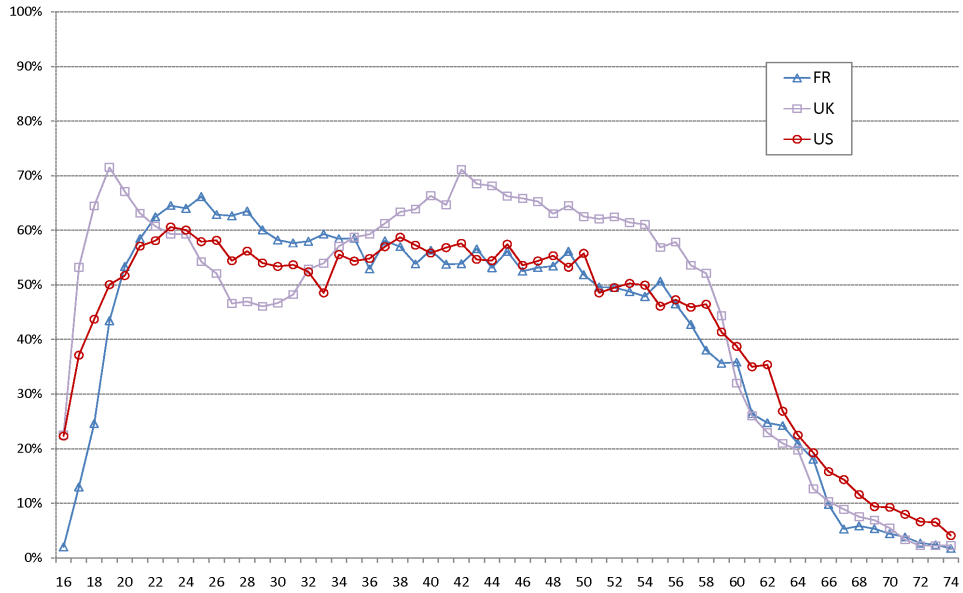


Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

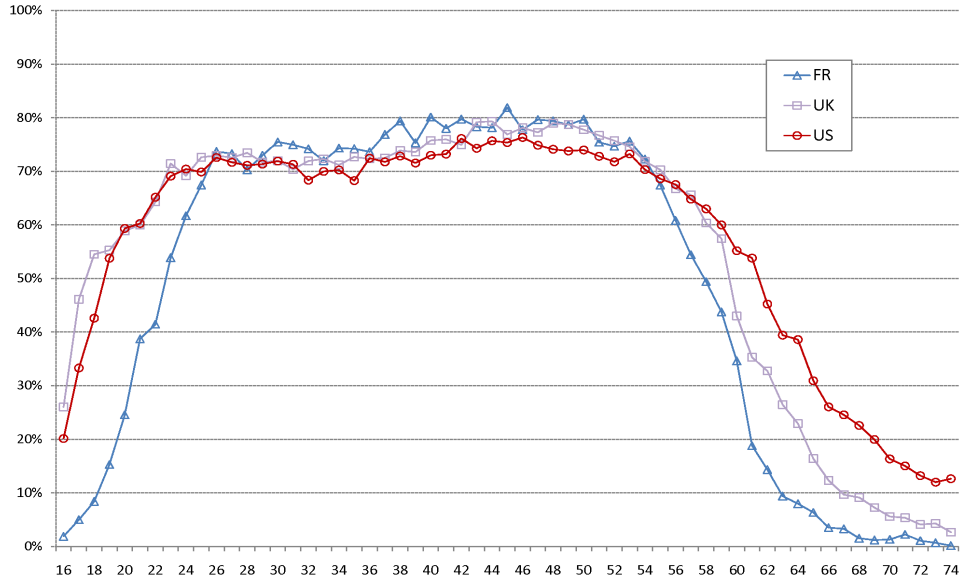
older ages British women show a lower employment rate than those in the US. Note that the state pension age in the UK is 60 for females and 65 for males. In France the lower employment rate of females seems to be almost entirely due to the low participation at young and older ages.

Figure 5: Female employment rate by age (1977-2007)

A. Female 1977



B. Female 2007



Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

The figures in this section point to important differences at the hours and employment margin by age and gender for each of these countries. But can we be more systematic about these comparisons? In the next section we develop a simple theoretical framework for decomposing responses at the intensive and extensive margin and examining the impact

on the aggregate hours elasticity. We then develop a statistical decomposition that mirrors the theoretical analysis.

3 Elasticities at the Intensive and Extensive Margins

Our aim here is to provide an illustrative theoretical framework to analyze the decomposition of hours responses at the intensive and extensive margins. To do this we consider an economy made of heterogeneous workers choosing between whether to work and how many hours to supply in work. In the application we use more flexible specifications and allow explicitly for observable as well as unobserved heterogeneity.

3.1 Fixed Costs of Work

To capture the main ingredients, different workers face different fixed costs of work and have different tastes for work. The labour supply decision in each period is based on the after-tax wage and the marginal utility of income λ. We assume that the period is short compared with the whole lifetime, so that λ can be considered as given, independent of current labour supply.[7] Preferences are represented as

$$U = \begin{cases} \lambda R(h) + v(T-h,\alpha) - \beta & \text{if } h > 0 \\ \lambda s & \text{if } h = 0, \end{cases}$$

where v is a concave increasing utility index of leisure time, T is total time available, h is labour supply measured in hours, $R(h)$ is the disposable income of someone who works h hours, h positive, s is subsistence income when unemployed and (α, β, λ) are positive parameters. The parameter α describes the marginal (dis)utility of hours worked while β stands for fixed costs of work. The agents also differ according to hourly wages w. It is convenient to describe the distribution of agents' characteristics in the economy through the conditional distribution of fixed costs β given (α, λ, w), $F(\beta|\alpha, \lambda, w)$, and the marginal pdf of (α, λ, w), $g(\alpha, \lambda, w)$.

In this discussion we shall limit ourselves to a fairly simple linear tax and benefit system, $R(h) = r + w(1-\tau)h$. We assume a constant marginal tax rate τ and allow for a possible discontinuity at the origin, subsistence income s possibly being different (larger) than the

[7] This hypothesis is satisfied in a continuous time model, where instantaneous utility is separable in consumption and leisure.

income r of a worker who supplies little market hours. If an individual works, her preferred number of hours maximizes

$$\lambda w(1-\tau)h + v(T-h,\alpha),$$

which gives

$$\tilde{h}(\lambda w(1-\tau);\alpha) = T - v'^{-1}(\lambda w(1-\tau),\alpha). \tag{2}$$

She works when the benefit exceeds the fixed cost β, that is when

$$\lambda r + \lambda w(1-\tau)\tilde{h} + v(T-\tilde{h},\alpha) - \beta \geq \lambda s,$$

or

$$\beta \leq \lambda(r-s) + \lambda w(1-\tau)\tilde{h} + v(T-\tilde{h},\alpha),$$

where to lighten notation $\tilde{h}$ stands for $\tilde{h}(\lambda w(1-\tau);\alpha)$ as defined by (2).

From this condition, the employment rate of agents of type (α,λ,w) is

$$\tilde{p}(\lambda, w(1-\tau);\alpha) = F\left(\lambda(r-s) + \lambda w(1-\tau)\tilde{h} + v(T-\tilde{h},\alpha)\right), \tag{3}$$

so that the number of hours worked by type (α,λ,w) agents is

$$\tilde{H}(\lambda w(1-\tau),\alpha) = \tilde{p}(\lambda, w(1-\tau);\alpha)\tilde{h}(\lambda w(1-\tau);\alpha).$$

Hours and employment elasticities follow from standard definitions. From the functional form, the elasticities with respect to wages w or to $(1-\tau)$ are equal, and we shall denote them with the letter ε. We shall use η for the elasticities with respect to subsistence income s. At the intensive margin of labour supply for individuals of type (α,λ,w) the elasticities are :[8]

$$\varepsilon_I(\alpha,\lambda,w) = \frac{\partial \ln(\tilde{h}(\lambda w(1-\tau),\alpha))}{\partial \ln w} = -\frac{1}{\tilde{h}}\frac{v'(T-\tilde{h},\alpha)}{v"(T-\tilde{h},\alpha)},$$

[8] An often used specification is

$$v(T-h,\alpha) = \frac{(T-h)^{1-1/\alpha}}{1-1/\alpha},$$

for positive α. This yields the intensive elasticity

$$\varepsilon_I(\alpha,\lambda,w) = \frac{T-\tilde{h}}{\tilde{h}}\alpha.$$

and

$$\eta_I(\alpha,\lambda,w)=\frac{\partial \ln(\tilde{h}(\lambda w(1-\tau),\alpha))}{\partial \ln s}=0,$$

whereas at the extensive margin we have:

$$\varepsilon_E(\alpha,\lambda,w)=\frac{\partial \ln(\tilde{p}(\lambda w(1-\tau);\alpha))}{\partial \ln w}=\lambda w\tilde{h}\frac{f(\lambda(r-s)+\lambda w(1-\tau)\tilde{h}+v(T-\tilde{h},\alpha))}{\tilde{p}(\lambda,w(1-\tau);\alpha)},$$

and

$$\eta_E(\alpha,\lambda,w)=\frac{\partial \ln(\tilde{p}(\lambda w(1-\tau);\alpha))}{\partial \ln s}=-\lambda s\frac{f(\lambda(r-s)+\lambda w(1-\tau)\tilde{h}+v(T-\tilde{h},\alpha))}{\tilde{p}(\lambda,w(1-\tau);\alpha)}.$$

3.2 Aggregating Elasticities and the Elasticity of Aggregate Hours

To see how changes in the total hours in the economy relate to these elasticities, first note that the total number $\tilde{H}$ of hours worked is

$$\begin{aligned}H&=\int_w\int_\alpha\int_\lambda \tilde{H}(\lambda w(1-\tau),\alpha)g(\alpha,\lambda,w)\mathrm{d}\alpha\mathrm{d}\lambda\mathrm{d}w\\&=\int_w\int_\alpha\int_\lambda \tilde{p}(\lambda w(1-\tau);\alpha)\tilde{h}(\lambda w(1-\tau);\alpha)g(\alpha,\lambda,w)\mathrm{d}\alpha\mathrm{d}\lambda\mathrm{d}w.\end{aligned}\tag{4}$$

The elasticity of H with respect to $(1-\tau)$ is

$$\begin{aligned}\varepsilon=\frac{\partial \ln H}{\partial \ln(1-\tau)}=\frac{1-\tau}{H}\frac{dH}{d(1-\tau)}=\\ \frac{1}{H}\int_w\int_\alpha\int_\lambda\Bigg[\tilde{p}(\lambda w(1-\tau);\alpha)\tilde{h}(\lambda w(1-\tau);\alpha)\frac{1-\tau}{\tilde{h}(\lambda w(1-\tau),\alpha)}\frac{\partial\tilde{h}(\lambda w(1-\tau),\alpha)}{\partial(1-\tau)}\\ +\tilde{p}(\lambda w(1-\tau);\alpha)\tilde{h}(\lambda w(1-\tau),\alpha)\frac{1-\tau}{\tilde{p}(\lambda w(1-\tau);\alpha)}\frac{\partial\tilde{p}(\lambda w(1-\tau);\alpha)}{\partial(1-\tau)}\Bigg]g(\alpha,\lambda,w)\mathrm{d}\alpha\mathrm{d}\lambda\mathrm{d}w.\end{aligned}\tag{5}$$

or

$$\varepsilon=\frac{1}{H}\int_w\int_\alpha\int_\lambda \tilde{H}(\lambda w(1-\tau),\alpha)[\varepsilon_I(\alpha,\lambda,w)+\varepsilon_E(\alpha,\lambda,w)]g(\alpha,\lambda,w)\mathrm{d}\alpha\mathrm{d}\lambda\mathrm{d}w.\tag{6}$$

The first term is the contribution of the intensive margin, the second that of the extensive margin, whose elasticities are weighted by the share of type (α,λ,w) labour supply in the aggregate.

A similar computation yields the elasticity of aggregate hours with respect to subsis-

tence income:

$$\eta = \frac{\partial \ln H}{\partial \ln s} = \frac{1}{H}\int_w \int_\alpha \int_\lambda \tilde{H}(\lambda w(1-\tau),\alpha)[\eta_I(\alpha,\lambda,w)+\eta_E(\alpha,\lambda,w)]g(\alpha,\lambda,w)\mathrm{d}\alpha\mathrm{d}\lambda\mathrm{d}w. \quad (7)$$

3.3 Nonseparable Preferences and Alternative Life Cycle Consistent Elasticities

Although we have assumed additively separable preferences between time and consumption this can be relaxed and the results can be implemented in a more general model where the utility function is not separable in consumption and leisure. Suppose that the instantaneous utility is $V(c, T-h, \alpha)$ when at work and $V_0(c,\alpha)$ when out of work. In a continuous time setting, the consumer maximizes

$$V(c, T-h, \alpha) + \lambda(R(h) - c) - \beta$$

with respect to the pair (c, h) in case of work, giving an indirect utility $\tilde{V}$, and

$$V_0(c,\alpha) + \lambda s$$

with respect to c in case of unemployment, giving indirect utility $\tilde{V}_0$. The highest of $\tilde{V}$ and $\tilde{V}_0$ determines consumption demand and labour supply.

The elasticity formulations so far have been written in terms of Frisch elasticities where we have conditioned on the marginal utility of wealth λ, see Browning et al. (1999). A equivalent decomposition in terms of the extensive and intensive elasticities will follow for alternative definitions of the labour supply elasticities for example Marshallian within period elasticities that condition on a consumption based measure of other income as in the two-stage budgeting formulations of the life-cycle model as discussed in Blundell and MaCurdy (1999, section 4).

4 Decomposing Changes in Total Hours

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 across a person characteristics, age and gender for instance. Suppose there are $j = 1, ..., J$ 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}

$$H_t = \sum_{j=1}^{J} q_{jt} H_{jt}.$$

Evidence from the long history of empirical labour supply studies suggests that measured responses of hours worked at the intensive and extensive margins differ across different categories of workers. Following formula (4) we decompose total hours of work H_{jt} as the product of hours per worker h_{jt} and participation to the labour market p_{j_t}

$$H_{jt} = p_{jt} h_{jt}.$$

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 margins. We propose a statistical decomposition: First we define a structural effect S_t due to the change in the composition of the population:

$$S_t = \sum_{j=1}^{J} H_{jt}[q_{jt} - q_{j,t-1}].$$

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

$$\Delta_{jt} = q_{j,t-1}[H_{jt} - H_{j,t-1}] \tag{8}$$

and the total change across all J categories of workers is simply

$$\Delta_t = \sum_{j=1}^{J} \Delta_{jt} \tag{9}$$

and we have by construction

$$H_t - H_{t-1} = S_t + \Delta_t. \tag{10}$$

4.1 Bounds on Changes at the Extensive and Intensive Margins

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 components. It is however natural

to suppose that any plausible measure I_j of the intensive margin would have the same sign as the difference of the hours worked per worker[9] at date $t-1$ and t: $\Delta h_j = h_{jt} - h_{j,t-1}$. Assuming linearity, we can then express the change Δ_j 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

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

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

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

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:

$$\Delta_{jt} = q_{j,t-1}\left\{[h_{jt} - h_{jt-1}]p_{jt} + [p_{jt} - p_{jt-1}]h_{j_{t-1}}\right\} \tag{11}$$

or

$$\Delta_{jt} = q_{j,t-1}\left\{[h_{jt} - h_{jt-1}]p_{jt-1} + [p_{jt} - p_{jt-1}]h_{jt}\right\} \tag{12}$$

The first term on the right hand side is the intensive margin, weighted in the top formula (11) with the final participation rate (as in a Paasche index) and in the bottom formula (12) with the initial participation rate (as in a Laspeyres index). The second term is the extensive margin (Laspeyres in (11), Paasche in (12)).

In the next section we examine the evolution of h_{jt} and p_{jt} for different age and gender groups. We then use (11) and (12) to provide bounds on the importance of 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 relate naturally to the decomposition of the total hours elasticity into its intensive and extensive components as described by (5). Suppose we think of the decomposition (11) for small changes and write

$$\Delta H \simeq \sum_{j=1}^{J} [\Delta h_j p_j + \Delta p_j h_j]$$

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

This expression can be rewritten in terms of the proportionate changes

$$\frac{\Delta H}{H} \simeq \frac{1}{H}\sum_{j=1}^{J}\left[p_j h_j \frac{\Delta h_j}{h_j} + p_j h_j \frac{\Delta p_j}{p_j}\right]$$

$$= \frac{1}{H}\sum_{j=1}^{J} p_j h_j \left[\frac{\Delta h_j}{h_j} + \frac{\Delta p_j}{p_j}\right]$$

$$= \sum_{j=1}^{J} \frac{H_j}{H}\left[\frac{\Delta h_j}{h_j} + \frac{\Delta p_j}{p_j}\right]$$

corresponding to the terms in the elasticity decomposition formula in (5) and (7) above.

4.2 The Decomposition of Total Hours for the US, UK and France

In our discussion of Figures 2-5 we have seen how an analysis of changes in total hours worked in an economy masks some key variations by age and gender. In this section we apply the approach to the decomposition of total hours for different subgroups of the population developed in the last two sections. 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 close number of hours worked per person at the starting year (France: 1148, UK: 1212, US: 1156), but their evolution differs: +165 hours for the US, -118 hours and -195 hours for the UK and France. The lines Δ of Table 1 show the contributions of the categories and the effect of demographic structure, according to equations (8), (9) and (10).

A first remark on these statistics is that the overall country movements, US and France at the extremes with the UK in between, holds for nearly all the categories that we have retained. The contribution to the aggregate of the hours worked by the young and prime age men is negative in all countries, with a larger decline in France than in the UK than in the US. Table 1 shows a large decline 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, -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

Table 1: Decomposition of the evolution of hours of work between 1977 and 2007 by sex and age groups

	Year	Youth (16-29)		Prime aged (30-54)		Old (55-74)		Residual	All
		Men	Women	Men	Women	Men	Women		(16-74)
FR	1977	1402	871	2010	951	827	367		1148
	2007	858	627	1639	1116	508	344		953
	Δ	-82	-38	-82	36	-36	-3	10	-195
UK	1977	1707	938	2117	873	1107	323		1212
	2007	1219	876	1786	1055	790	385		1094
	Δ	-71	-9	-70	39	-42	10	25	-118
US	1977	1344	835	2018	947	1025	447		1156
	2007	1236	956	1922	1373	1084	754		1321
	Δ	-19	22	-19	90	6	38	46	165

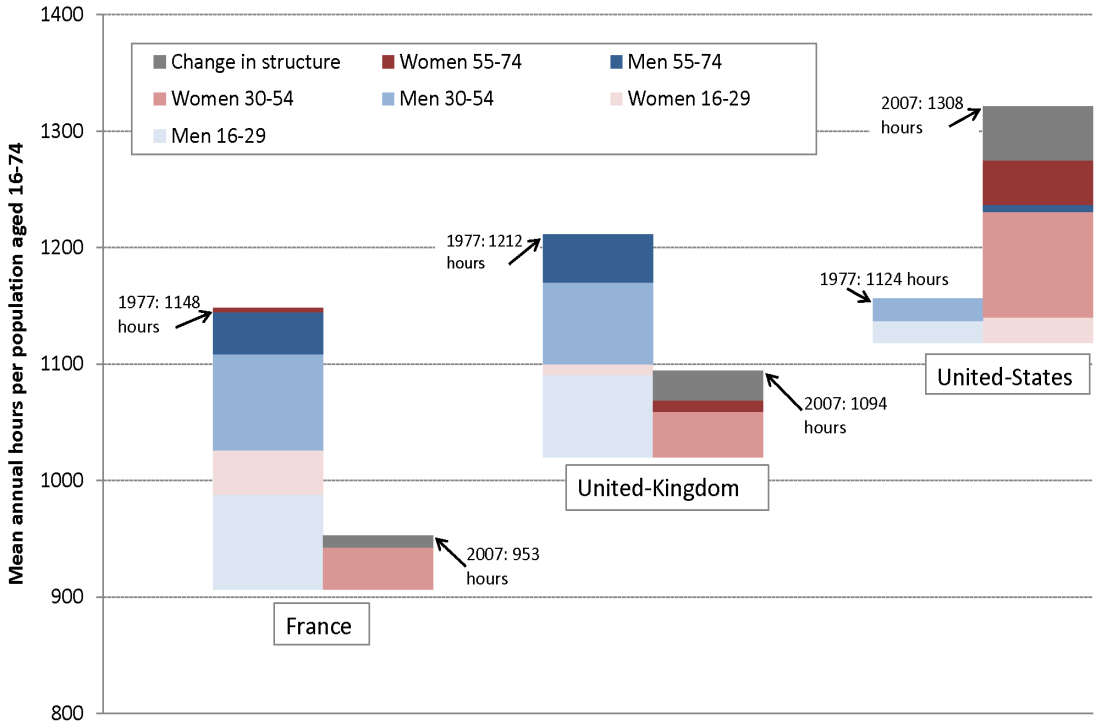
NOTE: Δ are computed following equation (8).
SOURCES: Enquête Emploi, Labour Force Survey, Current Population Survey.

works against the general trend. This is particularly obvious for middle aged women who all work more in 2007 than in 1977, but appears also for the old and young women.

The graphical decomposition in Figure 6 serves to illustrate the striking differences across the three economies. 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 section we can go further and examine some key features of these changes at the extensive and intensive margin. 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, L standing for Laspeyres (the change in hours being weighted by the initial participation rate), P for Paasche (final participation rate). Similarly the Laspeyres index for the extensive margin (E-L) (resp. (E-P)), given by the second term in equation (11) (resp. (12)), is equal to the change in participation multiplied by average hours worked at the initial (resp. final) date. The theoretical discussion in section 3 suggests that the relative importance of these two margins, for any particular subgroup of workers, will depend on the distribution

Figure 6: Decomposition of the change in total hours per population (1977-2007)



NOTES: Decomposition assumes the population structure unchanged. The residual is attributed to changes in the population structure.

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

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, French men aged 16-29. 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 not only have come from changes in taxes, welfare and social security, but 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

Table 2: Decomposition of the evolution of hours of work between 1977 and 2007 by sex and age groups

	Year	Youth (16-29)		Prime aged (30-54)		Old (55-74)		All
		Men	Women	Men	Women	Men	Women	(16-74)
FR	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]
UK	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]
US	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 designs the Paasche measure of the intensive margin, I-L the Laspeyre measure, and similarly E-P and E-L designs the Paasche and Laspeyre measure of the extensive margin, as described by equations (11) and (12).
SOURCES: Enquête Emploi, Labour Force Survey, Current Population Survey.

costs and benefits in each of the countries could explain the observed changes.

Turning first to prime-age workers, 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. 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 legal hours regulation than France and yet has experienced similar changes.

Income effects could be part of the explanation. 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 overall growth has been somewhat similar across all three countries, it would have to be that Europeans take more leisure in response to rises in income. A second source of income effect for prime age men is the increased participation by 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 30-54 are the largest positive change to be found in any country-age cell and at any

margin. But the largest overall increase, when the intensive margin is taken into account, is for US women. Yet the change in hours is the least for US men. Again responses would have to be different in Europe.

Table 2 tells us that the *extensive* margin for prime-age men in Britain and in France also falls more than in the US, although it declines in the US too. Increases in relative employment costs or out of work benefits in France and Britain could be part of the explanation. Also, even at the extensive margin, income effects may play a role as individuals cut back on their overall life-cycle labour supply. However, this seems more likely at either end of the life-cycle rather than during prime-age.

As we have noted, for prime age women it is the increase at the extensive margin that is so extraordinary, especially in the US and in France where the bounds in Table 2 suggest a very similar change and one that is nearly twice the size of that experienced in the UK. Intensive margin changes provide somewhat of a puzzle here, falling back strongly in France while growing in the US. Again 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.

For older men and women there is a large decrease in hours per worker in France, similar in UK, contrasting with an increase in the US. There are falls at the extensive and intensive margins for UK men but increases at the extensive margin for UK women. This surely is linked to the strong increase in participation among younger cohorts of women. This phenomena is replicated to some extent across all countries and offsets the stronger incentives to retire earlier in the UK and in France. The contrast with the US is stark. At all margins and for both genders the bounds point to positive changes for older workers. Clearly changes in social security, early retirement incentives and pension rules have a large role to play in explaining these differences and we return in Section 6 to a more detailed analysis of this group.

The changes among the young are sizable and predominantly negative. In France and the UK there are large falls for young men at both the extensive and intensive margin. When we delve deeper into the employment patterns of the young in Section 7, this appears to be related to differences in the relationship between education and work across the countries. There is in fact around the same proportion of the young population out of work and looking for a job in all three countries, especially in the UK and France. Moreover, there is a very similar proportion of the population in education in the US and in France, a much larger proportion than in the UK. However, in France those in education typically

do not work at the same time as they study whereas in the US simultaneous education and work in the 16-29 population is common.

Before presenting the estimated distribution of elasticities that underpin these changes in Section 6, we first examine in more detail the pattern of employment and hours for three key groups.

5 Children, Youth and Older Workers

Here we look successively at the difference in employment and hours for women with children, the employment of the young, the participation of the old and finally the differences by skill levels.

5.1 Women with Children

The dramatic changes in labour market participation by women have been accompanied by major changes to marital status as well as to the age when women have their first child. Figure 7 illustrates these changes: the share of married mothers has decreased in all three countries, albeit at a different rate. Whereby in 1975 close to 55% of 20-54 year-old women were married mothers in France and in the UK, in 2008 the ratio falls to only 43% in France, whereas the drop is even more pronounced for the UK. British females are now as likely to be married mothers as Americans. In contrast, the share of lone mothers has increased dramatically in the US and the UK, and less so in France. 14% of British and American women are now single with children, compared to 10% of French women.

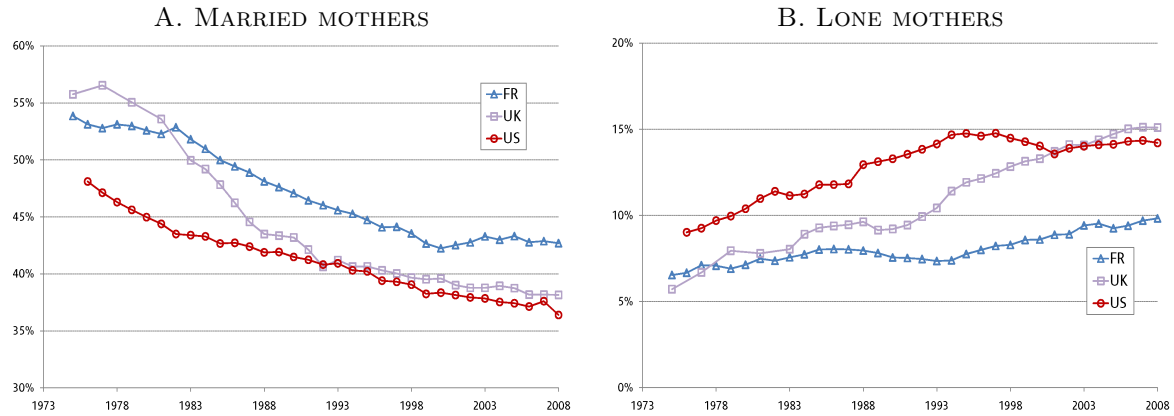
A detailed discussion of the causes of these trends is outside the scope of this paper. Here we simply point out the relationship between the (extensive and intensive) labour supply of women with children in these three countries. Figure 8 presents the evolution of the extensive and intensive margins for married mothers aged between 20 and 54. Although the rate of increase in female's 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 40% in 1975 to 70% in 2008, with the US leading the way until 2000. The intensive margin, on the other hand, offers a completely different picture. American married women have not only increased their participation, but also their mean annual hours of work, while French women have seen their average hours decline markedly. The UK also stands apart with married women hours of work below those of their French

counterpart - 1200 hours versus 1400 hours - but also markedly below the 1800 hours worked on average by American married mothers.

The differences Europe-US could be explained by different factors. The tax and benefit system treats differently earnings from the second earners. In France, the income tax system provides a large incentive to get married, especially when incomes are different between the two spouses, and with joint taxation, discourage additional earnings from the second earner. 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 jobs less than 16 and 30 hours per week, see Brewer et al. (2010).

Lone mothers represent another interesting case. Figure 9 presents the extensive and intensive margins of labour supply for 20-54 year-old lone mothers.[10] Contrary to the case of married mothers presented in Figure 8, the employment rate of lone mothers has been markedly different in all three countries. While very similar at the beginning of the period, the employment rate of American lone mothers has increased from 60% in the early 1990s to 70% in 2002.

Figure 7: Frequency of lone mothers and married mothers within the 20-54 female population



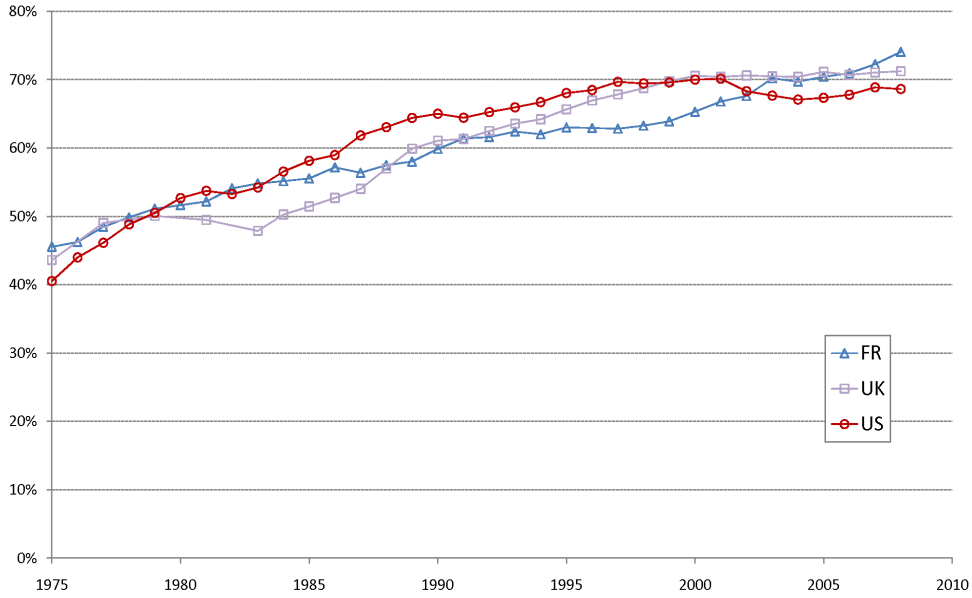
Notes: Lone mothers are defined as females, not married nor cohabiting, with kids. Married mothers include those cohabiting.
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

A significant part of this increase has been ascribed in the literature to the development of the Earned Income Tax Credit (EITC), that became after 1993 the flagship of the workfare policies implemented by the Clinton administration, see Blundell & Hoynes

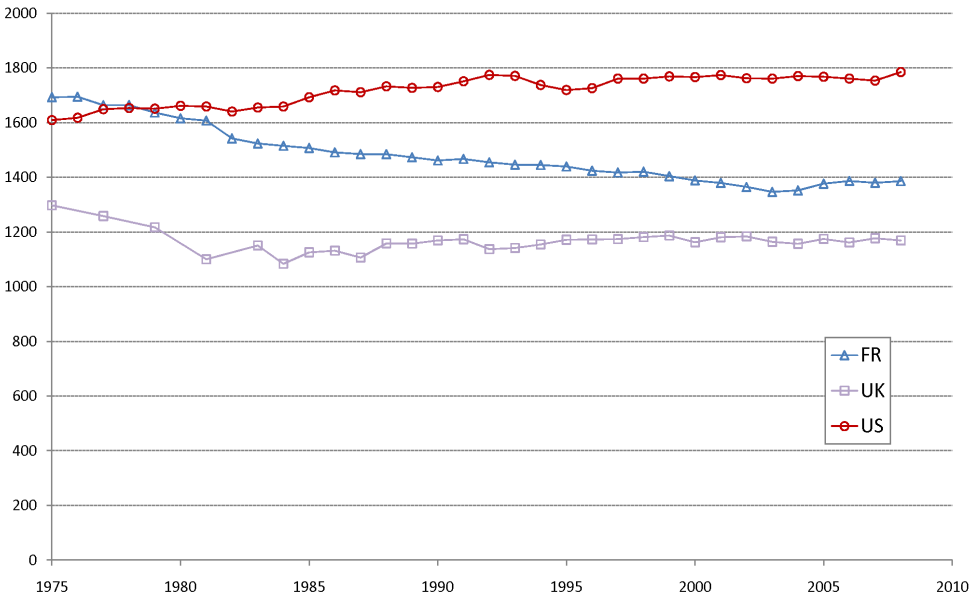
[10]Lone mothers are defined as females with children, not married nor cohabiting.

Figure 8: Margins of labour supply for 20-54 year-old married mothers

A. Employment rate



B. Annual hours per worker



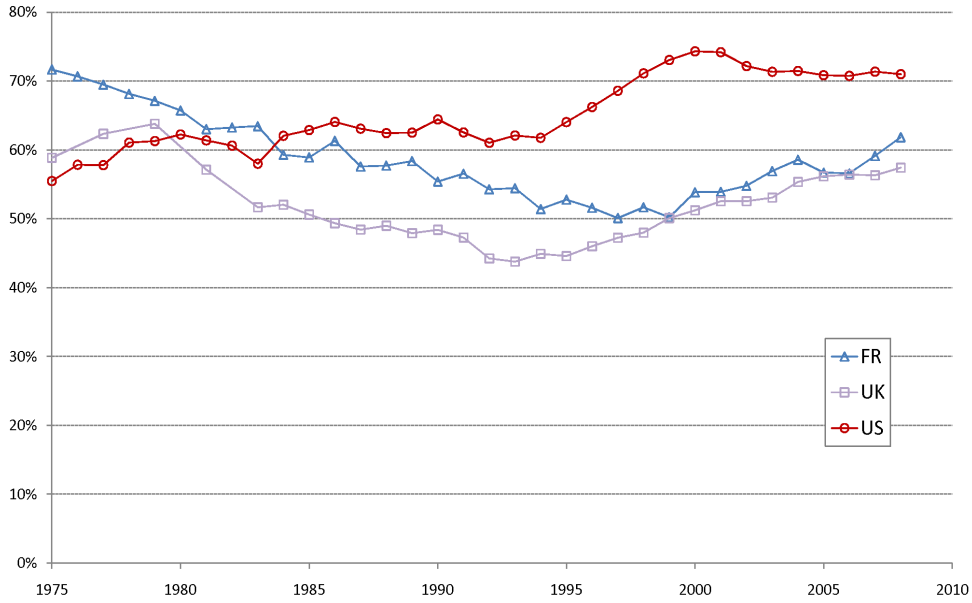
Notes: Lone mothers are defined as females, not married nor cohabiting, with kids.

Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

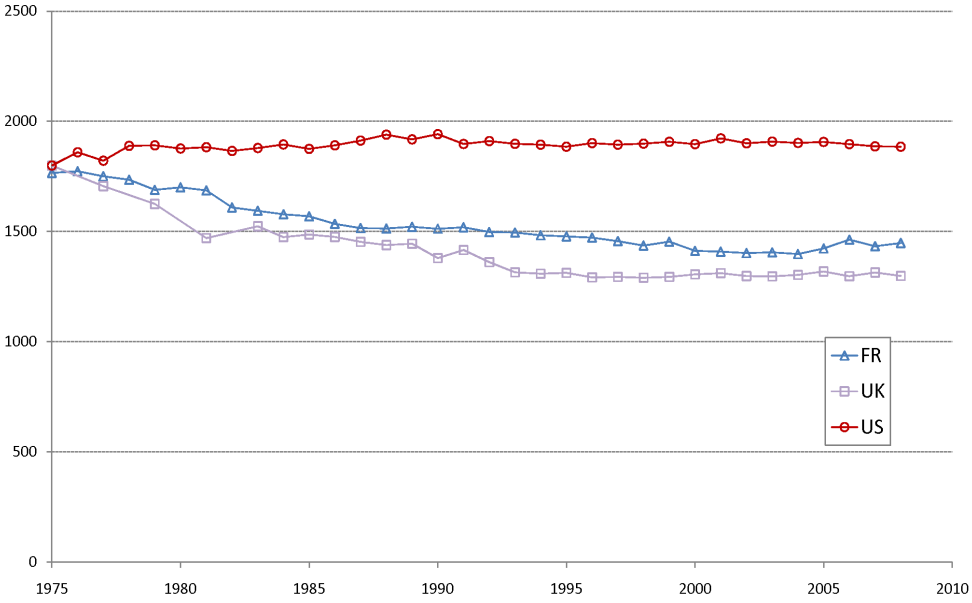
(2004). In the UK, the employment of lone mothers has continued to decline until the late 1990s, when the Working Family Tax Credit (WFTC) similar to the EITC has been put in place by the New Labour government. Comparisons between the UK and the US of

Figure 9: Margins of labour supply for 20-54 year-old lone mothers

A. Employment rate



B. Annual hours per worker



Notes: Lone mothers are defined as females, not married nor cohabiting, with kids.

Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

these schemes have been carried out carefully and have concluded that at least two third of the increase in participation could be ascribed to these schemes (Blundell & Hoynes (2004)). A scheme similar to the EITC and the WFTC, the Prime pour l'emploi (PPE),

was introduced in France in 2001 (Gurgand & Margolis (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. No discernable breaks are visible at the time of the introduction of the WFTC or PPE.

5.2 Youth Employment, Unemployment and Education

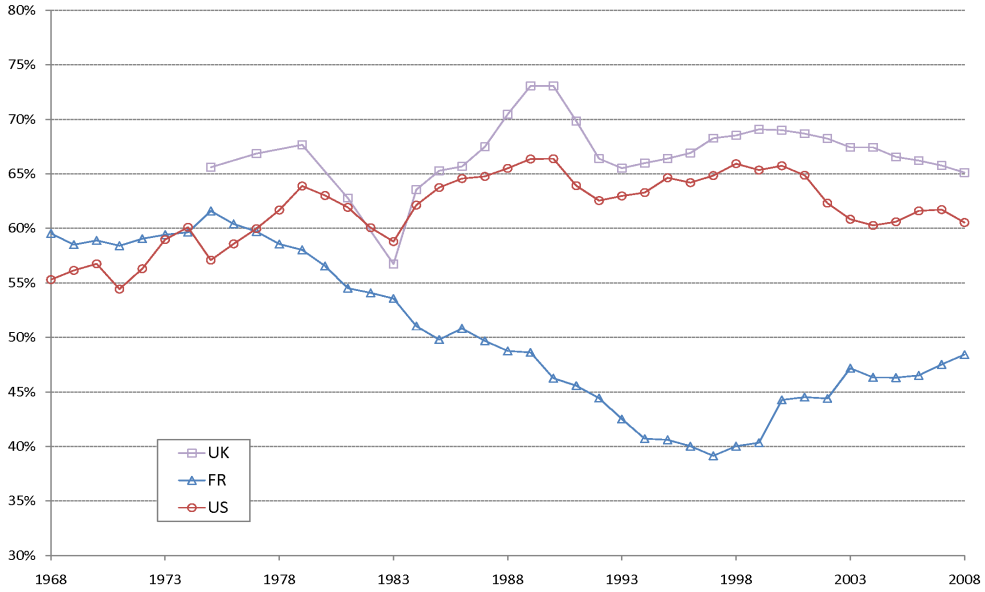
As we saw in Figure 3, one of the striking differences in employment rates between France the UK and the US concerns the youth, aged 16 to 29. Labour force participation at younger ages is complicated by decisions about the amount of market work to provide and the time in education. Depending on tuition costs, outside options in the labour market, returns to human capital investment and other factors, young individuals might decide to join or not in the labour market.

In Figure 10 we present two apparently contradicting pictures, the share of the 16-29 group who is employed and the share who is 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 10.B plots a non-employment rate, whose definition differs from ILO unemployment in that we use total instead of active population for the denominator. In all three countries, non-employment 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% of the entire population.

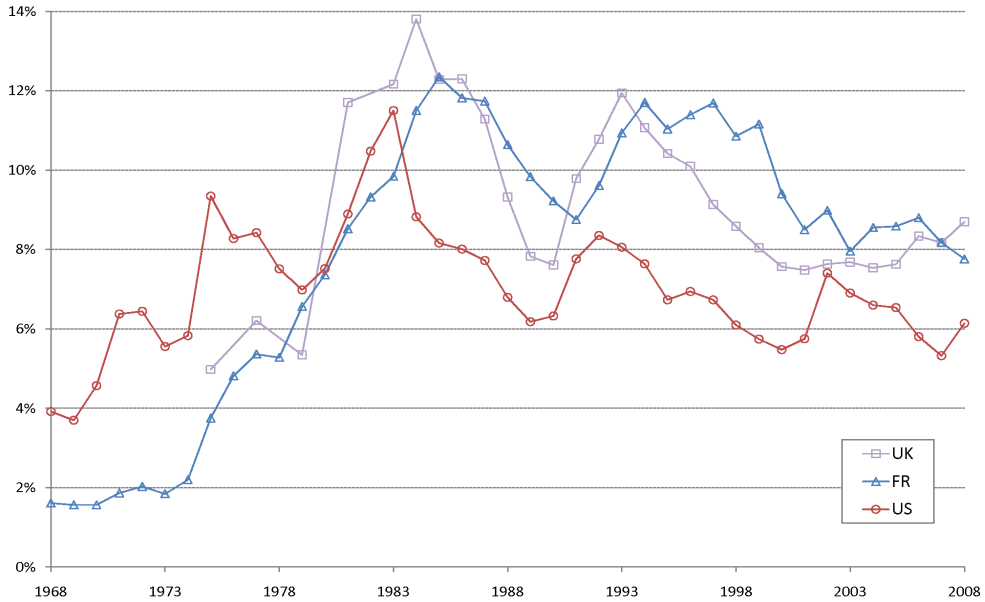
Most of the difference in the non-employment rates comes from the share of 16-29 year-old who are in education and training but not in work. Figure 11 shows the proportion of this age group who is in education or training (panel A) and the proportion in education and training but not in work (panel B). Both figures highlight the large increase in the proportion of young individuals following some form of education. At the end of the period, 45% of young French aged 16 to 29 are in education versus slightly less than 40% in the UK and the US. More strikingly, young French who are studying are generally not working, whereas young Britons and Americans are much more likely to be both working and in education.

Figure 10: Share of the 16-29 population in work or looking for work

A. In work



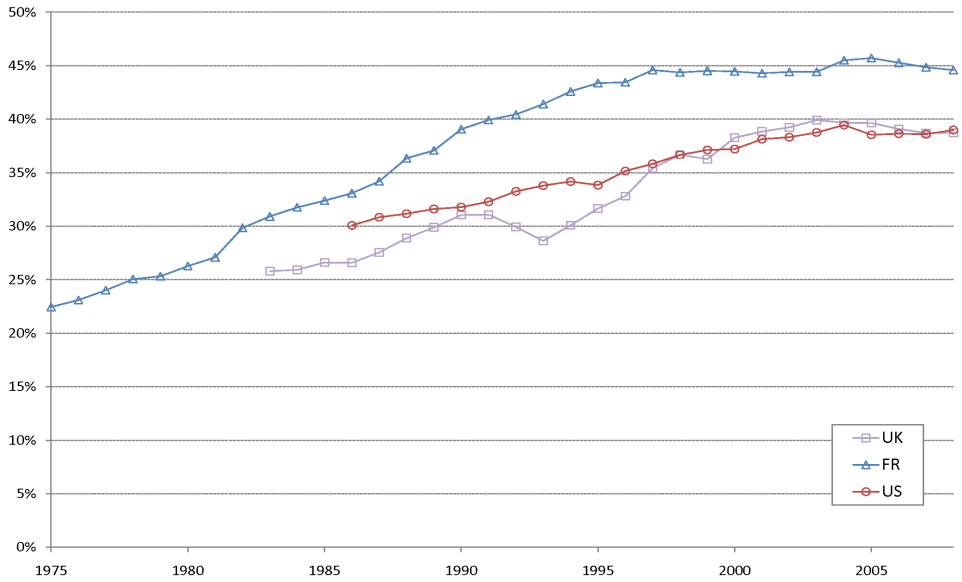
B. Looking for work



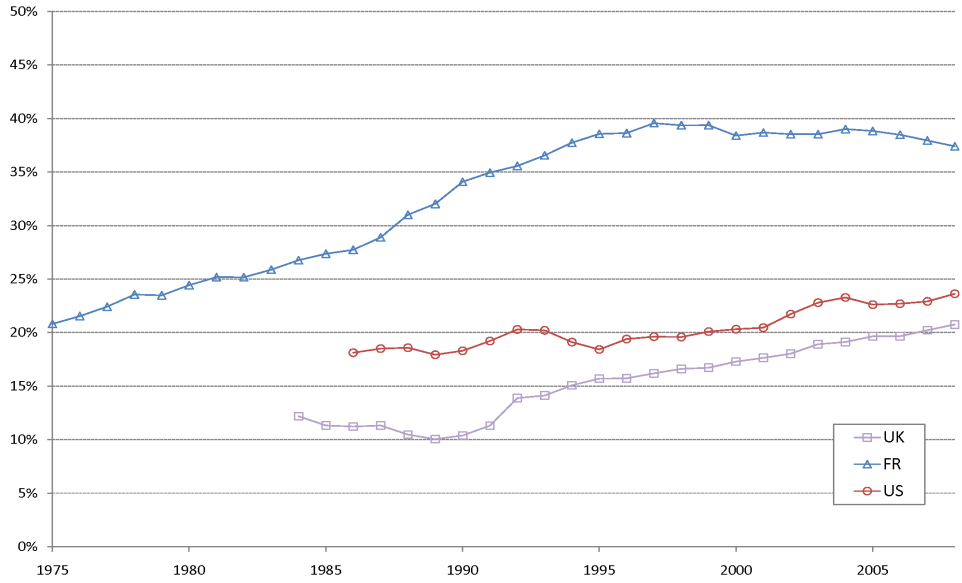
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.
Note: Individuals looking actively for work are unemployed, in comformity with the ILO unemployment criteria. The difference with the official unemployment rate is the use of total population as denominator and not active population.

Figure 11: Education and training for the 16-29 years old

A. In education or training



B. In education or training but not in work



Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

5.3 Older Workers, Pensions and Increasing Life Expectancy

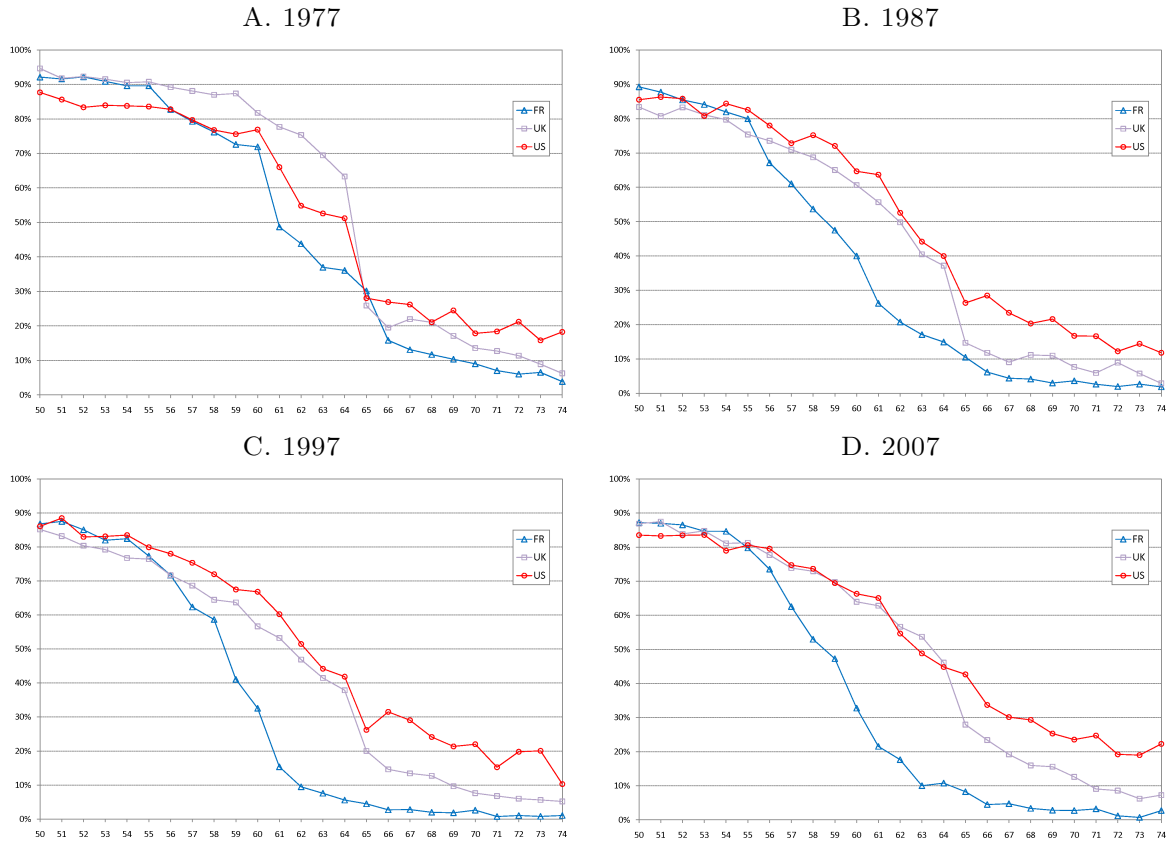
Another group for which the extensive margin differs markedly between the three countries is the older workers. Figure 12 presents the employment rate by age between 50 and 74 at ten years interval. In 1977 the employment rates of older workers in the three countries are not too dissimilar. French workers experienced a drop of 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, early retirement schemes) were entitled to a full pension.

At age 65, both the UK and US experience a large drop corresponding to the eligibility to State pensions and Social Security benefits. After age 65, the American workers stand out with much higher participation compared to their European counterparts. In 1987 all countries have experienced a drop in employment rates at older ages but France stands out with a much more pronounced decrease. In 1979 and 1980, early retirement policies have been expanded in France to a large group of 60-64 year-old. In 1981 these early retirement schemes have been extended to the 54-59 group and in 1983 the main scheme of the private sector has offered a full pension from 60 to those meeting the contribution length requirement. In 1987 French male employment rate at age 61 drops to 30 percentage points below the level of the UK and the US and by 2007 the difference reaches 41 percentage points.

The British and American males have very similar employment rates at older ages up to age 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, Social Security offers since 1961 an early retirement age at 62 while full entitlement is determined by the normal retirement age, at age 65 for those born before 1938. In Figure 12 it is clear that the US curve bends at two points, at age 62 and 65, when the Social Security system provides an incentive to retire.

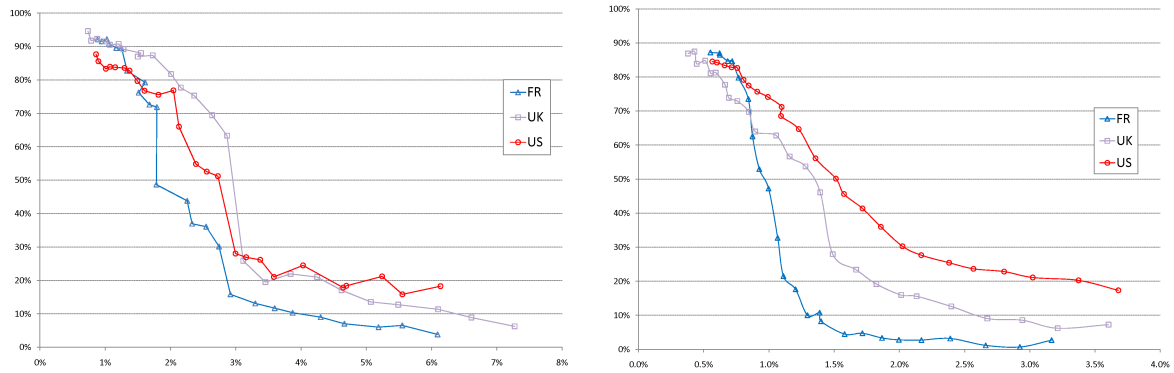
One interesting element of these comparisons is the difference at very old ages, i.e. between 65 and 74, between Americans on the one hand and British and French on the other hand. While today more than 20% of American males are working at 74, only 7% of British male do and not even 3% of French males are still attached to the labour market.

Figure 12: Male employment rate at older age



SOURCES: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 13: Male employment rate by mortality rates

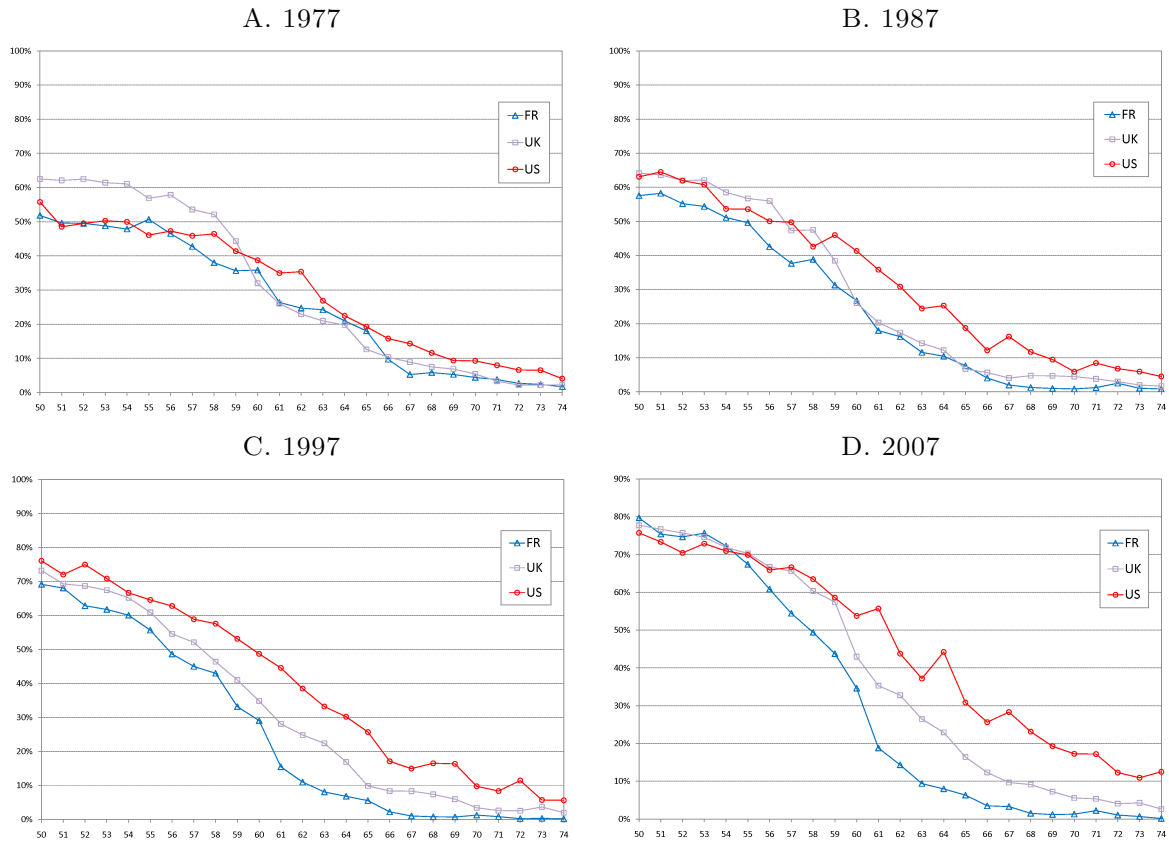


SOURCES: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 13 presents these same employment rates by mortality rates instead of age. Over the period, mortality rates at a given age have declined markedly in all three countries but more so in France and in the UK. This reinforces the labour market participation differences as the countries with lowest mortality rates are the ones where early retirement is more prevalent.

In Figure 14 we present similar graphs for females. One striking feature is that British females tend to have retirement patterns much closer to 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 10 years, when British females have experienced increased participation at all ages, while the French females, like their male counterparts, exhibit a significant drop in participation at 55 and 60.

Figure 14: Female employment rate at older age



SOURCES: Enquête Emploi, Labour Force Survey, Current Population Survey.

6 Estimating the Distribution of Elasticities

What are the implications for the distribution of labour supply elasticities of the changes in working hours we have uncovered? As an illustration of the way in which the evolution of the micro-data documented in the last section can be used to recover the distribution of labour supply elasticities, we provide an application to the UK. We use the British Family Expenditure Survey (FES) since this allows us to construct consistent series on marginal taxes, incomes, hours of work, wages and consumption for a representative sample of households from 1978 onwards mirroring the hours data in Table 2. The FES is a continuous household survey based on interview and diary data. The hours measure is usual weekly hours and has been used extensively in labour supply modelling (see Blundell et al. (2007)).

We estimate separate models for men and women and we also allow different responses at the extensive and intensive margins. Thus we allow general fixed costs of work and heterogeneity in preferences for work. We highlight differences between the extensive and intensive margins and draw implications for the aggregate hours elasticity. The approach to estimation and identification of the labour supply elasticities follows closely that in Blundell et al. (1998). We use the large changes in the relative growth of after tax wages and other incomes across different education, age and gender groups over the years 1978, 1987 1997 and 2007 to identify the distribution of wage and income elasticities. These years are buoyant years in the economy for which we expect the labour supply model to provide a reasonable approximation to observed behaviour.

6.1 Empirical Specification

We use consumption data in the FES to estimate labour supply elasticities that follow the intertemporal model outlined in section 3 above. To do this we define a measure of other income

$$\mu = C - wh \tag{13}$$

where w is the hourly after tax marginal real wage rate and C is the log of real household consumption expenditure on nondurables and services. Using this other income definition in a labour supply model allows the identification of life cycle consistent Marshallian elasticities for within period utilities, see Blundell and MaCurdy (1999, section 4). The other income variable μ will be endogenous in the labour supply model as the unobservable heterogeneity that governs the distribution of labour supply also enters consumption and

saving decisions. Our estimation approach addresses this endogeneity issue.

We assume within period preferences over consumption and hours of work h are such to generate the following semi-log labour supply model for the intensive margin

$$h = \alpha_0 + \alpha_1 \ln w + \alpha_2 (\ln w)^2 + \gamma\mu + \delta X + u \tag{14}$$

where X are a set of demographic characteristics including the age and number of children, the age of worker and his or her marital status and education. The u represents unobserved heterogeneity.[11]

To correct for selection into employment and to account for the endogeneity of the log wage, $\ln w$, and other income, μ, we follow a control function approach. We use the interactions between education, gender and year as excluded instruments as in the Blundell et al. (1998) study of married women's labour supply and tax reform. Consequently it is the differential changes across gender and education over these periods that are used to correct for selection at the intensive margin and to identify the wage and income effects. We then include a Heckman selection term λ and the error terms, v_w and v_μ, from the reduced form regressions for $\ln w$ and μ respectively. This results in the augmented labour supply model

$$h = \alpha_0 + \alpha_1 \ln w + \alpha_2 (\ln w)^2 + \gamma\mu + \delta X + \rho_w v_w + \rho_\mu v_\mu + \epsilon \tag{15}$$

which we estimate on the sample of workers replacing λ and the error terms, v_w and v_μ, with their estimated counterparts. To recover Frisch labour supply elasticities requires specifying the relationship between consumption and the marginal utility of wealth $\ln \lambda$.[12] Here we simply report the Marshallian elasticities.

Finally we model the extensive margin using a normal binary response framework allowing for general unobserved fixed costs of work. This probability is specified to depend directly on income in work, income out of work and a set of demographic and education characteristics. The measures of income in and out of work take spouses income and any other income as given. They are then computed for every individual using the IFS tax simulation model, TaxBen. For in-work income we approximate by assuming group average hours. In this illustration we also do not use consumption data to compute the extensive

[11] Stern (1986) derives the form of direct and indirect utility for these preferences.

[12] In general the within period relationship between hours and consumption (or μ) will not alone recover the Frisch elasticity, see Browning et al. (1999) and Blundell et al. (2007) for extensive reviews, and Blundell et al. (1993) for an early application.

elastcities.

6.2 Elasticity Results

We apply the labour supply specifications to the central age group 30-54 of Table 2. The models are estimated separately for men and for women. The parameter and elasticity results at the intensive margin for women line up closely with the earlier results reported in Blundell et al. (1998). Labour supply for women depends importantly on demographic composition and education. There are also significant income effects for women with children. Adjusting for the endogeneity in marginal wages, consumption and selection in to work using the differential changes in wages, taxes and other incomes across gender, education and age are all important and result in larger estimated elasticities.

As expected women with children have higher elasticities at the intensive margin than either those for women without children or those for men. Even though the data covers a much longer period than in the Blundell et al. (1998) study, the results for women with children line up very closely with those reported there. After allowing for differences in household composition, there are fewer differences between male and female labour supply. There is also little evidence of strong instability of preferences over time once we account for selection, and condition on the demographic, wage and other income effects.

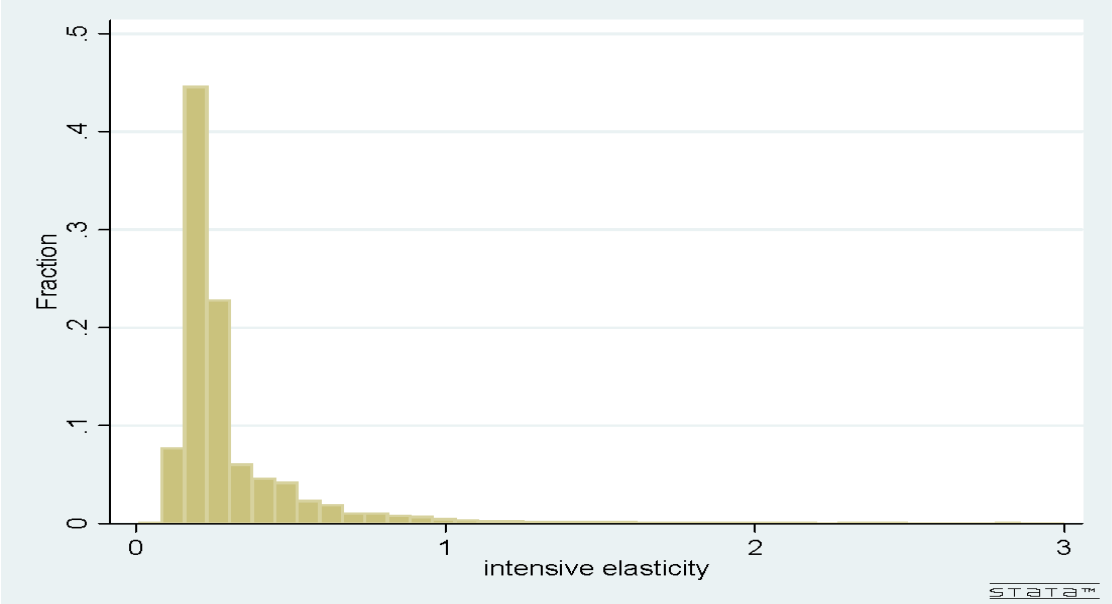
On average the intensive and extensive elasticities are relatively small for this age group. Elasticities at the extensive margin are somewhat larger than those at the intensive margin and elasticities for women at both margins are larger than those for men. The key determinant of these differences across gender is the age composition of children in the family.

Depending on the specification, the median value intensive elasticity ranges between .09 and .23 but with a wide distribution depending importantly on age and demographic characteristics. The overall distribution of elasticities at the intensive margin is presented in Figure 15.A. As noted above these are life-cycle consistent Marshallian within period intensive elasticities. Frisch elasticities are somewhat larger.

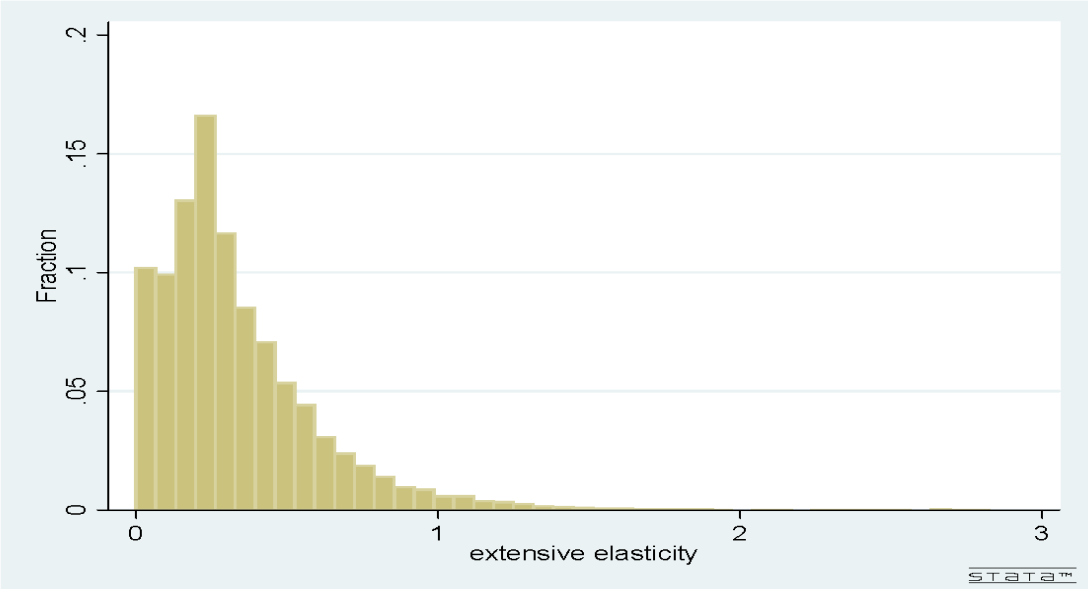
At the extensive margin we find a strong impact of potential in-work income as well as out of work income. These are both simulated using the tax and benefit model and the wage, demographic and other information. Extensive elasticities are larger for women than men, the median elasticity for women being around .34 and that for men of around .25. An overall extensive elasticity with a median of .3 and an interquartile range between .13 and .37. The complete distribution of extensive elasticities is presented in Figure 15.B.

Figure 15: Elasticity Distribution: Prime-age men and women (30-54) in the UK

A. Intensive Elasticity



B. Extensive Elasticity



Notes: Authors calculations from estimated models. Detailed model estimates and standard errors available from the authors

Using the empirical distribution of the wages, characteristics and unobserved heterogeneity we can use the empirical analog of equation (7) to compute the aggregate elasticity

for total hours. This overall hours elasticity for this age 30-54 group of men and women lies in the range .3 to .44.

7 Conclusions

In this paper we have proposed a systematic way of examining the importance of the extensive and the intensive margins of labour supply in explaining the overall movements in total hours of work over time. 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 40 years. We have shown that the extensive and intensive margins both matter in explaining changes in total hours.

The analysis has highlighted some key differences in behaviour at the intensive and extensive margins. For example, the overall trend in employment rates for women is strikingly similar and has almost doubled in all three countries. The intensive margin, on the other hand, offers a completely different picture. American married women have not only increased their participation, but also their mean annual hours of work, while French women have seen their average hours decline markedly. The UK also stands apart with married women hours of work below those of their French counterpart but also markedly below the hours worked on average by American married mothers.

The contribution to the aggregate of the hours worked by the young and prime age men is negative in all countries, with a larger decline in France than in the UK than in 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 extensive margin for prime-age men in Britain and in France also falls more than in the US, although there are declines in the US too.

The changes among the young are sizable and predominantly negative. In France and the UK there are large falls for young men at both the extensive and intensive margins. In France this is associated with a much higher recorded unemployment rate for youth than 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 large decrease in hours per worker in France, similar in UK, contrasting with an increase in the US. There are falls at the extensive and

intensive margin for UK men but increases at the extensive margin for UK women. The contrast with the US is stark. At all margins and for both genders the bounds point to positive changes for older workers.

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Appendices

A. Measurement Issues

A.1 The data sources available

The sources of data to measure hours worked are diverse, at least in the form of secondary data sets. The macroeconomic literature relies mostly on three main secondary sources: the Organization for Economic Cooperation and Development (OECD) series, the US Bureau of Labor Statistics (BLS) series and the Conference Board (CB) series.[13] For instance, Prescott (2004) uses the OECD database while Rogerson (2007, 2008) and Ohanian et al. (2008) use data from the CB series. All these databases rely on various primary sources. In particular the estimates for our three countries of interest are based on different primary sources and also different methodologies (see Appendices A.5 and A.6).

There are four main types of primary sources on hours of work: administrative data, establishment surveys, labour force surveys and time use surveys. Each has advantages and drawbacks that have been identified by labour statisticians, for instance Fleck (2009).

- Administrative data generally report contractual or paid hours, on a per job basis and for a subset of the economy. It therefore includes hours not worked and excludes unpaid hours. The French *Déclaration annuelle des données sociales* (DADS) is an example of such administrative data but no similar data set is available for the UK or the US. Other administrative data can be used to measure weeks worked in a year: on days of strike, sick leaves, mandatory holidays etc. Generally these data are only available at the aggregate level and their availability depends largely of the type of institutions monitoring paid leave or other periods of absence from work.

- Establishment surveys report paid hours of work, including overtime but also sick leaves and holidays. They are reportedly reliable given that firms are supposed to have a good view on the hours of work of their employees. The main problem is that they do not cover the entire population and exclude self-employed, the public sector, temporary workers and also sometimes supervisory employees. Examples of such surveys are the UK Annual Survey of Hours and Earnings (ASHE), the French *Activité et Conditions d'Emploi de la Main d'Oeuvre* (ACEMO) and the Current

[13]The Conference Board series were first developed by the University of Groningen under the name Groningen Growth and Development Center (GGDC) series and are now maintained and updated by the Conference Board, `http://www.conference-board.org`.

Employment Survey (CES) in the US.

- Labour Force surveys have the advantage of covering the entire population and reporting the actual hours of work per employee even when they work at two or more different jobs. The main problem with these surveys is that they have not always been continuous over the year and thus have not been very good in capturing the variations of hours worked within the year - at least for earlier years. Another often drawback is that hours of work are self-reported, and usually judged to be an overestimation of actual hours. The biggest advantage, however, is that these surveys have comprehensive information on households demographics, education and other background characteristics that are missing from other sources.

- Time use surveys have been designed to report all activities, especially paying attention to the time committed to leisure versus home production. They are also generally based on time diaries that are found to be more reliable than standard recall questions, but cover shorter reference period, i.e. one or two days.[14]

A.2 The data we use

The data that we have used in this paper come from the entire series of the French Labour survey, the Enquête Emploi (EE), for the years 1968 to 2008, a similarly designed survey in the UK, the Labour Force Survey for the years 1975 to 2008, supplemented by the older Family expenditure survey (FES) which covers the years 1968 to 2008. US data come from various editions of the Current Population Survey (CPS) for the years 1968 to 2008.[15] The French EE is an annual survey between 1968 and 2002, usually taking place in March (except during Census years), and a continuous survey from 2003 onwards. The British LFS is biannual from 1975 to 1983, annual between 1984 and 1992 and continuous from 1993 onwards. The US CPS is continuous from 1976 onwards and otherwise available since 1962 in March and 1967 in May.[16]

[14]See for instance recent work on US data by Aguiar & Hurst (2007).

[15]We use the March CPS data from the University of Minnesota (IUPMS-CPS), available at `http://cps.ipums.org/cps/`. The Basic Monthly CPS we use is from the National Bureau of Economic Research (NBER), available at `http://www.nber.org/cps/`. The LFS we use has been provided by UK Data archive, available at `http://www.data-archive.ac.uk/`. The EE is available through the INSEE, La Statistique publique, available at `http://www.statistique-publique.fr` and the Réseau Quetelet (French Data Archives for social sciences), available at `http://www.reseau-quetelet.cnrs.fr`.

[16]We use the continuous CPS only from 1989 onwards, as only from that date are variable dictionaries available on the NBER website.

Tables 3, 4 and 5 present the sample size of these surveys by year and month of interviews. They highlight the fact that it is only recently that continuous surveys are available for these three countries and that for most of the earlier years, annual surveys have to be relied upon.

Table 3: Number of observations by month of interview (EE)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1968	0	0	0	99,314	169,439	86,206	0	0	0	0	0	0	354,959
1969	0	14,800	102,961	520	0	0	0	0	0	0	0	0	118,281
1970	0	27,743	89,760	1,082	0	0	0	0	0	0	0	0	118,585
1971	0	30,974	87,935	985	0	0	0	0	0	0	0	0	119,894
1972	0	70,055	48,589	631	0	0	0	0	0	0	0	0	119,275
1973	0	66,476	51,535	505	0	0	0	0	0	0	0	0	118,516
1974	0	66,228	52,335	497	0	0	0	0	0	0	0	0	119,060
1975	80	27	3,171	110,985	5,171	109	13	2	21	6	2	11	119,598
1976	158	79,785	41,230	213	26	5	11	20	3	0	10	31	121,492
1977	8,007	113,143	575	12	54	3	2	0	0	0	0	43	121,839
1978	2,022	114,580	3,296	36	199	0	0	4	0	0	0	129	120,266
1979	41	108,889	12,274	335	0	0	3	3	0	0	0	31	121,576
1980	7,928	113,540	1,195	175	0	0	2	4	11	0	0	99	122,954
1981	4,441	117,206	1,246	231	2	4	11	2	61	0	0	48	123,252
1982	0	0	0	125,070	0	0	0	0	0	0	0	0	125,070
1983	0	0	125,172	0	0	0	0	0	0	0	0	0	125,172
1984	0	0	125,274	0	0	0	0	0	0	0	0	0	125,274
1985	0	0	125,135	0	0	0	0	0	0	0	0	0	125,135
1986	0	0	125,369	0	0	0	0	0	0	0	0	0	125,369
1987	0	0	126,454	0	0	0	0	0	0	0	0	0	126,454
1988	0	0	127,110	0	0	0	0	0	0	0	0	0	127,110
1989	0	0	127,127	0	0	0	0	0	0	0	0	0	127,127
1990	117,885	8,462	1,068	0	0	0	0	0	0	0	0	223	127,638
1991	0	40,361	88,285	0	0	0	0	0	0	0	0	0	128,646
1992	0	40,496	91,450	0	0	0	0	0	0	0	0	0	131,946
1993	0	34,426	102,760	0	0	0	0	0	0	0	0	0	137,186
1994	0	74,185	67,141	0	0	0	0	0	0	0	0	0	141,326
1995	0	64,324	76,788	0	0	0	0	0	0	0	0	0	141,112
1996	0	45,884	94,866	0	0	0	0	0	0	0	0	0	140,750
1997	0	46,714	92,759	0	0	0	0	0	0	0	0	0	139,473
1998	0	42,981	97,089	0	0	0	0	0	0	0	0	0	140,070
1999	110,011	0	0	0	0	0	0	0	0	0	0	29,757	139,768
2000	0	61,716	76,337	0	0	0	0	0	0	0	0	0	138,053
2001	0	45,943	89,334	0	0	0	0	0	0	0	0	0	135,277
2002	0	47,510	85,622	0	0	0	0	0	0	0	0	0	133,132
2003	21,041	20,434	25,337	20,828	19,907	24,608	19,078	19,610	25,082	20,710	20,214	25,113	261,962
2004	21,252	20,587	25,619	21,276	25,290	19,883	19,443	24,793	20,264	19,371	23,364	24,210	265,352
2005	26,473	20,356	20,277	20,888	25,498	19,771	18,907	24,874	20,013	25,186	20,093	19,478	261,814
2006	25,430	20,371	20,478	20,255	25,006	19,590	23,234	19,584	19,907	25,011	19,891	20,103	258,860
2007	26,203	20,808	20,804	26,273	20,899	20,506	24,369	20,059	20,431	25,950	20,241	20,476	267,019
2008	21,309	20,738	25,950	20,831	20,597	24,972	19,508	19,996	25,066	20,606	20,245	25,642	265,460

A few words are in order to assess the general comparability of these data sets.

- *Difference in coverage:* In all three surveys, the sample is the non-institutional population. This means that penal and mental facilities are excluded from the sample. The gap in incarceration rates between Europe and the US has increased over the last ten years and is very much concentrated in younger individuals.[17]

- *The Armed Forces:* The CPS is supposed to cover the civilian population and therefore excludes the Armed forces. The IUPMS-CPS we use has recoded the Armed

[17]The incarceration rate (per 100,000) in 2008 was 740 in the US, 154 in England and Wales and 96 in France.

Table 4: Number of observations by month of interview (LFS)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1975	0	0	0	126,861	116,386	112	0	0	0	0	0	0	243,359
1977	0	0	0	42,506	187,861	11,037	0	0	0	0	0	0	241,404
1979	0	0	0	0	165,220	62,185	1,164	0	0	0	0	0	228,569
1981	0	0	0	50,863	174,072	10,161	0	0	0	0	0	0	235,096
1983	0	0	0	116,287	98,824	2,834	0	0	0	0	0	0	217,945
1984	0	0	83,470	133,828	112,086	0	0	0	0	0	0	0	329,384
1985	0	0	52,453	58,018	55,765	0	0	0	0	0	0	0	166,236
1986	0	0	57,468	57,214	51,409	0	0	0	0	0	0	0	166,091
1987	0	0	56,114	54,293	52,113	0	0	0	0	0	0	0	162,520
1988	0	10,312	46,443	56,060	52,327	0	0	0	0	0	0	0	165,142
1989	0	10,084	48,669	66,803	39,498	0	0	0	0	0	0	0	165,054
1990	0	9,393	48,219	60,799	41,887	0	0	0	0	0	0	0	160,298
1991	0	9,067	54,615	52,339	42,046	0	0	0	0	0	0	0	158,067
1992	0	0	45,180	49,602	64,832	45,576	46,039	57,726	45,908	46,643	58,829	46,359	503,373
1993	59,148	47,142	46,553	46,867	58,865	46,470	46,230	58,181	46,043	57,950	46,327	45,961	605,737
1994	57,905	46,131	46,804	46,523	58,261	45,374	56,747	45,345	45,327	56,956	45,720	46,451	597,544
1995	58,787	47,106	47,039	59,277	47,433	46,889	58,991	47,003	46,400	58,813	47,171	57,554	622,463
1996	47,126	47,414	58,022	46,969	47,113	57,637	46,783	46,415	57,339	46,212	46,465	56,957	604,452
1997	46,349	46,269	45,373	45,245	46,268	55,812	44,820	56,491	44,905	44,436	56,758	44,113	576,839
1998	44,730	45,543	55,326	44,295	56,560	44,274	44,263	55,636	44,017	44,601	55,799	44,012	579,056
1999	55,784	44,302	44,059	43,994	55,004	43,745	43,445	54,326	43,356	54,769	43,312	42,947	569,043
2000	55,023	43,280	42,728	54,279	43,059	42,262	53,470	41,911	41,519	52,704	41,832	51,108	563,175
2001	42,210	41,691	41,062	53,213	41,613	41,601	52,940	41,463	52,313	43,120	42,202	52,371	545,799
2002	42,891	42,198	52,208	42,404	41,543	51,956	41,346	40,554	51,370	40,754	40,490	50,115	537,829
2003	40,563	40,611	50,368	39,736	40,313	50,074	39,094	49,255	39,882	38,971	49,097	38,824	516,788
2004	38,618	39,638	38,648	38,477	48,485	38,378	38,071	47,705	38,113	48,584	38,587	37,672	490,976
2005	48,398	38,613	37,278	37,855	48,008	37,454	47,088	37,428	37,127	46,821	37,375	36,401	489,846
2006	46,593	37,503	36,751	46,519	37,396	36,736	45,598	37,039	36,283	45,728	37,304	45,542	488,992
2007	36,778	37,576	36,414	45,981	37,302	37,096	45,587	36,893	46,491	36,688	36,758	45,698	479,262
2008	36,908	36,953	45,778	36,354	36,499	45,532	35,821	44,601	26,865	35,971	45,961	35,075	462,318

Table 5: Number of observations by month of interview (CPS)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1968	0	0	99,238	0	0	0	0	0	0	0	0	0	99,238
1969	0	0	100,589	0	0	0	0	0	0	0	0	0	100,589
1970	0	0	96,275	0	0	0	0	0	0	0	0	0	96,275
1971	0	0	98,080	0	0	0	0	0	0	0	0	0	98,080
1972	0	0	95,122	0	0	0	0	0	0	0	0	0	95,122
1973	0	0	93,172	0	0	0	0	0	0	0	0	0	93,172
1974	0	0	92,341	0	0	0	0	0	0	0	0	0	92,341
1975	0	0	90,621	0	0	0	0	0	0	0	0	0	90,621
1976	0	0	94,572	0	0	0	0	0	0	0	0	0	94,572
1977	0	0	113,113	0	0	0	0	0	0	0	0	0	113,113
1978	0	0	110,805	0	0	0	0	0	0	0	0	0	110,805
1979	0	0	110,431	0	0	0	0	0	0	0	0	0	110,431
1980	0	0	130,721	0	0	0	0	0	0	0	0	0	130,721
1981	0	0	131,105	0	0	0	0	0	0	0	0	0	131,105
1982	0	0	117,979	0	0	0	0	0	0	0	0	0	117,979
1983	0	0	118,243	0	0	0	0	0	0	0	0	0	118,243
1984	0	0	117,206	0	0	0	0	0	0	0	0	0	117,206
1985	0	0	117,690	0	0	0	0	0	0	0	0	0	117,690
1986	0	0	115,218	0	0	0	0	0	0	0	0	0	115,218
1987	0	0	113,731	0	0	0	0	0	0	0	0	0	113,731
1988	0	0	114,371	0	0	0	0	0	0	0	0	0	114,371
1989	103,198	102,796	101,318	103,578	104,568	105,107	105,645	106,159	107,012	108,338	109,197	109,342	1,266,258
1990	109,547	109,408	109,098	110,196	110,508	109,415	109,839	109,573	110,267	110,132	110,103	110,133	1,318,219
1991	108,931	108,990	108,519	108,992	108,718	107,931	107,941	108,342	108,883	108,663	108,501	108,493	1,302,904
1992	107,608	107,896	106,512	106,218	106,938	106,258	106,387	106,639	106,564	106,547	106,569	106,664	1,280,800
1993	105,689	106,162	105,449	105,433	105,256	105,089	104,956	104,805	105,285	105,017	104,591	104,038	1,261,770
1994	102,106	101,791	101,351	102,162	101,770	101,321	101,067	100,535	100,371	101,508	101,577	101,008	1,216,567
1995	101,871	100,640	100,355	100,547	101,100	101,569	101,579	101,822	98,002	97,941	97,559	95,807	1,198,792
1996	87,334	87,124	86,974	88,260	87,950	88,620	88,638	88,993	89,467	89,645	89,869	89,918	1,062,792
1997	89,095	88,016	88,001	88,419	88,921	89,139	88,564	89,199	89,829	89,636	89,813	88,633	1,067,265
1998	89,113	88,250	87,689	88,582	89,295	89,175	89,256	89,306	89,488	89,711	90,184	89,658	1,069,707
1999	89,661	88,820	88,048	88,749	88,971	89,467	89,520	90,277	90,616	90,663	91,584	90,226	1,076,602
2000	90,789	89,803	88,761	89,770	89,733	89,544	89,497	89,587	89,261	89,419	88,916	88,781	1,073,861
2001	88,225	87,180	85,744	86,284	86,779	86,777	104,430	104,980	105,298	105,324	104,770	104,269	1,150,060
2002	104,196	103,369	102,495	104,138	104,311	104,401	104,922	104,835	105,426	105,504	105,570	105,233	1,254,400
2003	104,689	104,175	103,923	104,643	104,584	103,417	103,045	102,943	103,639	103,088	102,925	102,491	1,243,562
2004	102,453	103,049	101,791	101,907	102,152	101,380	100,449	101,503	101,607	102,613	103,283	102,240	1,224,427
2005	102,753	101,617	100,330	101,467	101,804	101,852	102,001	101,887	100,869	101,897	101,775	100,741	1,218,993
2006	101,098	100,709	99,697	100,862	100,613	100,545	101,378	102,109	101,255	101,348	101,317	100,658	1,211,589
2007	99,700	99,253	98,870	100,467	100,944	100,565	100,317	100,145	100,128	99,759	100,039	99,531	1,199,718
2008	99,903	99,950	99,026	100,077	100,346	100,412	100,324	100,376	99,467	99,392	98,833	97,654	1,195,760

Forces in the population but information on hours of work is not available for this group.[18]

- *Survey weights:* Each national office uses a different methodology to compute weights - and they matter. For instance, the weights used by the US Bureau of Labor Statistics (BLS) are different from the weights recommended by IPUMS but the former are used in the series provided to the OECD. The BLS weights give higher employment rates for more recent years that the person weights recommended by IPUMS.

We look into more details issues surrounding the measurement of the extensive and intensive margin in Appendices A.3 and A.4.

A.3 The extensive margin

Labour Force surveys have relatively good quality data to measure participation to the labour force as they are primarily designed for this objective. Comparability across countries is also considered reliable as there have been efforts from an early stage to harmonize standards and definition. Recommendations from the International Labor Organization (ILO) have been in place since the first convention of 1962, followed by later improvements. The standard definition of employment is whether the person has worked at least one hour in the week of reference or was not working but had a job from which the individual was temporarily absent.

We should not conclude however that employment is a perfect measure especially for those groups at the margin between employment and inactivity. For instance Labour Force surveys, following recommendations by ILO, consider government schemes and on the job training programmes as included in the employment status. The measure of these schemes and the exact classification of a training programme as being on the job as opposed to be in education is sometimes difficult. More generally the exact classification between school and employment is not always consistent across country and across time. When the UK LFS was started, individuals were first asked whether their main activity was full-time education and if not they were not considered employed, even if they had a job. Later the questions were changed to incorporate ILO recommendations of measuring any kind of employment whatever the education status.

[18]This poses a problem of comparability of hours worked and employment rates which might not be on the same sample. Armed Forces in the CPS represent 0.6% of the 1968-2008 sample.

Another issue is that the ILO definition of employment takes the week as the reference period. With our definition of the extensive margin, i.e. the fraction of the reference period, 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 the individual is employed or self-employed. If one notes ($p_{itw} = 1$) the dichotomous variable denoting employment or self-employment status in the reference week w for individual i in year t, our measure of the extensive margin p_{it} is

$$p_{it} = \frac{1}{52} \sum_{w=1}^{52} (p_{itw} = 1) \tag{16}$$

In order to measure p_{it} with Labour Force surveys, one need additional information on the duration of employment during the civil year. Most surveys, including annual surveys, have questions on employment tenure or duration of inactivity that make it possible to recover a measure of the share of the past year in employment. In the US, the CPS asks respondents precisely the number of weeks over the last year for which they have been employed.[19] A general issue with this approach is that the employment status is much less precisely defined than for the reference week and the reference period depends also on the date of interview.

A simple and common alternative is to measure the extensive margin as the share of a given population employed at a given time, i.e. the employment rate $\overline{p_{jt}}$ of group j in year t is simply

$$\overline{p_{jt}} = \frac{1}{52} \sum_{w=1}^{52} \sum_{i \in j} (p_{itw} = 1) = \sum_{\in j} p_{it} \tag{17}$$

If interview are carried out uniformly in all weeks of the year, the two measures will be similar at the aggregate level, as exemplified by equation (17). Using continuous labour force surveys, the employment rate is likely to be a good measure of the extensive margin as previously defined. When using annual surveys, this approach will lead to a measurement error, likely to be bigger if large seasonal employment patterns are to be observed.

[ADD here some description of the two measures for recent years?]

A.3 The intensive margin

The intensive margin, i.e. annual hours of work for those in work, is much harder to measure consistently. International efforts to come up with comparable estimates have

[19] This variable is inappropriately called "number of weeks worked" as it really refers to weeks employed.

lagged behind those put in place for the measure of employment. The recommendation from ILO to use annual hours actually worked dates only from the 18th International Conference of Labour Statisticians, held in the fall of 2008. Historical series are fraught with concerns for a number of reasons:

1. *Hours reported:* Hours reported in Labour Force surveys are believed to be overestimates of real hours of work. They are higher than hours reported by employers (which report contractual or paid hours) and also higher than hours of work measured by time use surveys. More worrying still is the fact that US time use surveys tend to report higher decline in hours of work than the one observed from CPS data (see for instance Juster & Stafford (1991) and Aguiar & Hurst (2007)).

2. *Annual versus weekly hours:* As mentioned above, continuous surveys are not available for earlier years and we therefore do not have information all weeks of the year. This is a major issue to capture seasonal variations in hours worked, especially at times of holidays and other periods of leave.

There are two main ways to compute annual hours of work using Labour Force surveys. The first consists in using the *actual hours* of work in the reference week (which will be zero if on leave but employed). 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. For recent years, with continuous surveys over the entire year, the annual average actual hours of work is therefore considered relatively reliable. However, given that most surveys have started as annual surveys, generally in spring to maximize the availability of workers, historical series will overestimate the weeks worked in the year, as Summer and Christmas leaves are generally not included. This will be particularly important in countries where weeks worked have changed substantially over time like France.

The alternative approach consists in using *usual hours* of work declared in the survey and another measure of the number of weeks worked during the year, using various measures of days on leave (holidays, maternity leave, sickness leave etc.). The latter is only rarely available in Labour Force surveys, which explains the recourse to establishment or administrative data mentioned above. It is worth stressing here that the number of weeks worked per year is very difficult to measure and often simply no data is available (see for instance the description of OECD data in appendix A.5). Importantly the concept of usual hours does not capture average actual hours, it is supposed to describe hours worked in an

usual period of reference, when there is no unusual events like overtime or days of leave.

Our estimates of annual hours worked rely on the continuous surveys (available since 1989 for the US, 1992-93 for the UK and 2002 for France). We measure total actual hours as the annual average of the weekly measure of actual hours. It is important to stress that we can recover aggregate total annual hours with this method as continuous surveys sample equally each week of the year. But we cannot measure annual hours at the individual level. Recent Labour Force surveys have made progress in asking detailed questions about periods of leave in the year, but these remain limited.

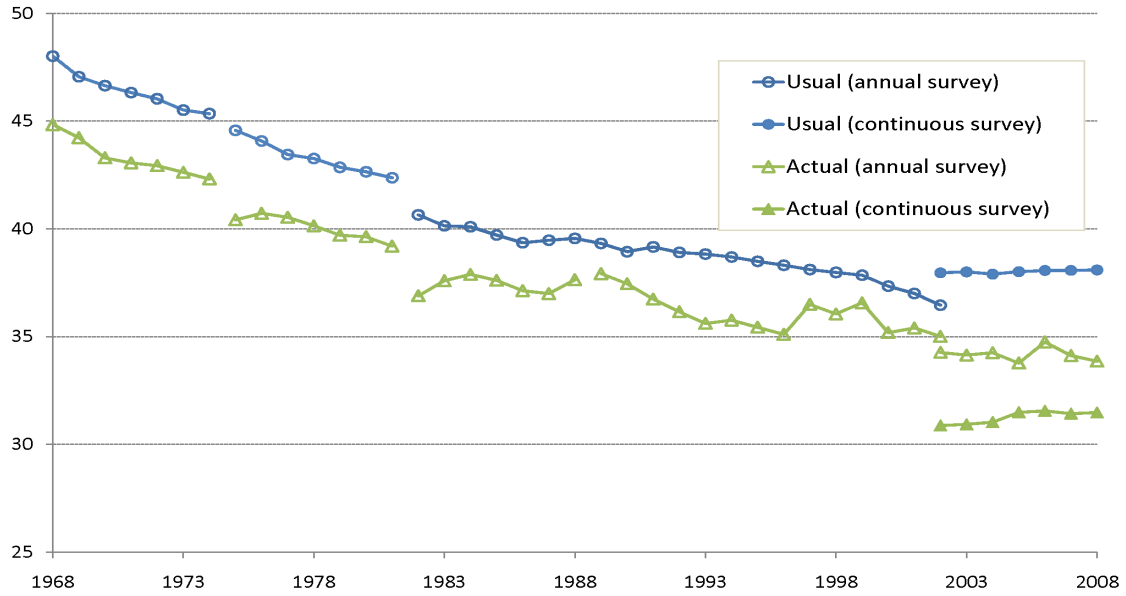
For earlier years, when continuous surveys are not available, we use actual hours of work for the UK and the US and we make an adjustment for the two series. In the case of France we use usual hours of work up to 2002 and we obtain an annual average by multiplying by an estimation of the number of weeks worked in 2002. We compute this number of weeks worked by age, sex, employment status, marital status and number of children by comparing for each cell the average usual hours of work in the annual survey and the annual actual hours of work. This estimate is likely to be biased downward for earlier years when the number of weeks worked is likely to have been higher than in 2002. In order to minimize this bias, we adjust the entire series using the trend in hours per worker from the French national accounts. This captures changes in the trend of weeks worked during that period. We do not capture with this procedure differential changes in weeks worked across different individuals.

Figure 16 contrasts the series of actual hours and usual hours that are available using the annual and continuous Labour Force surveys in France. The actual hours series is significantly lower using the continuous survey as it incorporates the low level of hours worked during the summer months in France. Actual hours from the annual survey are much more variable than usual hours, in parts because they vary with the month of interview. For instance the survey was carried out in April (incorporating Easter) in 1975 and 1982, leading to a bigger difference between usual and actual hours in these two years.

Another point, worth mentioning when looking at Figure 16, is the fact that there are discontinuities in the survey series, when hours questions were changed. We list below the main issues for the French case:

- During the 1968-1981 series, there is no question on usual hours. Respondents are asked about their actual hours, and then INSEE creates a series of usual hours of work which equals actual hours for those who have more than 45 hours or who work less than 45 hours on permanent basis (i.e. excluding the individuals who report

Figure 16: Usual versus actual weekly hours (France)



NOTES: The annual survey takes place mostly in March (with some exceptions, e.g. 1968, 1975, 1982, 1990 and 1999). The series of actual hours noted "annual survey" for the years 2002 to 2008 corresponds is based on the March respondents from the continuous survey. The sample consists in individuals aged 16 to 74.

SOURCE: Enquête Emploi.

low hours on temporary reasons). From 1982 onwards, the question related to usual hours is only asked to individuals who say they have usual hours, so that individuals who have variable hours are excluded.

- Actual hours in the 1968-1974 series relate to all professional activities whereas the 1975-1989 series relates to main activity. With the 1990-2002 series, a question related to the secondary activity is asked, while since 2003 questions on hours worked in a possible third and fourth occupations are also asked.

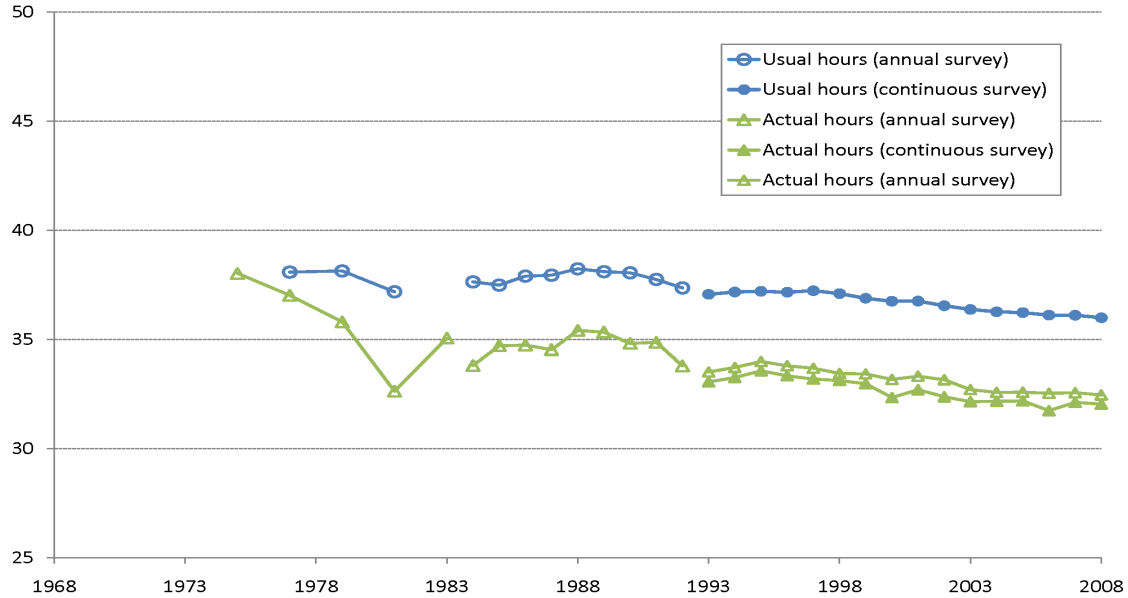
We present similar comparisons for the UK in Figure 17. The continuous survey starts in 1993 and we can therefore use actual weekly hours for a longer time period. The annual survey, before 1992, takes place during the spring quarter which is representative of UK annual hours of work. For years between 1975 and 1983, LFS is biannual and also considered less reliable.[20] We list below the main issues with the measure of hours of work in the LFS:

[20]For instance, the OECD does not use the LFS before 1984. More details in section A.5

- The question on hours of work is not based on international definitions until 1984. In 1975 respondents are asked about their actual weekly hours of paid work in main and subsidiary activities, including paid overtime hours and paid meal breaks. From 1977 to 1983, it excludes meal breaks and only from 1984 does the question includes both paid an unpaid overtime hours.

- Usual hours are only asked about the main activity and excludes unpaid overtime.

Figure 17: Usual versus actual weekly hours (UK)



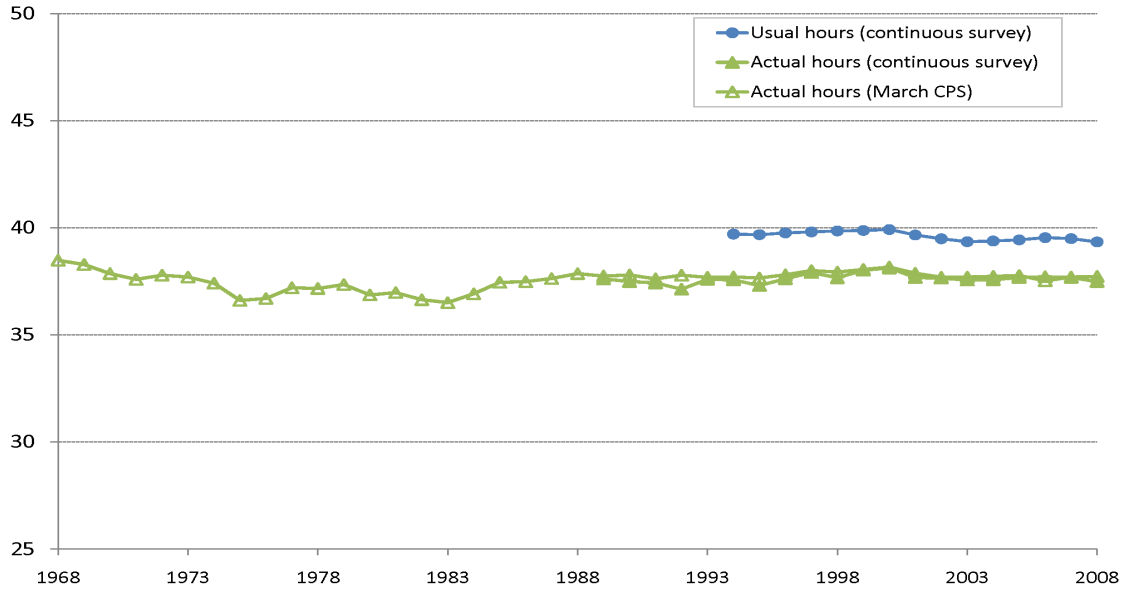
NOTES: The annual survey takes place in the spring. Usual hours relates to the main activity while actual hours relate to all activities. The sample consists in individuals aged 19 to 74.

SOURCE: Labour Force Survey.

We present similar comparisons for the US in Figure 18. We do not represent usual hours for the period 1989-1993 as the sample of respondent to this question is particularly low.

[ADD details on CPS measures]

Figure 18: Usual versus actual weekly hours (US)



NOTES: We use the March CPS for the annual survey and the continuous survey is used only from 1989 onwards (it is available from 1976 onwards). The sample consists in individuals aged 16 to 74.

SOURCE: Current Population Survey; March CPS from IPUMS-CPS, Basic Monthly CPS from NBER.

A.4 A note about the "35 hours week" in France

The "35 hours week" implemented in France since 2000 has been much discussed but the details of its implementation are rarely known outside of France.

First of all the law is not a mandatory limit in the number of weekly hours of work: it is the definition of the normal weekly hours above which the rate of overtime hours has to be paid. Second the limit is actually not computed on a weekly basis but on an annual basis. Firms could decide to keep the 39 hours week and provide additional days of holidays. The annual limit was put at 1600 hours per year. The regulation made a stark distinction between blue workers who benefited from the 35 hours week and white collars who were not subjected to weekly hours but who received compensation holidays which could be paid in cash or accumulated in "time accounts" (days called "RTT" i.e. the French acronym for "reduction of working time"). Third not all firms have had to comply to the regulation, in particular small firms (less than 20 employees) have not been subjected to the same regulation.

The regulation has had an impact on the measurement of hours of work in France. Employers have started to count hours more strictly - coffee pauses or smoking breaks were not included anymore in "hours worked" - and the distinction between weekly hours and number of weeks worked has been blurred by the wide possibilities of additional holidays or RTT.

These changes have made it even harder to measure in a robust way the actual changes in labour supply. The French labour force survey (annual up to 2002) show unchanged actual hours of work in the first years of the "35 hours week" introduction and a slight decline in usual hours of work. The new continuous survey asks a flurry of questions distinguishing the usual hours of work from the normal hours of work and comparison between the two surveys show that respondents may have been confused by the change.[21]

A.5 Comparison with OECD series

In order to compare OECD series with our series, it is worth recalling the methodology and data sources used by the OECD Secretariat.

- For the US, the annual hours series are unpublished data derived from an establishment survey, the Current Employment Statistics (CES), for production and non-

[21] Usual hours worked in March have been falling pre-2002, with an increase of respondent saying their usual weekly hours is 35. This decline is completely reverted in the continuous survey where individuals can make the distinction between normal and usual weekly hours.

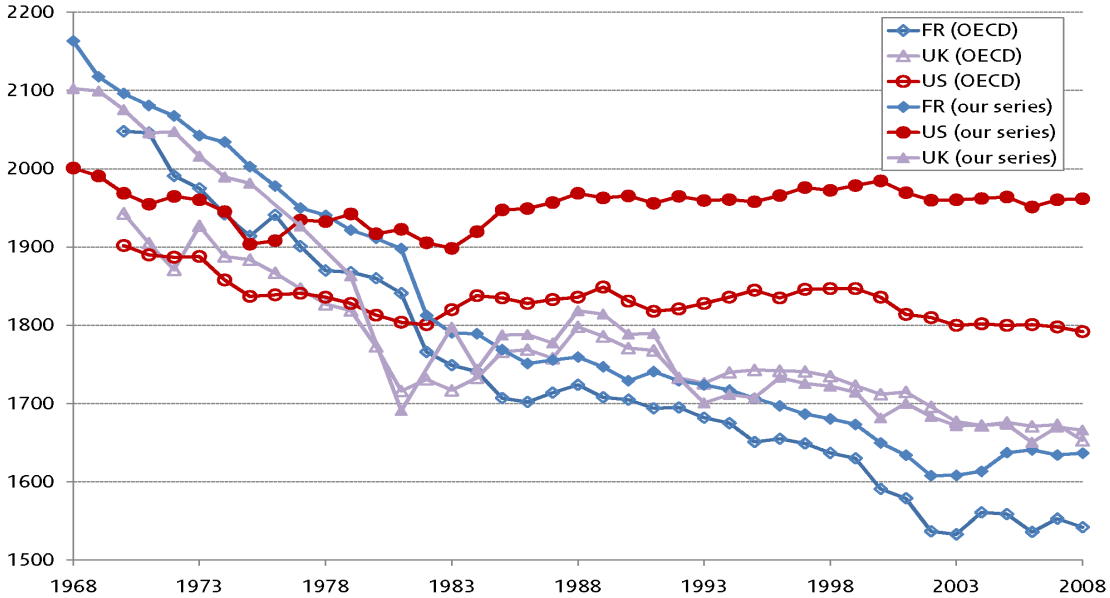
supervisory workers in private sector jobs and from the Current Population Survey (CPS) for other workers. For the establishment-based source, data on paid hours for the non-agricultural sector are then adjusted to hours actually worked on the basis of ratios of hours worked to hours paid obtained from the Hours at Work Survey (of establishments) until 2000 and the National Compensation Survey (NCS) since then. The OECD Secretariat converts this hours per job series to a hours per worker series by multiplying the job-based annual hours of work by (1 + CPS based share of multiple jobholders in total employment).

- For the UK, the annual series are average hours actually worked per week annualised multiplying by 52 weeks. From 1970 to 1983, the trend corresponds to estimates by Maddison (1980) who uses data from an establishment survey, the New Earnings Surveys (NES). For 1984 to 1991, the trend in the data is taken from the annual Labour Force Survey and from 1992 onwards the levels are derived directly from the continuous Labour Force Survey.

- For France, the series are supplied by INSEE following the methodology used in national accounts (Bouvier (2008)). For each sector of the economy, total hours worked are obtained by multiplying estimates of normal weekly hours of work for full-time workers by the number of full-time equivalent employees and an estimate of weeks worked in the year. Normal weekly hours of work come from establishment surveys (ACEMO data) and the Labour Force survey (the *Enquête Emploi*) for the sectors not covered by the establishment surveys, i.e. self-employed, public sector, agriculture. Given that the Labour force surveys give generally higher hours worked, the data from the EE are scaled down by 8%. Weeks actually worked are measured by deducting from 52 various periods of leaves, e.g. holidays and bank holidays (using legal entitlements and legal bank holidays), sick leave, maternity leave and work accidents (using data on paid days from the public health insurance) and strikes (using data from the Employment Ministry).

As should be clear from the previous description, the OECD series (and similarly the BLS and GGDC series) does not rely on a consistent source for our three countries of interest, even though the various sources are known to lead to systematic differences. The OECD Secretariat is fully aware of these issues and warns users not to compare across countries hours of work in levels but unfortunately this advice is often forgotten by analysts.

Figure 19: Hours worked per person employed (OECD versus Labour Force surveys)



NOTES: OECD data are based on national accounts for France, establishment surveys for the US and LFS for the UK. Our series is based on the sample of 16 to 74 years old.

SOURCES: OECD, Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 19 contrasts series of annual hours of work per employed from the OECD database and our series based on Labour Force surveys. For France and the US, the trends are similar but the OECD data lead to fewer hours of work. For the UK - unsurprisingly given the source and the methodology are similar - the estimates are very close. They are slightly lower in the OECD data since 1993 as we keep using the March to May reference month while the OECD uses the yearly average. For years prior to 1984 we have higher hours than the number from Maddison (1980), which relied on the New Earnings Survey.

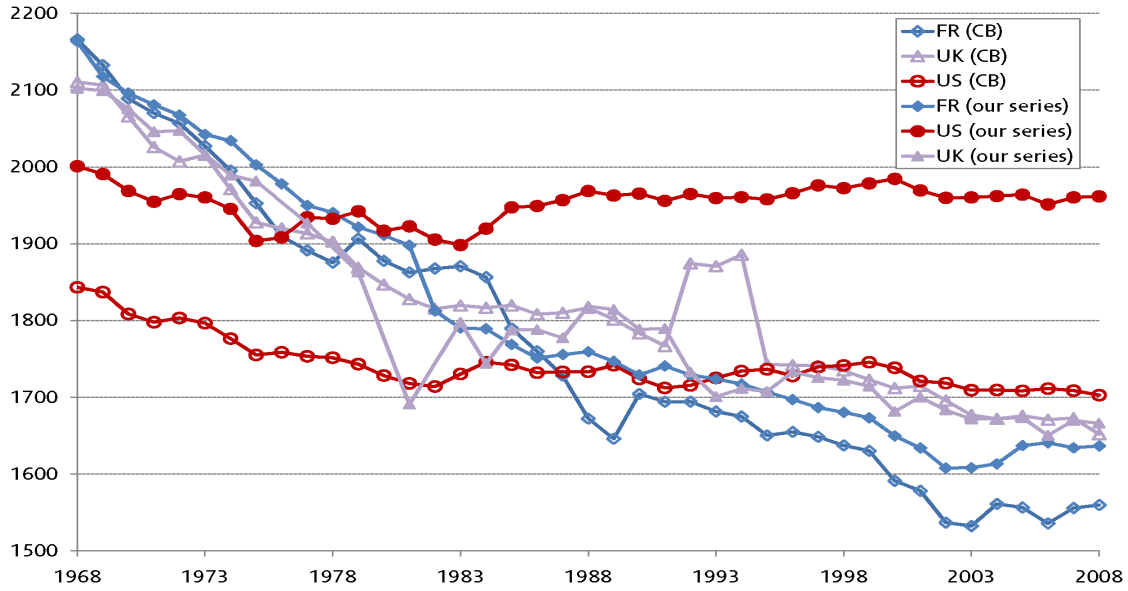
A.6 Comparison with Conference Board series

Macroeconomists often use the datasets on employment and hours worked compiled by the Conference Board.[22] The Conference Board uses itself mostly secondary sources like the OECD datasets, Eurostat National Accounts or other sources. For instance for France annual hours of work come from Eurostat for the years 1978 to 2009 and NIESR for the years pre 1978. For the UK Eurostat National Accounts are used from 1991 onwards while

[22]The database where information on annual hours can be found is the Conference Board Total Economy Database, `http://www.conference-board.org/data/economydatabase/`.

NIESR is used for years before 1990. For the US the BLS series is used since 1950.

Figure 20: Hours worked per person employed (Conference Board versus Labour Force surveys)



NOTES: CB stands for Conference Board datasets on annual hours worked per worker from the Total Economy database available at `http://www.conference-board.org/data/economydatabase/`, version January 2011. Our series is based on the sample of 16 to 74 years old.

SOURCES: OECD, Enquête Emploi, Labour Force Survey, Current Population Survey.

We present in Figure 20 the annual hours worked per worker from the Conference Board database and our series from Labour Force surveys or equivalent. In the case of France and the US the Conference Board series are very close to the one from the OECD. The trends are very similar to our estimates but the level of hours worked from household surveys is higher than the one measured using establishment surveys and national account methodology. The series for the UK is similar in trends with two notable exceptions: our series experience, like the OECD series, a more pronounced blip down during the recession of the early 1980s and we do not observe the upward blip visible in the Conference Board series in years 1992 to 1994 - which looks like a copy mistake of roughly 100 hours.

A.7 Comparison between LFS and FES

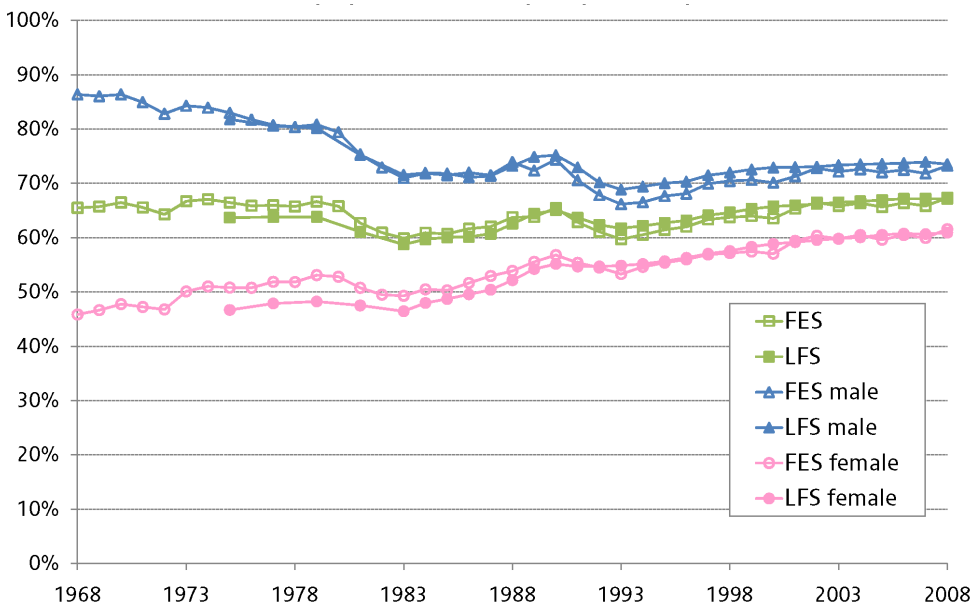
In order to give more credit to our use of both LFS and FES surveys in the case of the UK, we compare in Figure 21 measures of hours of work and employment rates by sex for the two surveys. The two surveys are quite consistent although some discrepancies are

clearly noticeable in earlier years. This is the case for instance for the employment rates of women, who are found to be significantly higher in the FES than in the LFS for the years 1975 to 1992. Strangely, the opposite is found for men in recent years, when the LFS has slightly higher employment rate than the FES.

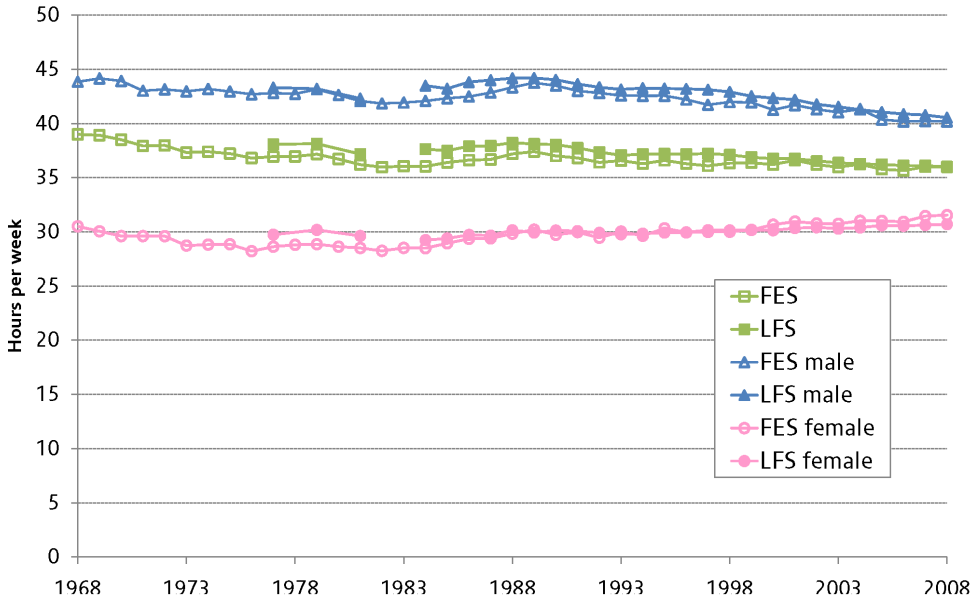
Usual hours of work (actual hours are not available in the FES) are very similar in both surveys, even if the LFS tends to exhibit higher hours per worker in earlier years, presumably because the FES includes in employment more women with low hours.

Figure 21: Comparison of labour measures between LFS and FES

A. Employment rate



B. Usual weekly hours



Notes: Usual weekly hours are defined as usual weekly hours in the main job including paid overtime.
Sources: Family Expenditure Survey, Expenditure and Food Survey, Labour Force Survey.

B. Weekly Hours vs Annual Hours

The measure of the intensive margin that we have considered in this paper takes the civil year as reference period. To assess the likelihood of various potential causes behind the observed differences in hours worked per year, it is worthwhile to examine in closer details the decomposition of this intensive margin into the intensity of a normal week of work and the share of the year dedicated to work. Fixed costs could appear at different points: fixed cost of work could explain why the hours of work per day might be inelastic, fixed costs of operating a plant might explain why some industries prefer to close for weeks than to operate at reduced capacity during a longer period, and finally fixed cost in holidays might explain why workers might prefer to use the number of weeks worked as the key margin for changing their overall hours of work.

This decomposition of annual hours into weekly hours and weeks worked has also implications for comparing measures of labour supply elasticities at the micro or macro levels. At the individual level there is limited data which allow measuring annual hours work as survey questions generally relate to a reference week.[23] At the aggregate level, it is possible to incorporate average measures of sick leave or holidays following national accounts standards. As a result, it is important to document, using comparable micro data, how much annual actual hours differ from usual weekly hours.

It is possible to make these comparisons using our labour force surveys, but only with recent data, as it is necessary to use continuous surveys available throughout the year. Table 6 decomposes the total annual hours of work in each country in 2007 between part-time and full-time workers and within each group between usual weekly hours and a measure of weeks worked in the year.[24]

The first striking difference across the three countries is the different prevalence of part-time across sex. French males are twice less likely to work part-time as are Americans and British males (5% versus 10%). On the other hand, French women are more likely than American women to work part-time (29% versus 24%), but still much less so than British

[23]US studies that use annual hours obtain this by multiplying usual weekly hours by the number of weeks in employment. This provides a annual measure of usual hours which is different from annual actual hours, i.e. it does not take into account weeks employed but not worked (on holiday, sickness or other).

[24]The number of weeks worked is difficult to measure precisely across countries as not all surveys have questions relating to the number of days worked in the reference week. Only the French Enquête Emploi asks this question, and only since 2007. We use here an approximation, by computing the weeks worked as the ratio of hours actually worked annually and the usual hours worked weekly. Checking on French data for 2007, it gives very similar results than using the number of days actually worked in the reference week. See appendices for details.

Table 6: Weekly hours and weeks worked (2007)

	Men			Women		
	FR	UK	US	FR	UK	US
Annual hours (all)	1800	1919	2107	1445	1389	1792
Share part-time	5.0%	10.5%	10.1%	29.4%	41.9%	23.9%
Full-time workers						
Annual hours	1839	2044	2229	1631	1777	2041
Weekly hours	42.1	46.8	44.6	39.0	43.5	42.0
Weeks worked	43.7	43.7	50.0	41.8	40.9	48.5
Part-time workers						
Annual hours	995	857	1030	1008	851	1021
Weekly hours	22.5	22.2	21.3	23.7	22.9	21.5
Weeks worked	44.2	38.6	48.4	42.5	37.1	47.5

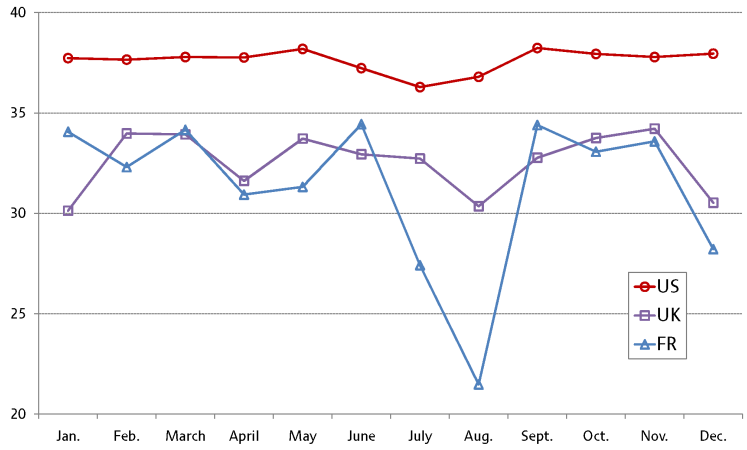
NOTE: Sample is all those in work aged 16 to 74. Weeks worked are estimated using annual actual hours of work and usual weekly hours.
SOURCES: Enquête Emploi, Labour Force Survey, Current Population Survey.

women: 42% of women in the UK declare to work part-time. When they work full-time, French females work significantly less than their British and American counterparts. So although on average British females work less than the French, this hides the much larger heterogeneity in annual hours worked in the UK than in France. The extent of part-time work is the main reason behind the low intensive margin of women in the UK, while for France it is mainly the low number of hours when working full-time - mainly because the development of part-time work in France is non negligible either.

The second fact that Table 6 brings about is the extent to which the decomposition between weekly hours and number of weeks worked differs across countries. The differences of mean annual hours across countries hide much larger differences in the way these hours are made. France and the UK seem to work a very similar number of weeks every year but the British work more hours per week than the French (more than 4 hours). On the other hand, most of the difference in annual hours of work between the US and the UK comes from the number of weeks worked, as American males barely take 2 weeks off, while the British tend to enjoy, like the French, 8 weeks non-working. This is in part undone by longer weekly hours in the UK (2 hours more for men), but only partly.

These differences could be seen as puzzling as it is difficult to believe that differences

Figure 22: Actual weekly hours by month of the year (2002-2008)



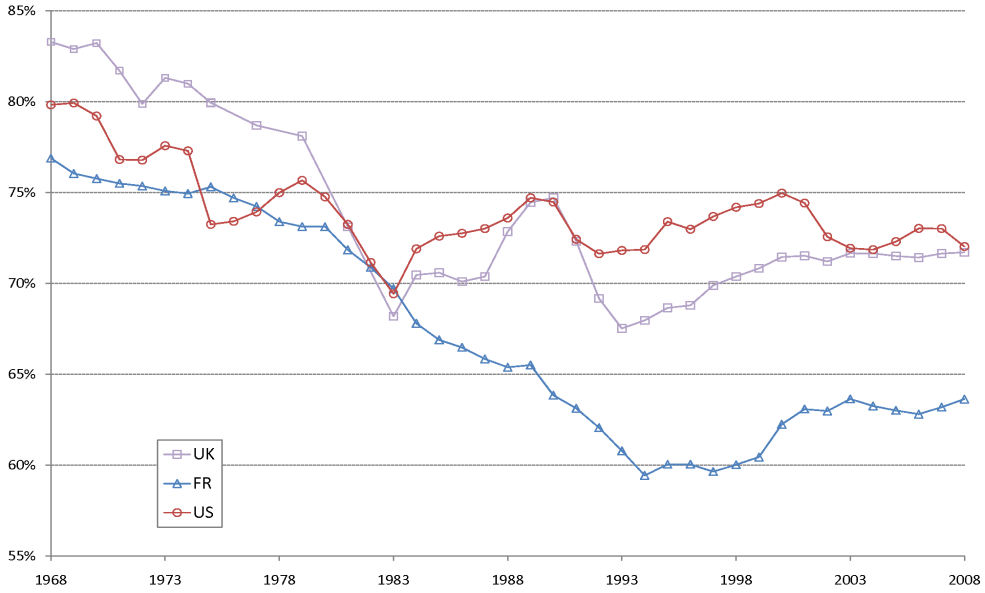
NOTE: Sample is all those in work aged 16 to 74 (means over the years 2002 to 2008).
SOURCES: Enquête Emploi, Labour Force Survey, Current Population Survey.

in fixed costs of work or leisure should be so different in these three countries. What is however very different are labour laws regulating weekly hours of work, mandating bank holidays, annual leave, maternity leaves and others. In Figure 22 we show how the actual weekly hours vary across the year in the three countries. The Americans experience only a small dip during the summer month, while both the French and the British reduce significant the amount of work at Christmas and Easter. The French stand out by taking long holidays in July and especially August.

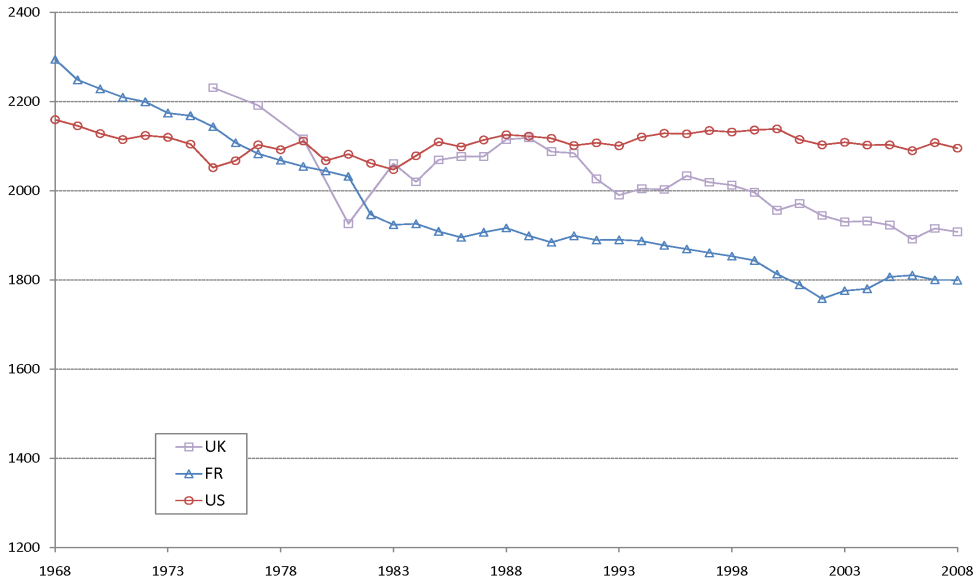
C. Additional Figures

Figure 23: Margins of labour supply for the 16-74 year old males (1968-2008)

A. Employment rate



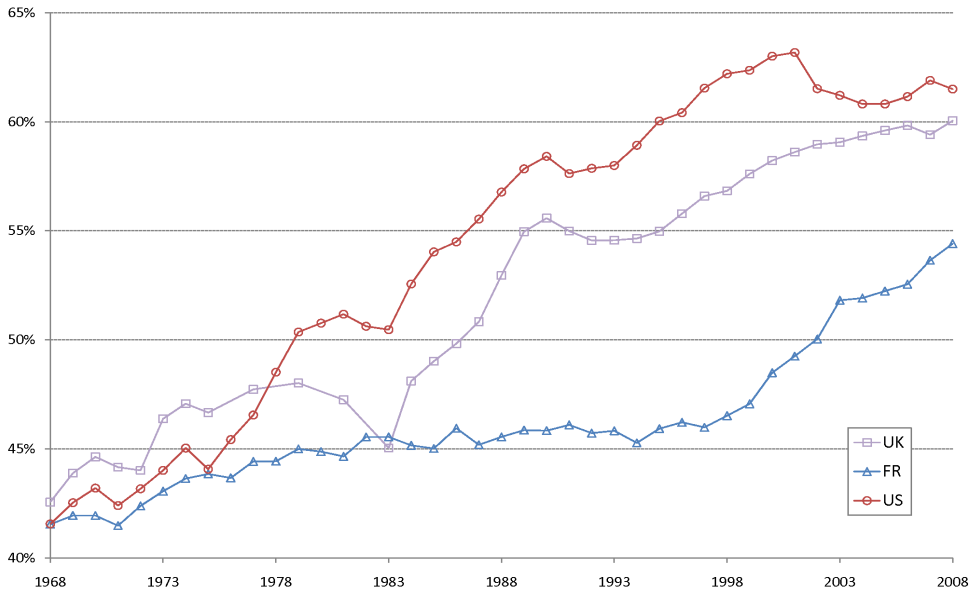
B. Hours of work per male employed



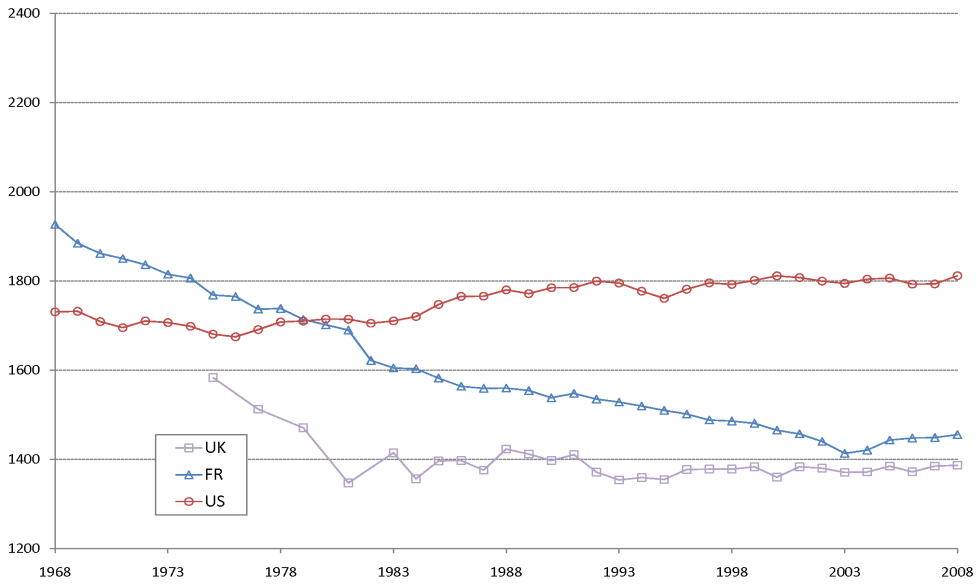
Sources: Enquête Emploi, Labour Force Survey, Family Expenditure Survey, Current Population Survey.

Figure 24: Margins of labour supply for the 16-74 year old females (1968-2008)

A. Employment rate



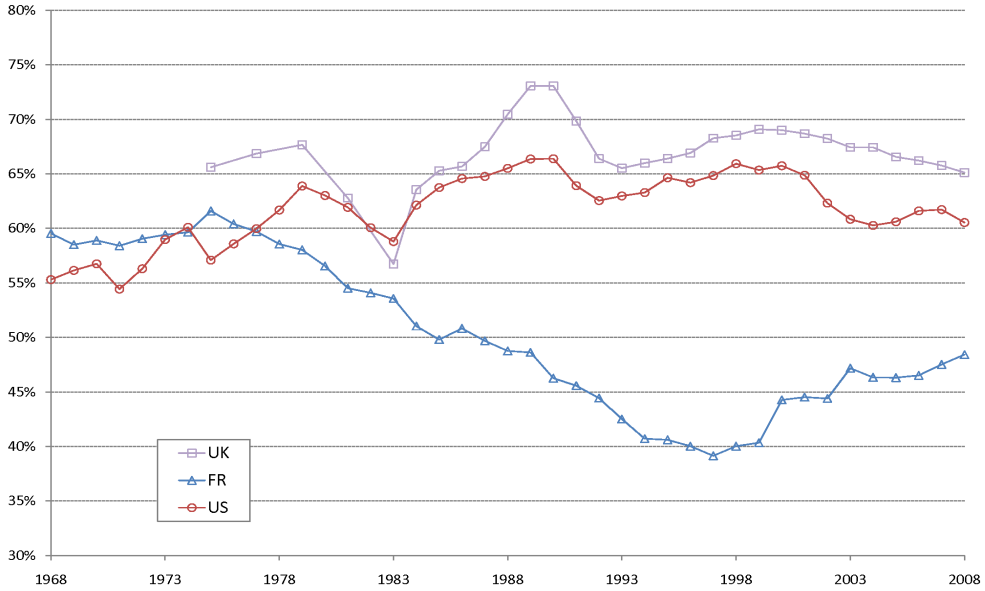
B. Hours of work per female employed



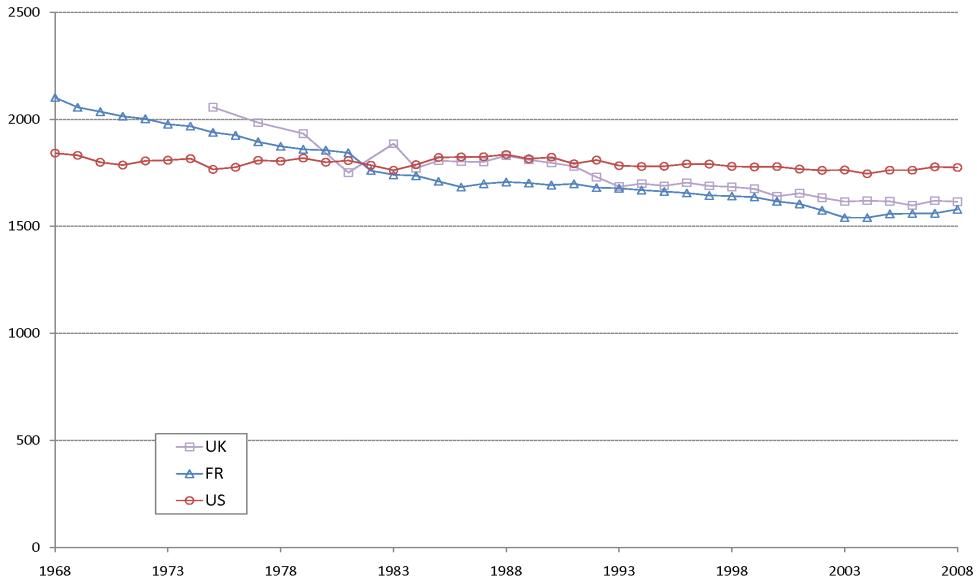
Sources: Enquête Emploi, Labour Force Survey, Family Expenditure Survey, Current Population Survey.

Figure 25: Employment and hours worked for the 16-29 years old

A. Employment rate



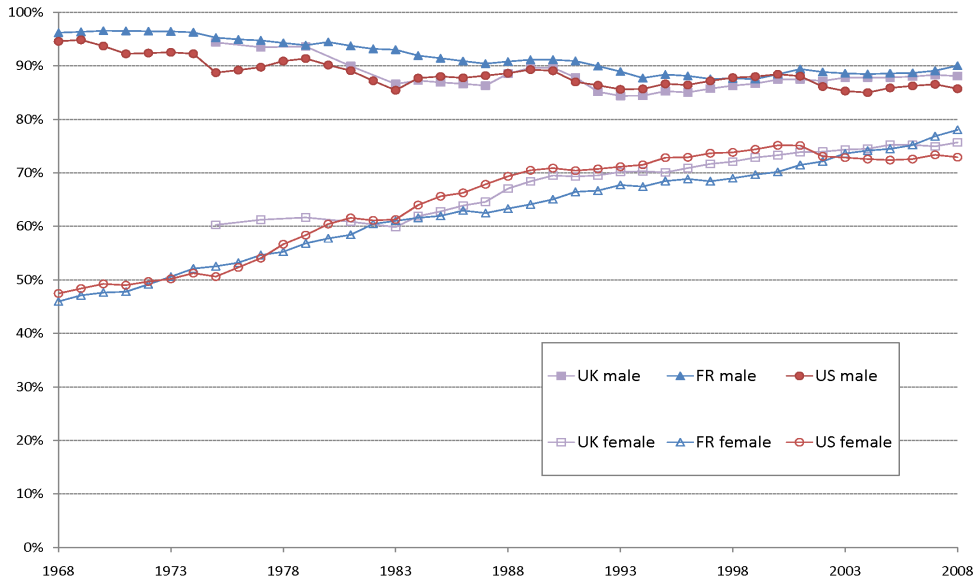
B. Annual hours of work per worker



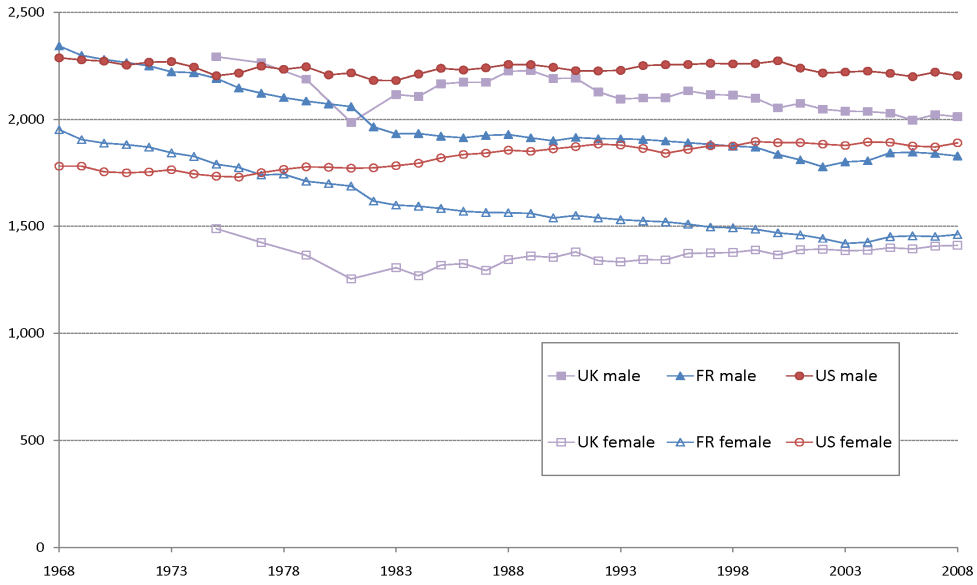
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 26: Margins of labour supply over time for the 30-54 years old

A. Employment rate



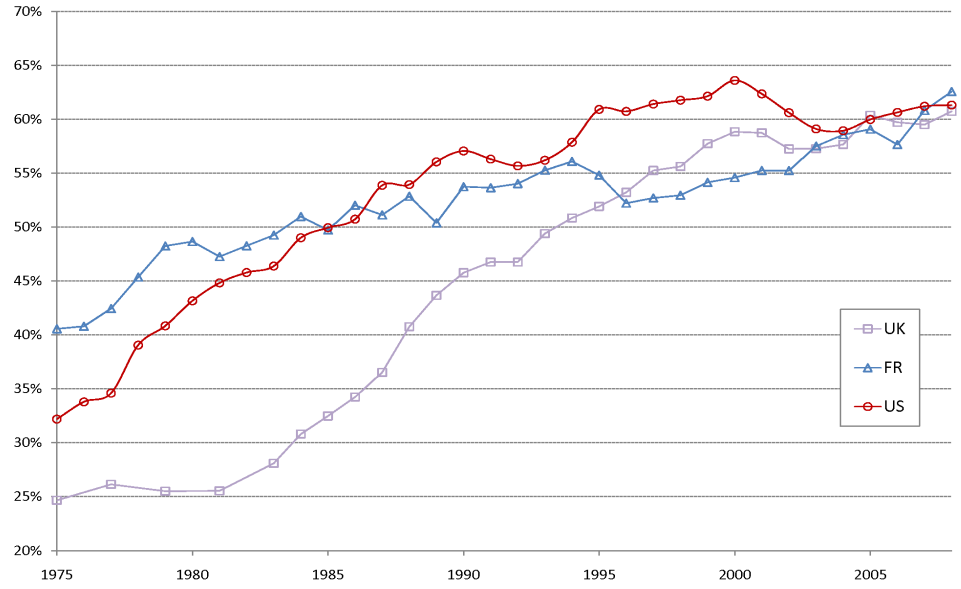
B. Annual hours of work per worker



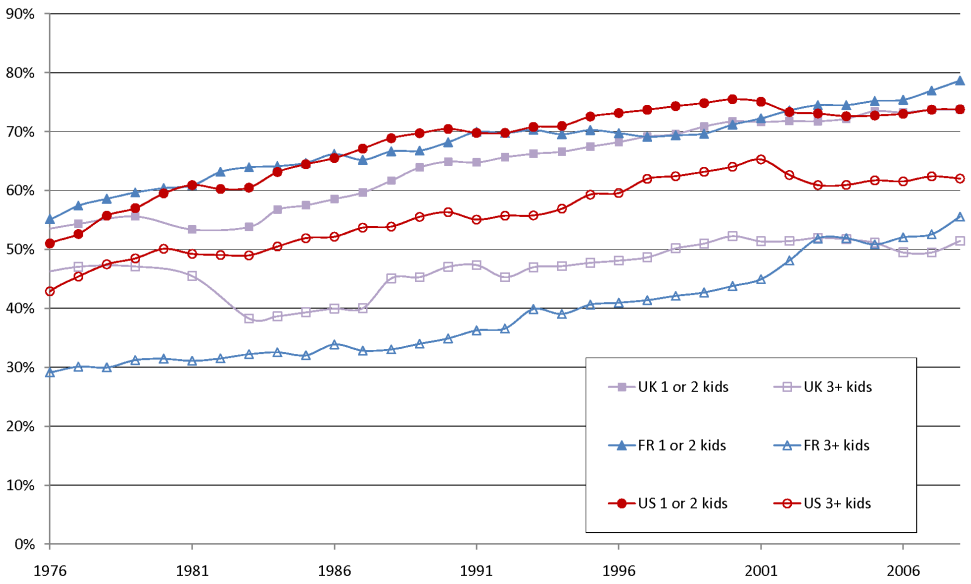
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 27: Employment rate of 25-54 women according to age and number of kids

A. Employment rate of 25-54 women with young kids



B. Employment rate of 25-54 women according to the number of kids

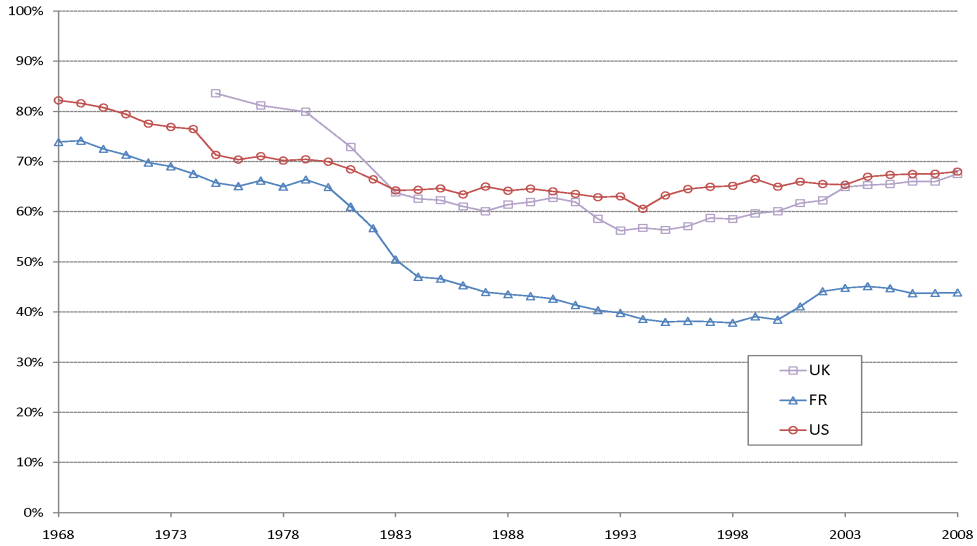


Notes: Young kids are aged under 5 in the US and the UK, under 6 in France.

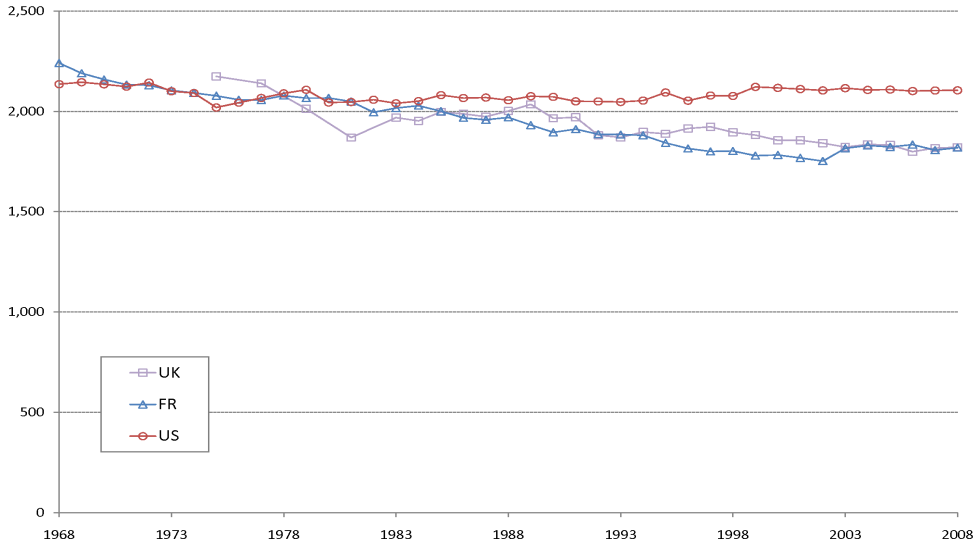
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 28: Margins of labour supply over time for the 55-64 years old male

A. Employment rate



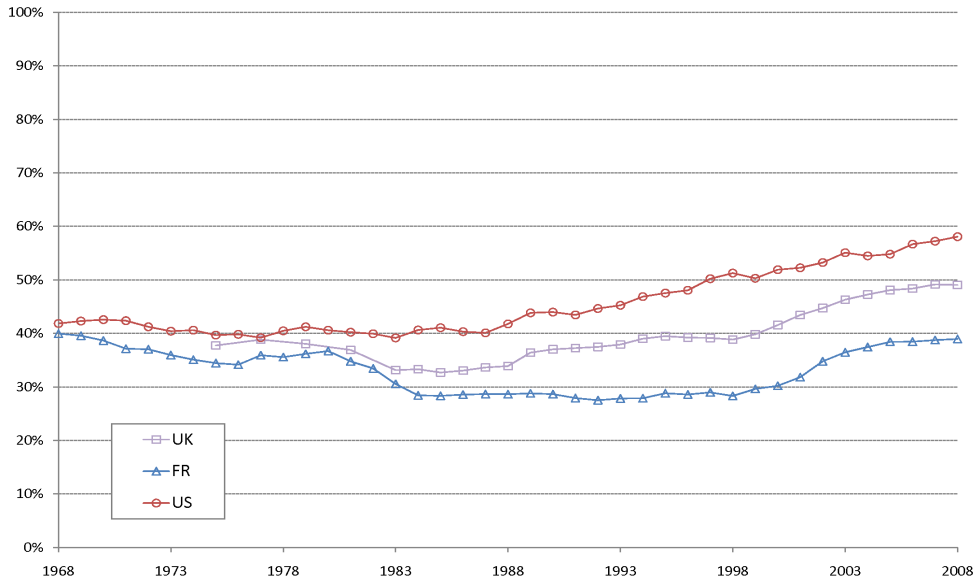
B. Annual hours of work per worker



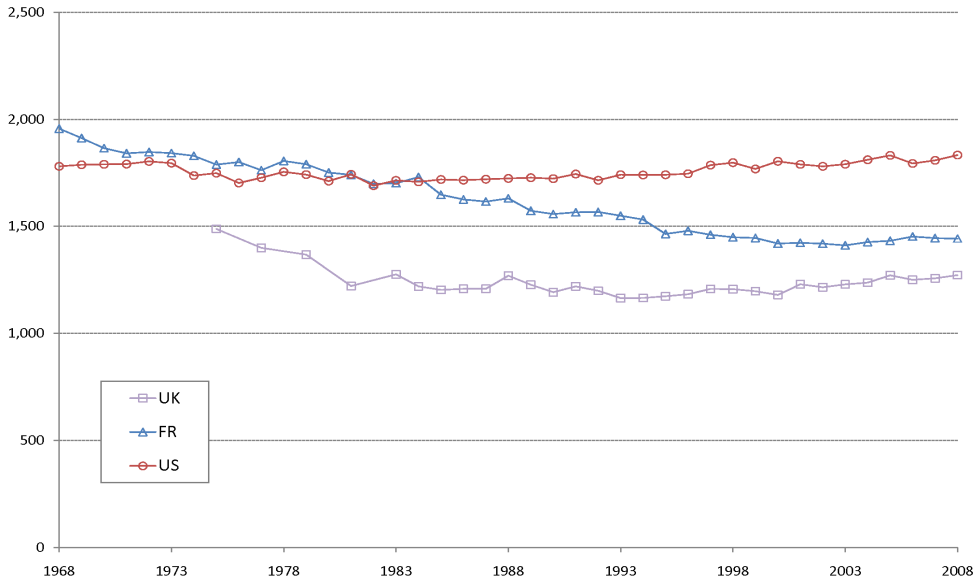
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 29: Employment rate and hours over time for the 55-64 years old female

A. Employment rate



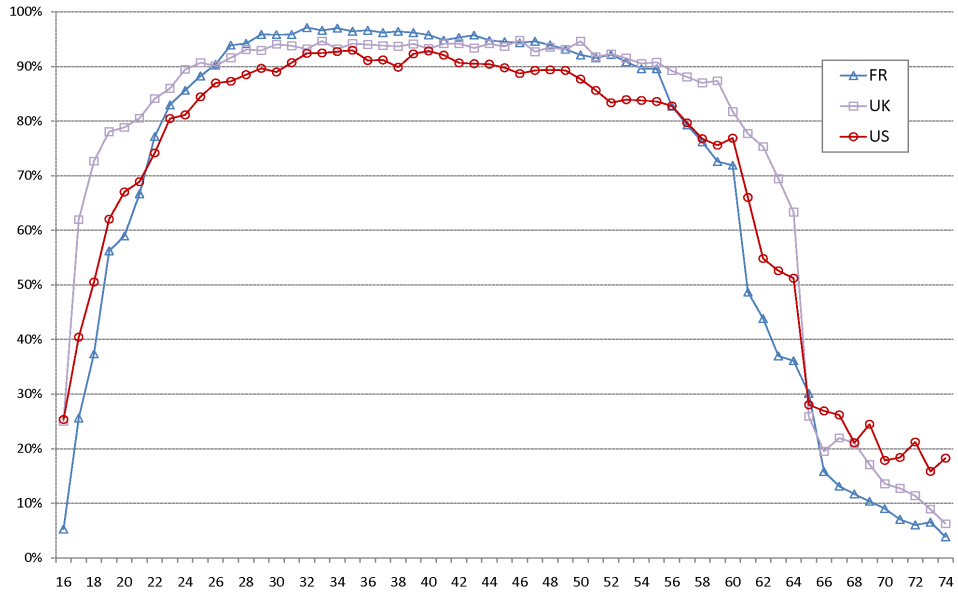
B. Annual hours of work per worker



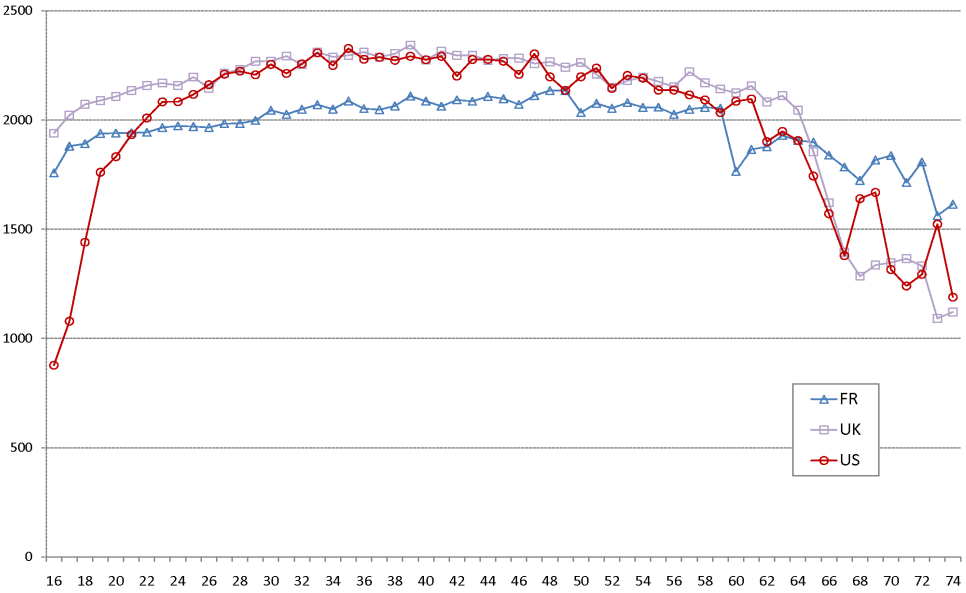
Sources: Enquête Emploi, Labour Force Survey, CPS.

Figure 30: Margins of labour by age (male 1977)

A. Employment rate



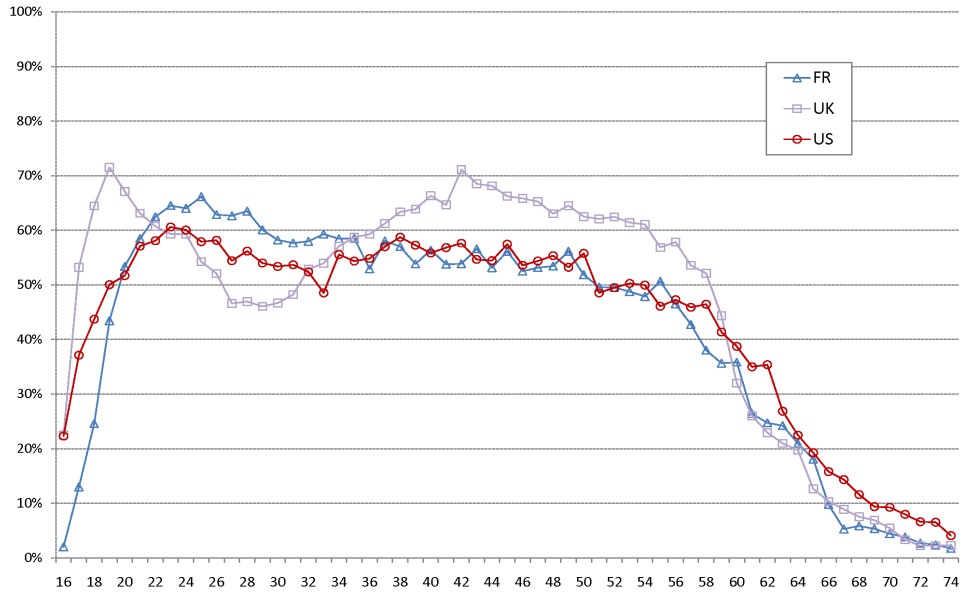
B. Hours per worker



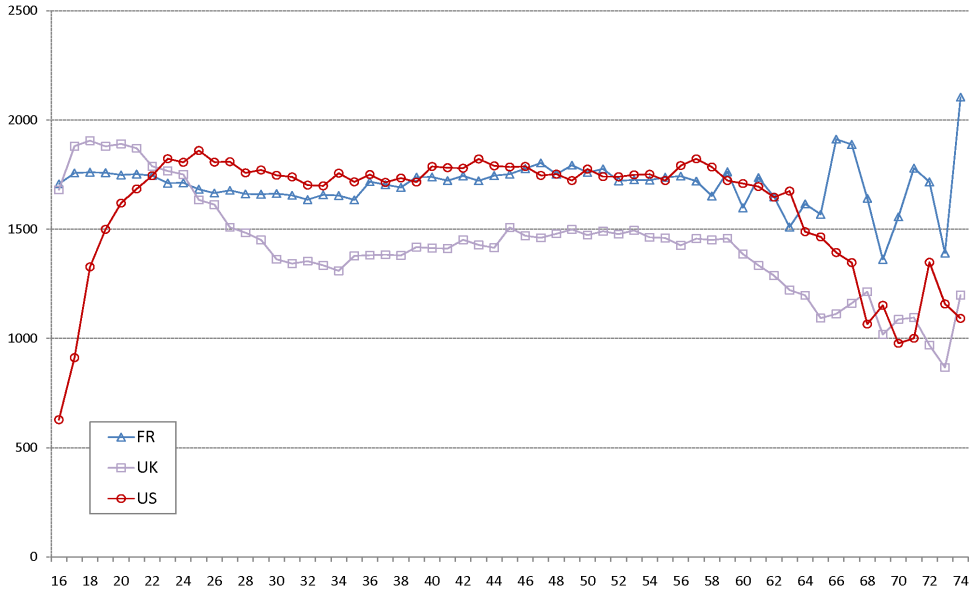
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 31: Margins of labour by age (female 1977)

A. Employment rate



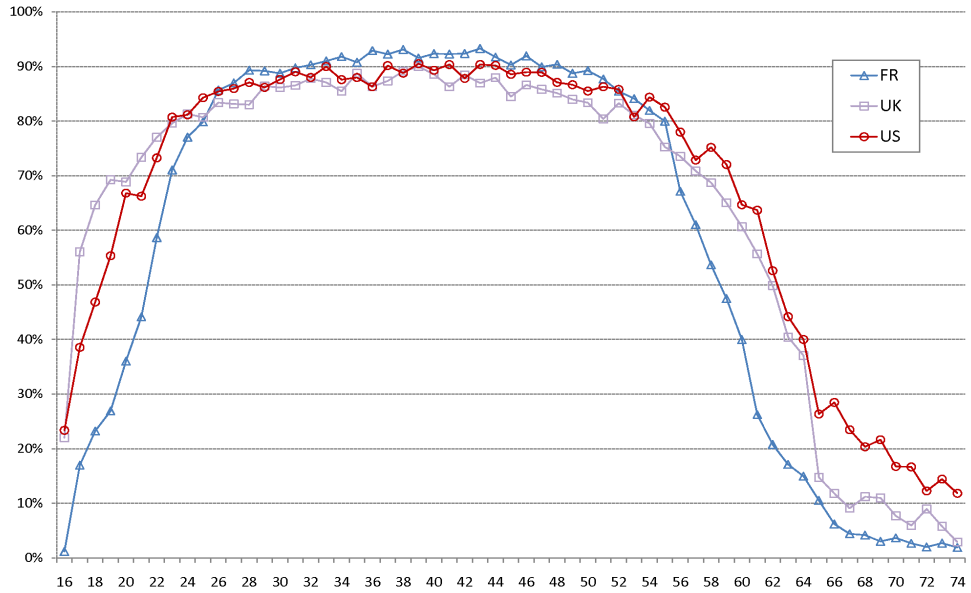
B. Hours per worker



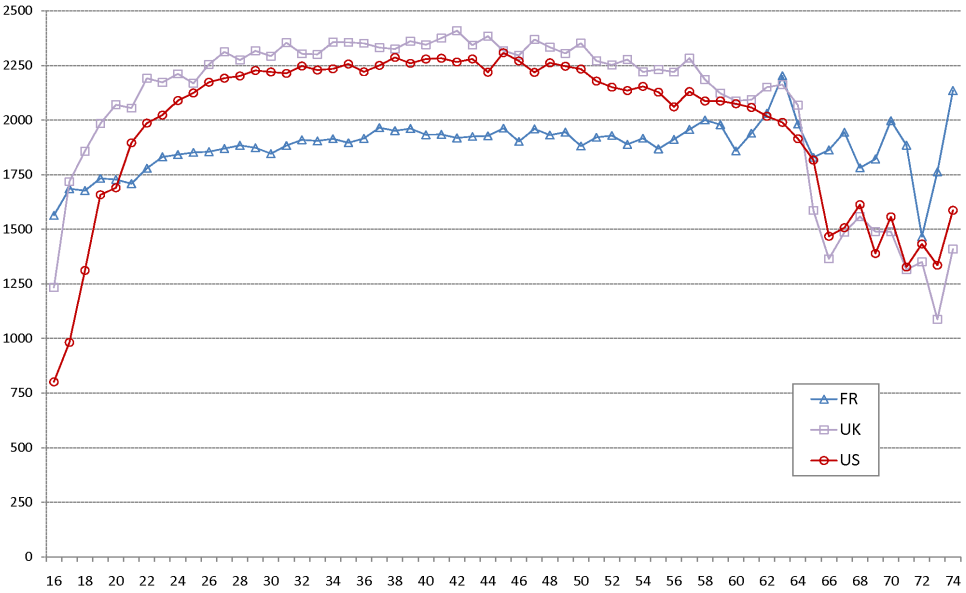
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 32: Margins of labour by age (male 1987)

A. Employment rate



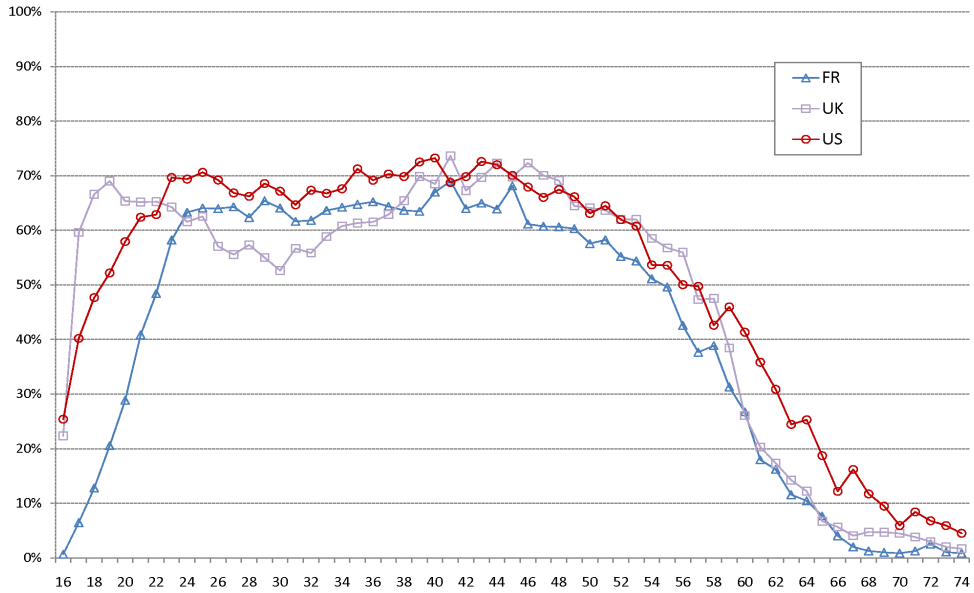
B. Hours per worker



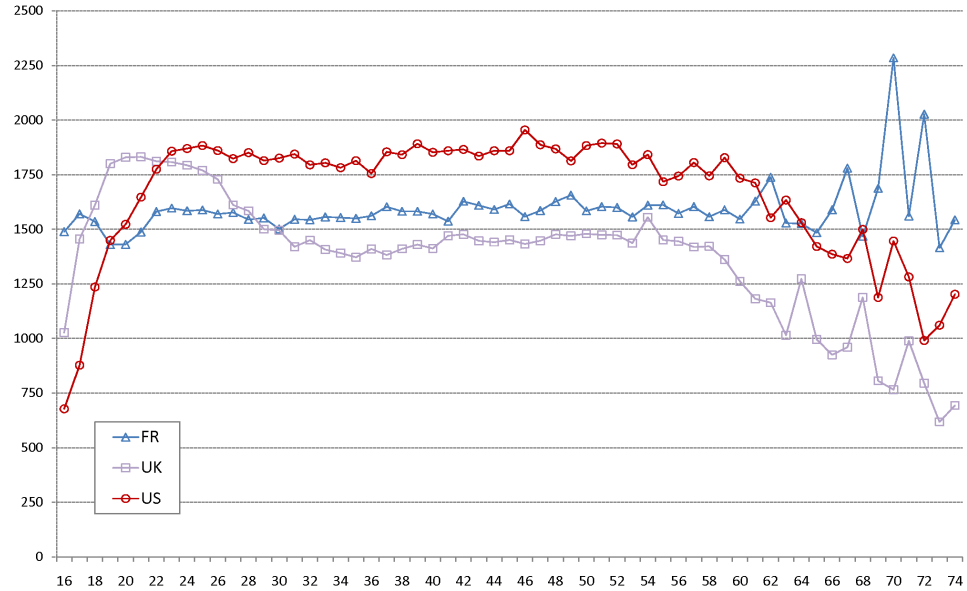
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 33: Margins of labour by age (female 1987)

A. Employment rate



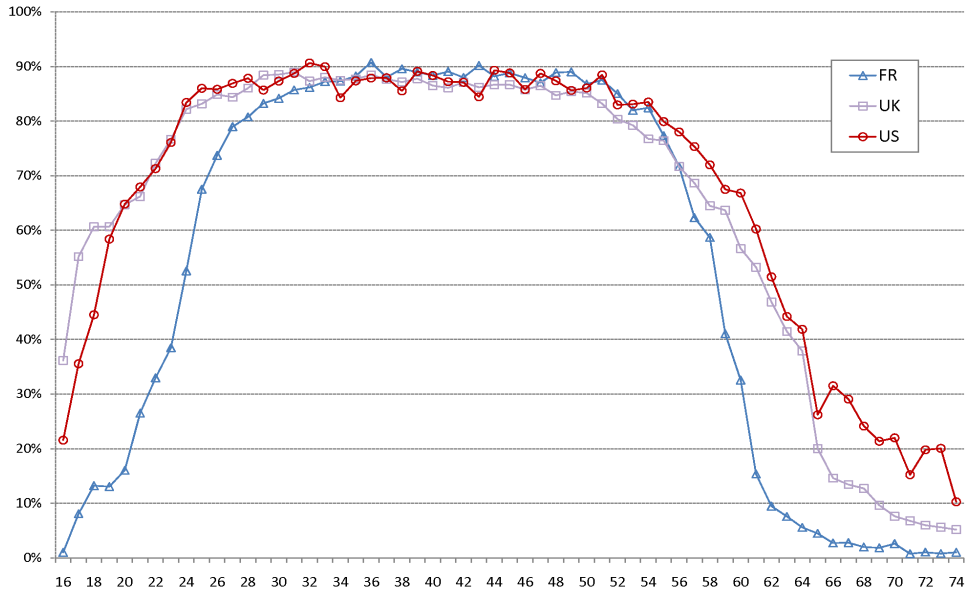
B. Hours per worker



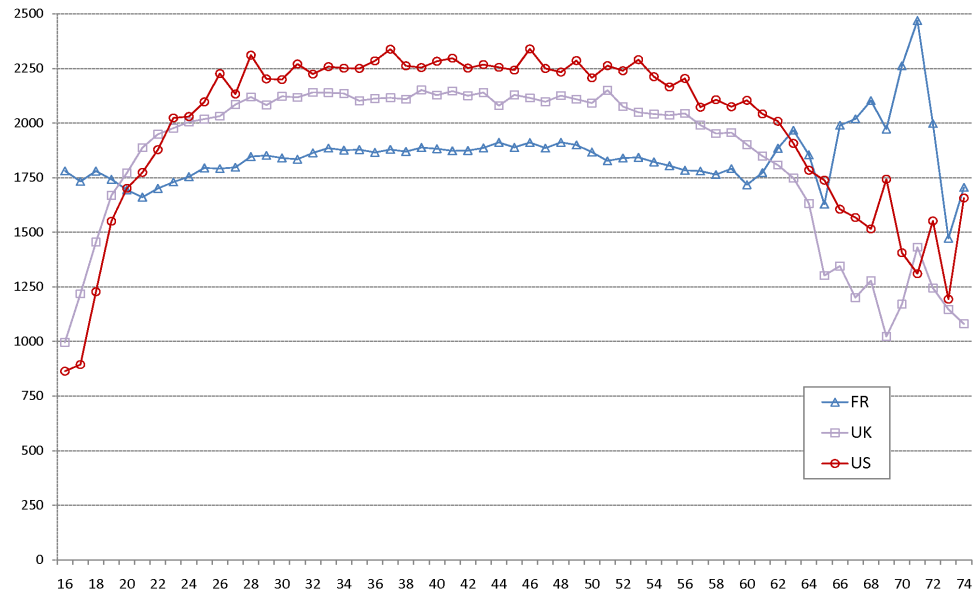
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 34: Margins of labour by age (male 1997)

A. Employment rate



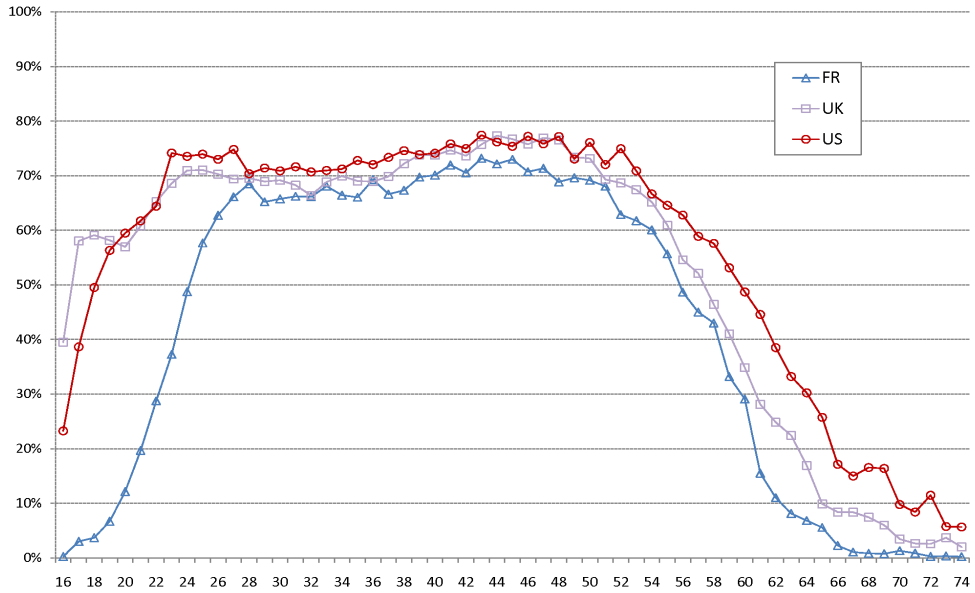
B. Hours per worker



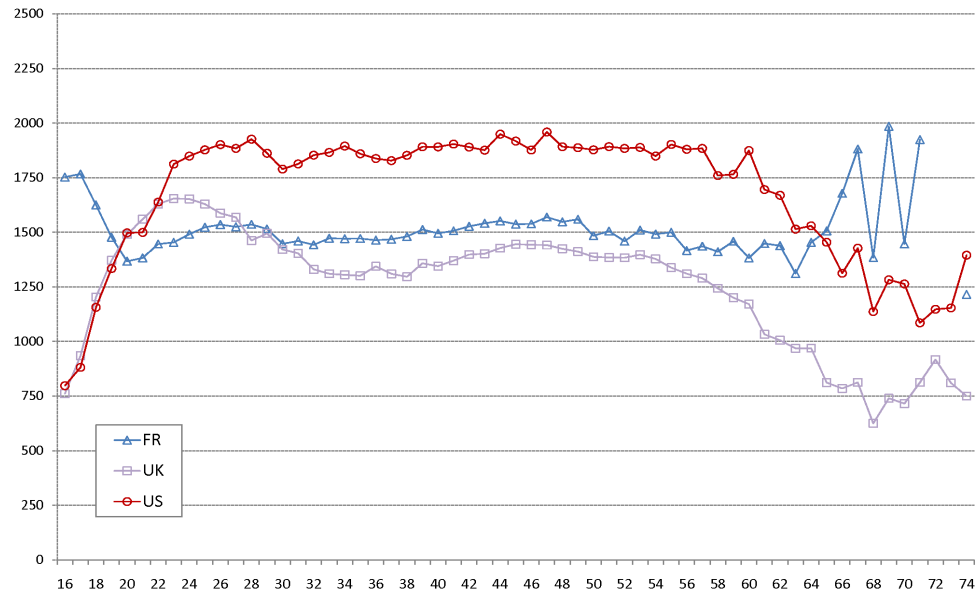
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 35: Margins of labour by age (female 1997)

A. Employment rate



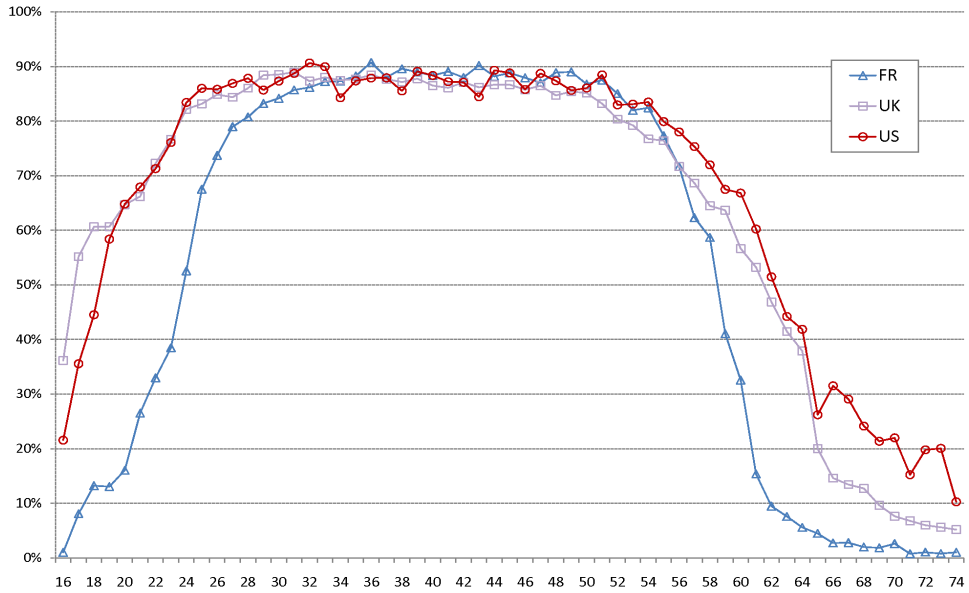
B. Hours per worker



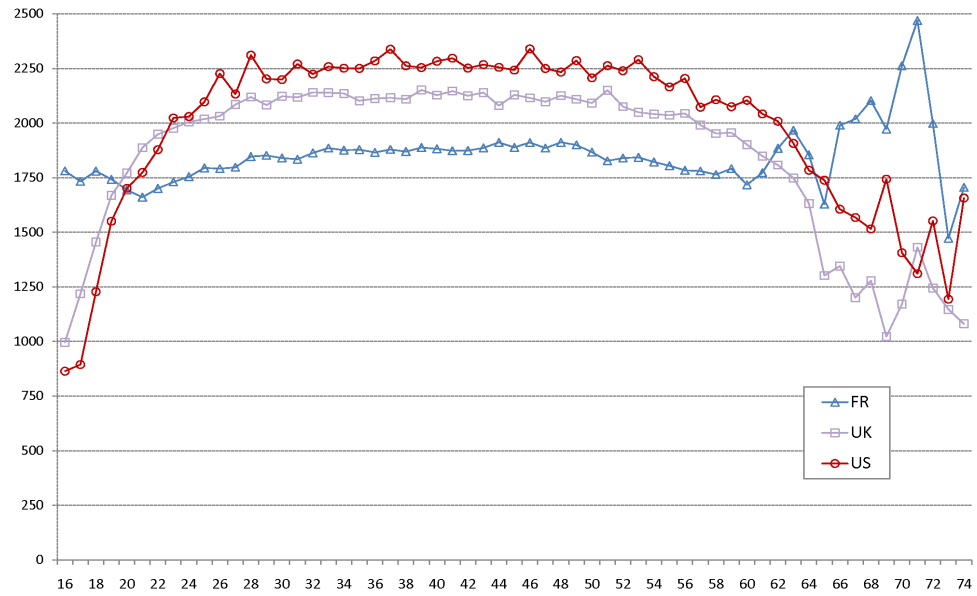
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 36: Margins of labour by age (male 2007)

A. Employment rate



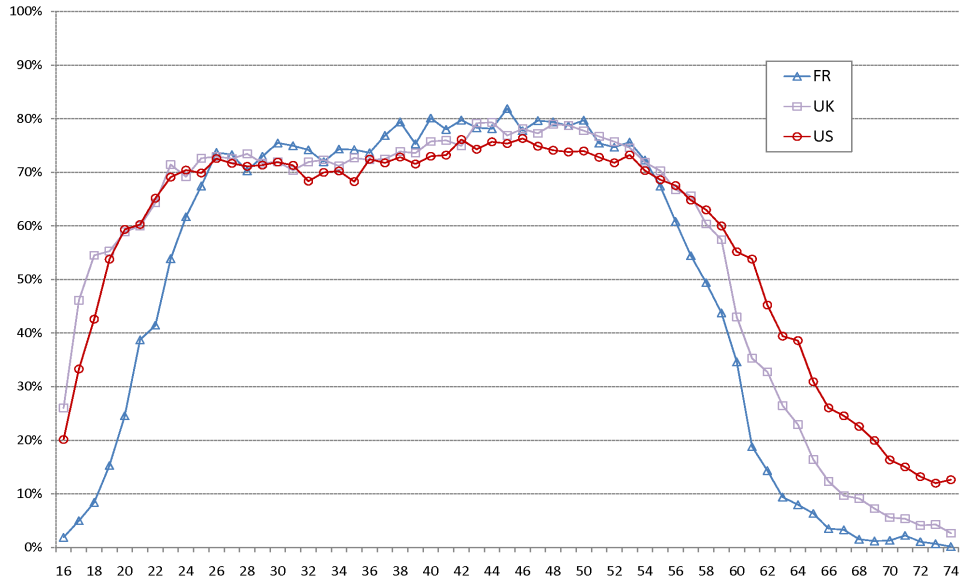
B. Hours per worker



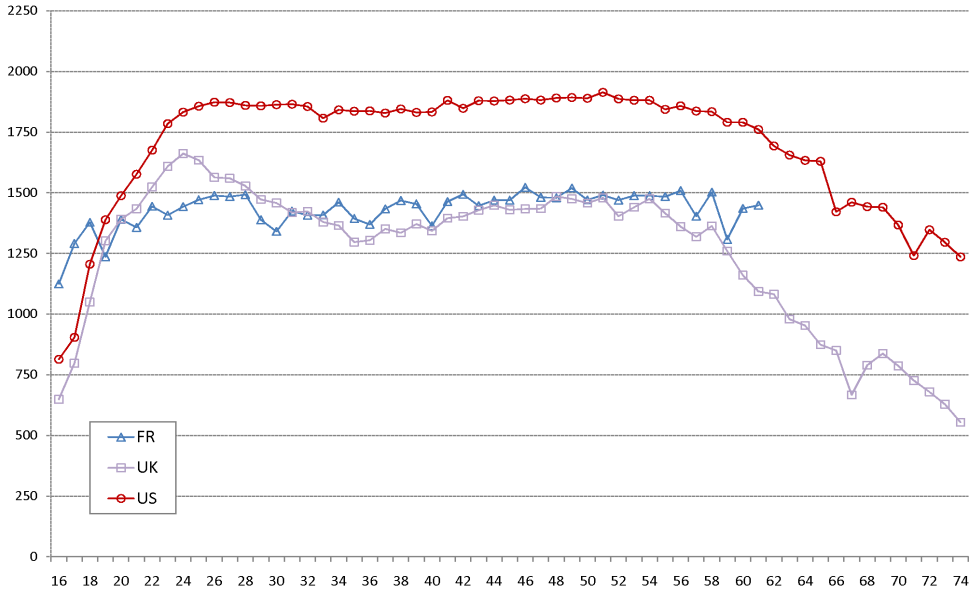
Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 37: Margins of labour by age (female 2007)

A. Employment rate



B. Hours per worker



Sources: Enquête Emploi, Labour Force Survey, Current Population Survey.

Figure 38: Decomposition of the change in total hours per population (1987-2007)

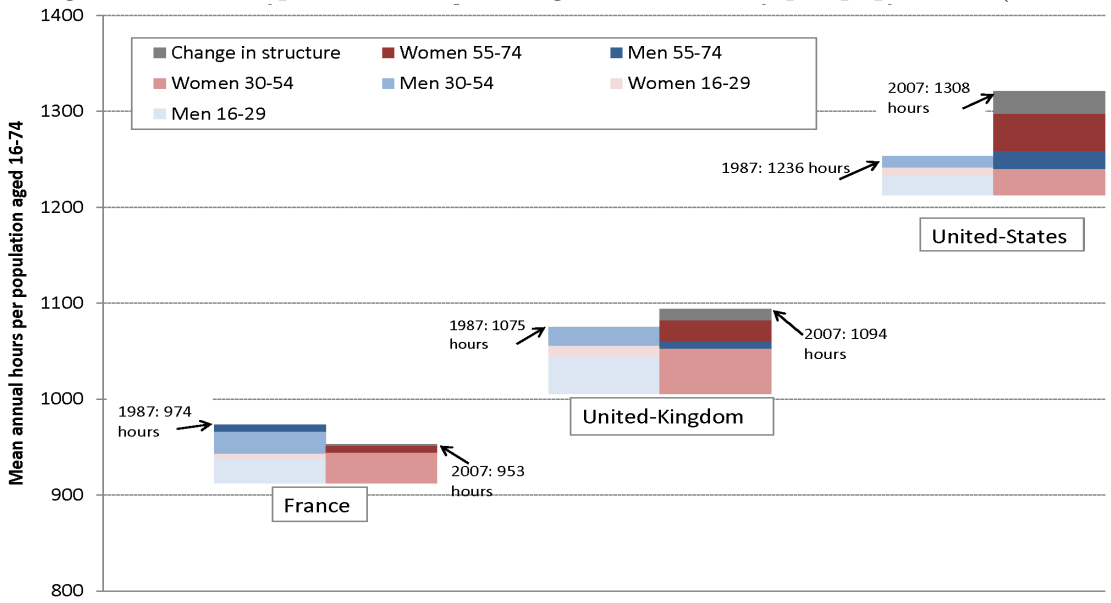
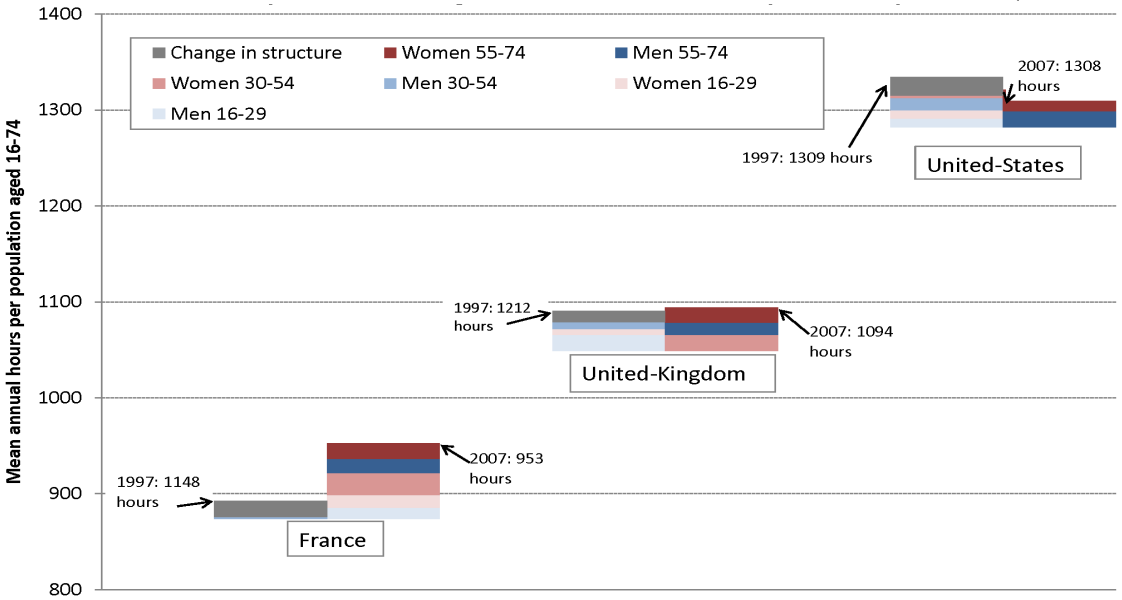


Figure 39: Decomposition of the change in total hours per population (1997-2007)



NOTES: Decomposition assumes the population structure unchanged. The residual is attributed to changes in the population structure.

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