

Is it Better to Work When We Are Older? An Empirical Comparison Between France and Great Britain

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Abstract

Classical literature uses the cross-sectional age-earnings profile to describe how the earnings evolve over the life cycle. Using a cohort analysis, I argue that this interpretation of age-earnings profile is not correct. I show that the cohort effects largely explain the decline observed at older ages. I illustrate this point by using a rotating panel data from France and a British longitudinal panel dataset for the period 1991 to 2007. I find no clear evidence that the earnings decline at older age, although the profiles are different between countries. Earnings for French workers rise linearly with age, with a further increase at the end of career, while it becomes flat for older workers in Great Britain. Overlapping cohorts provide an explanation of the observed decline of earnings for older workers in cross-sectional data. This suggests that cross-section age-earnings profile fails to represent the individual age-earnings profile.

Keywords: Age-earnings profile, Older workers, Cohort analysis.

JEL: J3, J14, J24

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1. Introduction

With an ageing population and the rising dependency ratio¹, the low employment rate of older workers is problematic and has been of growing interest in public and political debates in many European countries. For instance, the participation rate in France decreased from 54% among the 55-59 years olds to 13% for the 60-64 year age group, a decrease of 40 percentage points, and half the EU-15 average in 2003. The figures are higher for U.K with participation rates of 67.5% to 40% respectively². The low participation rate in France is partly explained by employment policies implemented since the early 1980s which included measures such as age of retirement, preretirement, and special treatment of older unemployed workers. On the other hand, the weakness in labour market is the result of lower demand for older workers. Further evidence supports the idea of age discrimination. Hypothesis of wage-productivity gap, poor physical health are among other reasons which have disadvantaged older workers in the labor force.

Increasing the labour market participation of older workers remains a key goal in reforms to finance social contributions and to improve overall economic growth. It is for this reason that several countries with contribution-based state pension systems have implemented reforms that raise the legal minimum retirement age and create incentives for workers to remain in the labour force. Related to these facts, is the cross-section observation that earnings decline on average for seniors at the end of their working life. There are many implications if an individual's earnings do in fact decline. For example, if average earnings are lower for older individuals, workers are encouraged to reduce their labour supply and it would constitute a challenge for the implementation of current policies. Understanding how individual earnings really evolve over the lifecycle is not only essential for human well-being, but also it can help policy makers concerned with the problem of pension financing. In this paper, I want to answer the following questions: Do the earnings decline at older ages? What is the role played by cohort effects on earnings? What are the differences in age-earnings profiles between France and Great Britain?

To answer these issues, I examine the identification problem in attempting to separate "pure" effects of age, cohort and period on the lifecycle earnings profile and model the evolution of earnings for groups of individuals, using rotating panel data for France and panel data for Great Britain. The main objective of this study is to investigate the age-earnings profiles by first exploring the effect of ageing on earnings growth in France and Great Britain, two different countries in terms of social institutions. To carry out this research, I only examine earnings trajectories among cohorts and not among individuals since it is not feasible with the French dataset. Second, I investigate how far age-earnings profiles are different between gender, across occupational groups

¹i.e. the ratio between the working population and the pensioners, 25.1% in France and 24.3% in U.K in 2005, Source: EUROSTAT

²source: OECD, available at https://stats.oecd.org/Index.aspx?DataSetCode=LFS_SEXAGE_I_R, accessed 5 October 2016

and sectors.

I show that the cohort effects explain in large part the decline observed at older ages for both countries. This observed inverted U-shaped earnings profile is not the consequence of ageing itself, as in the human capital model. It results from the tendency of successive generations or cohorts to earn more on average than the preceding ones. This overtaking phenomenon can in theory generate a concave inverted U-shaped age-earnings profile in cross section data. I also find differences in age-earnings trajectories between countries. The most important relates to age effects on earnings profile which has a different form. In France, earnings increase linearly until age of 60 with further increase that occurs right at the end of a career. In contrast, British earnings profiles have the typical concave shape flattening out, but there is no clear trend of earnings decline among male workers, which is consistent with [Bazen and Charni \(2016\)](#).

This paper contributes to the literature by identifying the role played by the cohort effects on the decline of earnings profiles observed in cross section analysis. Contrary to the studies based on cross section data, I do not find clear evidence of a decrease of earnings at older ages, once generational effects are taken into account.

I begin the paper by first looking at the literature related to the age-earnings profile. Section 3 describes the data sets used and the approach to construct the cohort panel data. Section 4 examines the relationship between age and hourly earnings by cohort in France and Great Britain using the age-period-cohort decomposition method. Section 5 presents the estimation results. Section 6 presents some sensitivity analysis before concluding in Section 7.

2. Age and Cohort Effects

Specifications in the literature assume that an individual has an age-earnings profile that follows an inverted-U shape with a decline generally occurring in the 40 to 50 age interval. Figure 1 represents a typical cross-section age-earnings profile. Empirical studies using cross-section data find that age-earnings profiles decline around the age of 40 ([Welch \(1979\)](#), [Mincer \(1974\)](#)).

A concave relationship is justified by the human capital theory ([Becker \(1964\)](#), [Lemieux \(2006\)](#)). As a worker ages, investments in human capital will decline, becoming less profitable. Productivity will start to diminish and because wages are determined by productivity, this implies this inverted U-shape as depicted in the Figure 2. Most empirical studies use the “earnings equation” developed by [Mincer \(1974\)](#) to explain how earnings grow over the life cycle. In this model, the logarithm of earnings depends on years of education and a quadratic function of labour market experience to capture the concave relationship between age and earnings underlined by human capital theory. An older worker must have lower earnings growth than the younger one. Despite the pervasiveness of the shape of life-cycle earnings in the labour literature, recent evidence suggests that the

functional form of Mincer's model raises some issues. For instance, [Murphy and Welch \(1990\)](#) find that the standard Mincer equation provides a poor approximation of the true empirical experience-earnings profile, and it is better represented by a quartic specification rather than a quadratic specification. The decline observed at older ages exists but the quadratic specifications underestimate early and late career earnings growth leading to an important decline of earnings profile. These findings have been confirmed in a recent study by [Lemieux \(2006\)](#) using the Current Population Survey (CPS) data for 1979 to 2001 period. He shows that standard quadratic specification of potential experience is not sufficiently flexible, and the addition of higher polynomials of potential experience in the Mincer's model helps to capture the main characteristics of the data. He concludes that the decline observed for older workers is an artefact of the quadratic specification.

Alternatively, there have been a number of attempts to explain an increasing relationship between earnings and age. These models include human capital investment, incentive contracts or wage bargaining for instance. Investments in human capital provide an explanation for higher wage at end of a worker's career. Following [Becker \(1964\)](#), human capital can be divided in two types: general human capital accumulated through education and used across jobs, and specific human capital, accumulated through work experience with the same employer and only used within a specific job. Longer job tenure increases the stock of specific human capital which involves higher productivity to the firm and leads to higher wage.

Other theories such as the model of deferred compensation ([Lazear \(1979\)](#)) also predict earnings growth with work experience. In this model, because employers do not observe workers' behaviour, firms use seniority wages to detect shirking. By paying their employees less than their marginal revenue product (MRP) in the first part of their careers and then above than their MRP at the end of their careers, workers are discouraged from shirking because when detected, workers are fired and so cannot get their premium. In this model, a long-term relationship with employees is encouraged and employees are rewarded with a deferred compensation. Another point of concern of this model is the difficulty in identifying the "true" relationship between age and earnings, principally due to the age-period-cohort identification problem.

Again, recent research has shown that the age-earnings profile does not have the form predicted by the Mincer-type analysis and not reproduce the main characteristics of earnings function in recent decades mainly because it ignores cohort effects. [Card and Lemieux \(2001\)](#) and [Lemieux \(2006\)](#) by extending the original analysis of Mincer's –based on white males– from the 1960 US Census to three recent time periods (1979-1981, 1989-1991, 1999-2001) find that the college-to-high school earnings gap profile increases for younger generations while it remains stable for older workers since the mid-1970s. They attribute this change of earnings structure to cohort effects, that is to say, the change in structure of population. [Lemieux \(2006\)](#) points out that returns to education are determined by matching the demand and supply of skilled labour. When Mincer estimated

the earnings equation in the 1960s, controlling for cohort effects was not necessary because demand for skilled workers was roughly equal to supply. But in more recent periods, the change in composition of the population, due to the decline in the supply of high-skilled workers of post-1950 cohorts relative to the pre-1950 trend, in addition to a faster increase in demand for skilled labour than supply, due to skill-biased technical change for instance, implied an increase in returns to education of the most educated workers. As a result, in recent data, the profile is no longer parallel for different cohorts and the consideration of cohort effects in the earnings equation improves its fit. Lemieux concludes that the Mincer earnings equation remains a benchmark in a “stable environment where educational achievement grows smoothly across cohorts” (2006, page 142). In contrast, the shape of the wage profile changes when the environment becomes less stable, in other words when educational achievement varies across cohorts. These studies underline the important role of demographic factors on earnings profiles (the literature on cohort effects has shown the role they played on earnings growth). The theory behind the cohort effects is based on supply factors and on perfect substitutability between individuals belonging to the same cohort. An increase in supply (i.e. in cohort size) will have negative effects on earnings due to the competition in the labour market. The entry of a large birth cohort, the baby boom generation for instance, into the labour market would mean they experience relative lower earnings.

These effects have been found by [Welch \(1979\)](#), [Riboud \(1987\)](#), and [Wright \(1991\)](#). [Welch \(1979\)](#) examines the relationship between earnings and cohort on US data from the March CPS, for the 1967-1975 period and finds that cohort effects have a negative impact on earnings growth. To overcome the identification problem³, he examines the impact of cohort size, which approximates cohort effects, on earnings levels and finds that large cohorts experienced lower earnings in their early career. [Wright \(1991\)](#) using British data finds similar results for the period 1973-1982. [Berger \(1989\)](#), using the same type of data employed by Welch but with a less restrictive model, confirms the negative role played by cohort size but in contrast to the Welch’s results, he finds that these effects do not disappear with experience. Cohort size effects continue to operate as a worker’s career progresses. In other words, individuals belonging to large birth cohorts experienced lower earnings over their career relative to those from small birth cohorts. The existence of cohort effects could explain the declining trend of earnings is observed among older workers aged 50 or older found in cross-section data.

Another set of studies, based on panel data, do not find evidence that individual earnings decline at later age. [Carliner \(1989\)](#) was one of the first to examine wages of the elderly, that is years immediately before the retirement, by considering the net depreciation rate of wage by taking into account the effects of other factors like macroeconomic effects. Using a longitudinal data the National Longitudinal Survey of Older Men, for British men aged between 45 to 64, for the 1966-1975 period, Carliner finds that the wage starts to decline at

³Experience = year - cohort, where cohort is defined as the entry year in the labour market

the age of 50 but the negative effects of age are offset by a general increase in wage levels (i.e. positive effects of period dummies increase the general level of real wages in this period which outweigh the decline which occurs with age). The wage really starts to decline later at the age of 60, after considering the period effects. [Johnson and Neumark \(1996\)](#) come to the same conclusion using the National Longitudinal Survey of Older Men (NLSOM), a US longitudinal survey. They find that the decline observed for the elderly is attributable to partial retirement, i.e the shift from full time to partial time employment. They also point out the role of Social Security benefits which encourage workers to reduce their work effort in order to increase their Social Security income. [Myck \(2010\)](#) uses the British Household Panel Survey (BHPS) and the German Socio-Economic Panel (GSOEP) to examine the age-wage relation with a non-parametric specification. Using the dimension of panel data, Myck shows that the age-earnings profile is subject to some reductions two years before the age of retirement even though the earnings grow until late in the career. He points to the role of selection out of employment and cohort effects on the shape of age-earnings which are responsible for the “U-inverted” age-wage profile.

Evaluations of earnings profiles have also been undertaken for generations of workers especially in France, where some papers date back to the 1990s ([Guillotin \(1988\)](#), [Lollivier and Payen \(1990\)](#), [Guillotin and Bigard \(1992\)](#), [Koubi \(2003\)](#)). These studies sought to decompose individual earnings profiles by separating the part due to macroeconomic factors from effects related to life-cycle, generational effects and individual characteristics such as education and skills. The results show that the male age-earnings profile is concave, which is consistent with human capital theory. The profile increases with age at the beginning of individual’s career and is constant or even decreasing at older ages. At a given age, earnings are higher from one generation to the next, particularly for older generations of workers, albeit with a reduction in the earnings growth differential between generations from the middle of the 1970s, but these estimates do not control for composition effects. [Koubi \(2004\)](#) further investigates earnings trajectories by cohorts over a long period, by allowing for composition effects in the estimation. Differences in annual earnings between cohorts are examined for France for the 1967-2000 period, using the DADS data (Déclarations Annuelles des Données Sociales), an administrative database in which earnings are declared by employers, which covers only employees working in the private sector. He finds no evidence of deterioration in earnings for younger employees⁴. The profile of annualized earnings is higher for generations up to the 1942 birth cohort where earnings come down progressively until the 1956 birth cohort. Thus, workers born between 1950 to 1955 receive lower earnings than those born years earlier have received, at the same age. Thereafter, annual earnings remain stagnant or even slightly higher for

⁴He uses two alternative measures: annual and annualized earnings, which latest is independent of labour supply dimension. Estimations with annual earnings show evidence of deterioration of earnings for the younger generations while this is not the case with the annualized earnings measure.

successive generations. Koubi suggests that earnings have not decreased across generations, but the reduction in working time and the multiplication of new forms of employment contract (including decline in working hours, growth of part time employment contracts) are responsible for the deterioration of the position of the youngest in the wage hierarchy.

In the light of these conflicting pieces of evidence, the following question arises: How can the regularity of cross-section be explained? One reason may be related to the dynamics of the working population. Earnings profiles, and the theory they are based on, are assumed to represent the evolution of earnings of an individual over his life cycle. However, in most studies the estimation of earnings profile is based on cross-sectional data which means that the earnings profile is not estimated for different stages of an individual's life, but rather is constructed from different individuals at different stages of their working life. These do not reflect the true life cycle process of a typical worker except in special circumstances. The importance of taking into account cohort effects in earnings estimation involves the consideration of other factors, and raises the issue of identification of age, period and cohort effects as we shall see in a later section.

3. The British Household Panel Survey and The French Labour Force Survey

This article uses data for the same period 1991 to 2007 for the analysis of life-cycle profiles of earnings. The French data used in this study for France are taken from the French Labour Force Survey (FLFS) conducted by the National Institute of Statistical and Economic Information (INSEE), while the British data are taken from the British Household Panel Survey (BHPS) conducted by the Institute for Social and Economic Research (ISER). The FLFS is a rotating panel of households where one-third of households are replaced each year until 2002. People are interviewed in March of each year in the surveys, and are present in the survey for at most three consecutive years. There was one exception in 1999, when it was combined with the population census and undertaken in January. Since 2003, the survey has been undertaken quarterly and each person who participates in the survey appears in at most in six consecutive surveys. The survey provides information on socio-demographic status such as occupation, sex, education level, economic activity and working hours. The advantages of using a rotating panel data is the large number of observations contained in each sample, which guarantees a greater degree of representativeness compared to long run panel data (such as the PSID or BHPS). The BHPS is a panel survey and is a nationally representative sample of the British population. The first wave was conducted in 1991 and 10,300 individuals were interviewed (5,500 households, where all members over 16 years of age are interviewed) and are followed each year.

The analysis is for individuals aged between the ages of 18 and 65 for British males and between the ages of 18 and 60 for French males and for females in both countries. The sample excludes the self-employed and farmers. Moreover, many of employees appear to work more than the standard working week (i.e. 35 hours per week

and 39 until 2000) implying that part of employed population is paid below the hourly minimum wage (i.e. SMIC). To limit the measurement errors, respondents with hourly wage below the SMIC are removed from the sample. The key earnings measure is the real hourly wage. I use the monthly wage to construct hourly wage by dividing by hours declared by the respondent (net of employee payroll taxes for French monthly earnings and gross for British monthly earnings). Wages are converted into real values using the Consumer Price Index which is equal to 100 in 2005.

The analysis of life-cycle earnings involves following individuals through their working life which would usually require panel data. However, because the French survey used in this analysis is not a panel survey but a rotating panel of households, in other words households interviewed over the sample period change and are replaced by others, we cannot follow the same individuals over time. One way around this is to work at a more aggregate level as suggested by [Deaton \(1985\)](#) and to analyse the average behaviour of a group of individuals in the absence of panel data. While this method has been used widely in sociological research, [Deaton and Paxson \(1994\)](#) (detailed in [Deaton \(1997\)](#)) were among the first who used annual surveys to track cohorts over time in the analysis of cohort effects in earnings. For the sake of comparability between the two countries, I follow the same approach for the British case even though it is possible to study the earnings at individual level (this is done in [Bazen and Charni \(2016\)](#)).

The basic idea of a “pseudo-panel” is to construct N groups or cohorts, and to study the dynamics of average earnings through time and across cohorts. The definition of the cohort could be varied but individuals belonging to the same group must share at least one characteristic such as date of entry in the labour market, or date of birth. Using a pseudo-panel approach has many advantages. First, a pseudo-panel does not suffer from problems of attrition because the sample is frequently renewed. In this way the sample is representative of the underlying population. The extent of measurement error is also reduced because the pseudo-panel averages of variables are determined using a group of individual observations. Individuals born in the same year share a certain number of characteristics: they have grown up in a similar educational system and experience the same macroeconomic conditions. In this paper, I define cohort groups by pooling individuals born in the same year into a cohort, and I calculate average earnings for each cohort. I apply this method to successive cross-sectional surveys in order to follow cohorts across time.

In all, fifty five cohorts are followed. The oldest cohort is comprised of individuals born in 1931, the following cohort by those born in 1932, and so on until the youngest cohort (1985). However due to the time span of the data (1991-2007), we cannot observe each cohort at each age. The oldest cohorts are observed at their later ages and the younger cohorts at the beginning of their careers. The oldest cohort who was born in 1931, was aged 60 years old in 1991 when the data set begins, and followed for 5 years until the retirement age of 65 in the case of British males. The other cohorts were retained up to the age 60. Hence, we are able to examine

the change in average earnings and the position of each cohort's earnings over the life-cycle. Each cohort is tracked over 17 years or until it reaches the official retirement age whichever is sooner. Over the 1991-2007 period, there are 287,076 observations for France and 99,366 observations for Great Britain. The cohort cells size for both countries are presented in Tables 1 and 2, for each of the surveys. These are generally several hundred for Great Britain and often three thousand for France. The first column of Table 1 shows the sample of individuals born between 1932 and 1935. The decline in number shows individuals who left the survey due to those who left the labour force for retirement or for other reasons. The variation in sample size, which occurs around the age of 57, is more important in France mainly due to specificities of the retirement system such as early retirement options.

4. Decomposition Analysis: The Age Period Cohort model

4.1. Stylised Facts from Cross-Sectional Analysis

The cross section age-earnings profiles in 1991 and in 2007 in France and in Great Britain are represented in the Figures 4a and 4b. These profiles obtained from the data set have the typical inverted U-shape found in cross section data. Earnings grow rapidly for younger workers and reach a maximum between the ages of 40 and 50; at 50 in France and around age of 45 for Great Britain. The rate of increase in earnings slows down and eventually becomes negative. In Great Britain, the decline in earnings is more pronounced than in France. The earnings of workers aged over 60 are around those of a 30 year old, while in France, the average earnings of those aged 60 are similar to those earned by those aged 40. The same cross section hourly earnings profiles are presented in the Figure 4b for 2007. The profiles for both countries are not very different. In France, the profile is still concave but does not decline at a later age, while in Great Britain the profile falls away in a pronounced manner from age 45. There is also higher dispersion in earnings. The evidence from this cross section perspective thus suggests that the profile is concave and that earnings decline for older workers. However, this approach in terms of age ignores cohort effects: changes in earnings are attributed only to age.

4.2. Average Earnings and Cohort Analysis

The aim of this section is to explain why cross-sectional and panel data provide conflicting conclusions about the earnings dynamics at old age. The question behind this fact is whether age really influences earnings negatively at end of career or if other factors come into play. In this section, I present a methodology which permits one to distinguish the age profile of earnings from cohort trends. I begin by presenting the age-earnings profiles across cohorts for France and Great Britain. Figures 9a and 9b represent age-average-earnings profiles for different cohorts born since 1931 for both countries. Cohorts have been defined for five-year intervals (eg those born between 1931 and 1935 are in one cohort group) to provide a clearer picture. Each line represents

the average hourly earnings for a particular cohort at a given age during the period 1991-2007. We observe that, for both countries, there is no evidence that earnings decline for cohorts at older ages in comparison to what is observed in cross section data except possibly for the oldest cohorts born before 1945 and observed around the age of 60. The slope of the cohort earnings profile does not, in general, become negative from around the age of 50, as cross-section data would suggest. The trajectories are overlapping suggesting that cohort effects exist, except for some generations for which profiles become confounded at a certain age: younger generations generally earn more than the previous cohort. Overall, the cohort profiles suggest an increasing age-earnings path throughout the working life. Figure 9a shows the cohort hourly earnings profiles in France. The age-earnings profile increases until the age of 60 when it peaks, and declines thereafter. Earnings increase from generation to generation, at a given age. The rate of increase is lower from the 1946 generation where earnings profiles for the generations born between 1946 and 1960 overlap. In the same way, Koubi finds that real earnings rise rapidly for successive generations until the 1950 cohort, and diminish for the following generations. Workers who enter the labour force during the post-war period up to the 1970s are in better position than those from recent generations who began to work in the mid-1970s, which marked the end of post war-boom. During the first oil crisis, in the mid-1970s, the economic downturn led to a reduction in the earnings gap between successive generations (Guillotín (1988)). For the generation born between 1931 and 1945, we observe a dip just before the age of 60. The decrease that occurs at 60 could be the consequence of retirement effects (i.e. the minimum retirement age is 60 until 2010) in France. Indeed, one of the points changed by the pension reform in 1993 concern the number of contributions for a full pension which moves from 150 to 160 quarters, corresponding to 40 years of contributions. For the generations born in 1943 and after, they must contribute for at least 40 years to obtain entitlement to a full pension (it was 37.5 years before the reform) but the minimum age of retirement remained at 60 in France. In the sample, only four cohorts reach this minimum legal age of retirement and three cohorts are affected by the reform of 1993. But all of these generations which are characterized by low education level (see Figure 5, 70 to 80% of them have at most secondary school certificate) can retire early between the ages of 56 to 59 for long careers. Added to this, specificities of the French social system with particular measures which allow for workers to earn pension points and to leave early the labour force. Invalidity or disability pension; pre-retirement; and the Dispense de Recherche d'Emploi (DRE) which allows unemployed older persons aged above 55 to continue to receive unemployment benefits and to be exempted from actively seeking employment, do not encourage to search for work and they could explain the low participation rate of those aged 55 or over. Hence, it is difficult to draw conclusions about the earnings dynamics around the age of 60 for France. Results should be interpreted with care due to the potential selection out of employment amongst older workers.

Figure 10a presents the average earnings profiles of cohorts separately for males and females for France. The

overlap of trajectories for the 1950 generation is also present for both genders. The profiles are particularly clustered for males although this is less marked for younger generations of females. Not surprisingly female average earnings are lower than those for males, at a given age and for any generation, but the disparities between gender seem to narrow during the period, particularly for more recent generations of workers. It is important to note that the earnings trajectories increase with age, and this increase is all the more important for males at older ages. As noted earlier, average earnings across cohorts increase throughout the cycle. However, the 1936-40 and 1946-50 cohorts are the only ones for which earnings decrease at the end of career in the case of males. The observed decline in the earnings profile observed for these groups could be explained by the characteristics of the French system which allow workers to retire early. The decline around at the age of 60 for the 1946-1950 may be explained by the effects of “long-career-based” early retirement established in 2004 and applied to cohort born after 1945. [Aubert \(2009\)](#) on French data (Echantillons Interrégimes de Retraités (EIR) et de Cotisants (EIC)) for the year 2004, finds that more than fifty percent of workers born in 1938 who are present in the labour market after the age of 50 leave the labour force before age of 60, even if the pension plan was not fully wound up (only for 9%). For females, the earnings never decline and earnings increase with age until the age 60 – except for one generation, the 1931-1935 birth cohort. Also the education level of this group will be such that they have made the necessary contributions in order to retire.

Looking at the cohort age-average earnings profiles for Great Britain (Figure 9b), there is no evidence of a decline of earnings after a certain age. The slope of the cohort earnings profile does not in general become negative from around the age of 50 in contrast to the cross-section case. There is very little evidence to suggest that earnings decline, except perhaps for the oldest cohorts born before 1945 and then from around the age of 58. There is the beginning of a downturn for the cohort born between 1950 and 1954 from the age of 53, but no clear trend. Figure 10b shows that the dynamic of earnings is different between gender. First, the decomposition indicates that the cohort earnings profiles are declining at older ages for British males but not the females. Secondly, the results reveal that earnings growth has slowed and mainly affects younger generations, while in France it occurs before, around the 1950 generation.

The age-earnings profiles by cohort generally show no sign of significant decline, in contrast with cross-section profile which suggests a concave inverted-U curve. Average earnings across cohorts do not appear turn down at older ages. However, average earnings in cross-section analysis mix several effects such as ageing process with cohort membership effects and following cohorts across time present the same weakness because the effects of ageing are confounded with the period effects. So we cannot say clearly if the decline is due to ageing process or generation effects or period effects. In the next section, I use a smoothing technique to disentangle age, period and cohort effects.

4.3. The Age Period Cohort Methodology

Earnings are influenced by age effects, or process of ageing, by cohort effects or cohort membership which capture the demographic characteristics across generations, and by period effects that represent the impact of macroeconomic events on earnings such as periods of economic boom or recession, and are common to all age groups and affect all cohort groups simultaneously. In order to distinguish the different possibilities, I use a decomposition analysis by applying the so-called Age-Period-Cohort model (i.e. APC) to see if the decline in average earnings profile at the end of working life is driven by the characteristics of generations, or by other factors related to age or period.

The APC decomposition was first introduced in the sociological literature to examine the impact of social changes, and was then developed in economics by [Mason et al. \(1973\)](#), and adapted later by [Deaton and Paxson \(1994\)](#), mostly in order to study labour supply. The model uses the average earnings within each cohort to decompose the effect of age, cohort membership and time.

In panel data analysis, hourly earnings can be modeled as:

$$W_{it} = \beta + \gamma_i + \psi_t + x_{it}\alpha_i + u_{it} \quad (1)$$

where W_{it} is the hourly earnings of an individual i at time t , β is the intercept, x_{it} is the age of the individual, and α represents the effect of age on earnings, γ_i represent the individual fixed-effects, u_{it} is the error term and is assumed to be *iid* with zero mean. Here, I analyse life-cycle earnings using a pseudo-panel data approach which permits us to follow cohorts obtained from averaging observations with similar date of birth. Hence, the model becomes:

$$W_{ct} = \beta + \gamma_c + \psi_t + x_{ct}\alpha_c + u_{ct} \quad (2)$$

where the subscripts c and t indicate the cohort c at time t . W_{ct} is the mean of hourly earnings of a cohort, β is the intercept, α refers to the net age effects, γ is the net cohort effect and ψ are the net time effects. u_{ct} denotes the random error with zero mean.

The equation can be written in matrix form:

$$W = I\beta + C\gamma + Y\psi + A\alpha + u \quad (3)$$

where W is the vector of cohort-year observations, C is a matrix of cohort dummies, Y is a matrix of year effects, and A is a matrix of age dummies. However, equation (2) is not identified due to the exact linear

relationship between age, period and cohort regressors. We cannot separately identify the pure effects of these variables because of the mechanical relation linking age, year and cohort birth date (namely, Age = Period (calendar year) - Cohort (birth year)). Therefore there is no unique solution for each of the three components. It is impossible to identify uniquely and simultaneously the APC parameters without making some assumptions.

Various approaches have been developed to deal with this identification issue (for a review see for example [Browning et al. \(2012\)](#), [de Ree and Alessie \(2011\)](#)). One of the solutions is to drop one of the multicollinear variables (i.e. A, C or Y), and to assume that this variable has a zero effect on the dependent variable (as for example in [Glenn \(1994\)](#)). This approach could be problematic because each of these variables could be important in explaining changes in earnings. Another approach is to model one of the collinear variables using a proxy as in [Beaudry and Lemieux \(1999\)](#) who solve the problem of identification of the model by replacing the period effect by macroeconomic effects. The unemployment rate among men between the ages of 25 to 44 captures short term economic fluctuations. They assume that the macroeconomic effect is entirely captured by unemployment rate and there is no other time trend in this effect. Age effects and cohort effects are modelled with fourth and second degree polynomials, respectively.

Alternatively, the model can be constrained such that any two ages, periods or cohorts have same effect parameters. [Mason et al. \(1973\)](#) show that imposing that the effect of two ages are equal, the first and second for instance, is sufficient condition to identify the model. However, because I am principally interested in age and cohort effects on earnings and to a lesser extent in period effects, I use the Deaton's approach which imposes assumptions on period effects to identify the three effects separately. Deaton suggests normalising the year effects such that they have zero mean (so they represent fluctuations), and are orthogonal to the time trend (so the time effects is not follow any trend). This normalisation attributes any change in earnings to the effects of cohort and/or age. Time effects capture cyclical fluctuations that cancel out in the long run. In other words, time effects represent the temporary deviations from the age or cohort trend. The age and cohort variables can be modelled by polynomials or dummy variables. Deaton recommends using dummy variables especially when the data are abundant, since they allow for more flexibility and let the data determine the trajectories. The approach assumes that there is no interaction between the three effects so the age profile is the same for each cohort, and the estimated coefficients represent the net effect of these variables on earnings. The normalisation applied by Deaton implies dropping two rows of the period dummies matrix (Y). The year dummies are redefined as:

$$d_t^* = d_t - [(t - 1)d_2 - (t - 2)d_1] \quad (4)$$

where d_t is equal to one if the year is t and 0 otherwise for $t = 3, 4, \dots, 17$. This transformation makes the year

effects orthogonal to the time trend, and the sum of year dummies equals zero. The model can be identified subject to the normalisation by regressing W on each of age dummies excluding the first, on each of cohort dummy excluding the first, and on each year dummy excluding the first two. The restriction on the year coefficients identifies the first two year effects dropped previously.

5. Decomposition of Earnings Trajectories by birth cohort

The cohort analysis uses the average earnings (not in logarithm) of each cohort at a given age, in a given year, to separate the factors behind the observed cohort age-earnings profiles which are presented in Figures 9a and 9b. One advantage of using average earnings variable and not the logarithm, for instance, is the reduction of influence of outliers in earnings equations. The graphical representations of the A.P.C decomposition for all workers (males and females together) are presented in Figures 11a and 11b for France and Great Britain, respectively.

5.1. Decomposition of Earnings Trajectories by gender

5.1.1. Earnings Trajectories in France

Figure 11a shows the age, period and cohort effects on earnings profile in France for all workers. The top left of the figure illustrates the typical age profile associated with life-cycle changes. The relation between age and earnings is increasing overall. Hourly earnings double between the age of 20 and 30, are multiplied by 4 between the age of 20 and 50, and reach their highest value at the end of career.

The earnings increase around the age of 56-57 must be treated with caution. The low participation among those older than 50 associated with early retirement suggest selection out of employment. A large proportion of those aged 50 and over has left the labour force (see Figure 7). This is explained in part by the fact that older generations with shorter education can retire early for long careers. In this regard, workers who have left the labour force tend to have lower wages than the average of workers who stay. Indeed, early retirement is possible in France for workers with long careers, ill health, and manual job with difficult conditions. Hence, self selection due to effects of legislation before age of 60 could explain the slightly more favourable trend in earnings late in career. One solution to reduce the effect of selection bias, as we will see on the next section, is to differentiate profiles by occupational status. Alternatively, this steeper growth could be attributable to seniority premia. For instance, studies examining the wage-productivity gap at the firm level for French case have found that there is no clear evidence that the wage decreases at older ages. [Aubert and Crépon \(2003\)](#) and [Aubert et al. \(2005\)](#) find that wages in France increase whereas in Anglo Saxon countries (United States, U.K...) the wage declines around the retirement age. The observed increases are attributed to seniority premia, which is consistent with Lazear model ([Lazear \(1979\)](#)).

The second graph at the top right of Figure 11a represents year effects. Year effects could temporarily move cohorts off their trends and age trajectories. The coefficients controlling for aggregate shocks are significant but the coefficients are smaller compared to those of age and cohort effects, around one-tenth. Between 1991 until 2000, years effects are negative which coincides with a period of crisis (impact of oil crisis in the years 1990-1993), followed by a sequence of positive effects (i.e. the French economic recovery in 1999, 2000, 2001).

The third graph at the bottom of Figure 11a depicts the impact of cohort membership on earnings growth. It shows how earnings evolve for successive generations compared to the reference group, the 1932 birth cohort. The dummy variables controlling for cohorts are all positive and significant except for 1933 to 1935 cohorts, and they affect generations of workers differently. Lifecycle earnings grow for individuals born before 1950. Those who entered the workforce in the post-war period up to the mid seventies have higher earnings compared to their elders other things being equal. These results may be explained by favourable economic conditions until the mid-seventies, a period marked by a multitude of strikes and demonstrations, by wage bargaining, technological shifts in the French industry... Improved access to education and skills acquisition for these generations is another explanation. The increasing reduction of the share of individuals with no qualifications reflects the increasing levels of education (see Figure 5). Cohort effects continue to increase thereafter, albeit at a lower rate and increase for the youngest, i.e. the 1975-1985 cohort groups. This is consistent with different crisis situations that 1950-1960 generations have experienced. The deceleration observed from the 1955 cohort coincides with the entry into the labour market of this cohort in the mid 1970s and the end of the “Glorious Thirty” year period (i.e. oil crisis, economic downturn around 1980 and 1990). However, cohort effects are positive for young generations which indicate that the younger cohorts, those born more recently, tend to have higher earnings than the older ones. Younger generations benefit from healthy economic situations (around 2000s) which have boosted their living standards compared to the previous cohorts at the same age.

Studies carried out by Lollivier and Payen (1990) and by Koubi (2003) support these results. Significant earnings disparities occur between the pre-boomers and generations born in the second half of the 1950s. In contrast with Koubi’s findings, the earnings profile continues to increase strongly for the youngest. The differences between the two papers arise because the data used and differences in sample chosen (Koubi studies employees from private sector only). Moreover, the measure of earnings is different from that used in the current paper. He employs total annual earnings which include a labour supply dimension that contrasts with the hourly earnings, a productivity measure, used in the present paper.

Thus, younger generations have an advantage compared to the older ones because they tend to have higher levels of education (see Figure 5). A large proportion of individuals in the 1971-1975 cohort groups entered higher education, that is 35.2 percent compared with 7.5 percent for 1931-1935 cohort groups. More than 50%

of the latter have no qualifications. The education levels of the youngest partly explain why younger cohorts have higher wages on average. Cohort effects are clearly present, and could explain the downturn observed in cross-section data for older workers.

Earnings Trajectories by Gender

The estimation of age effects by gender shows differences in age-earnings profiles. The relation is increasing for both genders, but male earnings profiles are growing faster at the beginning of career, until the age of 40, while the growth is more moderate for females (see Figure 12a). However, acceleration in earnings growth is then observed at the end of working life, around the age of 55, regardless of gender.

The typical earnings profile observed in Figure 11a for all workers is similar once the decomposition is undertaken by gender with some differences between cohorts. As with the full sample, males and females born up to the end of 1950 see their earnings diminish compared to previous cohorts but the effect is more marked and longer for the males. Another difference is the rapid and strong earnings growth that younger generations of women experience. It is clear that the differences between gender are partly due to the massive entry of females into the labour force which occurred in France over the period 1970 to 1980. Female participation rates have increased significantly from that period on and the fact that they are better educated than their elders could explain the catch-up in female earnings for those generations, even through earnings differences remain between genders.

5.1.2. Earnings Trajectories in Great Britain

Turning now to Great Britain, Figure 11b shows the results of the A.P.C decomposition for all employees. The period effects represent the impact of cyclical and other macroeconomic events on wage. The first important point is that over the period studied, 1991-2007, the estimated year or period effects are smaller than either the age or cohort effects. Between 1991 and 1993, year effects are positive, followed by a sequence of negative effects until 2000. After this, the effect is positive until 2005. The age profile has a concave shape which reaches a maximum level at the age of 64 – but it never declines. This finding is important because it means that older workers do not on average see their earnings decrease as retirement approaches as in commonly observed in cross section data.

The estimated cohort profiles exhibit some fluctuations due to the use of dummy variables in the decomposition and not imposing any parametric form overall. The results show an increasing trend over the generations of individuals. This implies that older generations tend to have lower earnings than the younger cohorts. The size of cohort effect is close to that of age. Again this could explain the decline observed at older ages in cross-sectional analysis, so that the decline is not due to the effect of ageing itself. In terms of their magnitude, cohort

and age effects size in Great Britain are similar to those in France, but the age effects are more pronounced and stronger.

Earnings Trajectories by Gender

Differences arise when the decomposition is undertaken separately for males and females (see Figure 12b). A confounding factor is the male-female difference in minimum retirement age, so that very few women are observed in the labour force beyond the age of sixty. The cohort and period effects are similar for both genders. The most interesting difference is between the age effects. The age-earnings profiles are generally increasing until the age of 60 for females even if one or two reductions are observed for the 50 to 60 age group. There is no evidence that the earnings decline at older age, for females. But for males, the age-earnings profile turns down for older workers. Earnings increase until the age of 54, and after this age earnings decline until the age of minimum retirement. The decline observed in cross-section data does not appear to be due solely to age itself. Age effects could play a role in explaining the negative slope of the cross-sectional earnings profile observed, but for male workers only. However, it should be noted that confidence intervals are wider at older ages. So, we cannot be sure whether earnings really decline as the consequence of age effects. Nonetheless, the cohort effect is still responsible for the major part of the negative slope of the age-earnings profile observed in cross section data but for males, age may contribute as well.

The results indicate differences between countries. In particular the effects of age and cohort particularly on earnings growth differ. Cohort effects are monotonic in Great Britain which indicates that successive generations have higher earnings than their predecessors. In contrast, in France, the cohort effects are still positive but with a slowing trend observed from the 1950s generation onwards. The ageing process itself may be responsible in part of the decline of earnings for male workers in Great Britain. Cohort effects are the main factor, and there is no clear evidence that the decline is due to age itself; it is more probably the result of cohort effects. Indeed, the cohort effects are positive and reveal that younger cohorts earn more than their elders, regardless of gender. The findings of non-declining earnings profiles at older ages are thus contrary to the prediction of human capital theory, or to the hypothesis that productivity can be decreasing with age. The findings are more consistent with models of implicit contracts (Lazear (1979)).

5.2. Decomposition of Earnings Trajectories by Occupational Groups

The decomposition of the aggregate age-earnings profiles has shown that age, period and cohort have an influence on earnings growth. The results indicate that cohort effects are responsible for a large part of the earnings decline observed at older age in cross-sectional data. The results also suggest that age could have a negative role on earnings growth at older age among male workers in Great Britain.

Similarly, earnings profiles may evolve differently within a cohort, and these differences in earnings could be explained by observable characteristics. However, because there is an issue concerning how to compare skills on the basis of education level between different generations, I choose to explain differences by occupation level based on the skills implicit in the type of work done. Indeed, the older labour force in the year 2000 will contain persons born before 1945, and at this time only a small proportion of cohorts would remain in the education after the age of 16. The minimum school leaving age in France and in Great Britain was 14 until 1960, and access to post-secondary education was limited for these individuals. For this reason, it is difficult to analyse differences in earnings between cohorts for a given education level in which education system has experienced important changes over the years. The complexity of this issue is clearly apparent in Figure (5) which indicates how cohorts are heterogeneous in terms of education attainment. The level of education has significantly increased over time across cohorts. Older workers have a much lower general educational attainment compared to the youngest. The older generations of individuals cannot really be compared with successive generations in terms of education level. It is therefore more relevant to undertake the APC decomposition by occupational status rather than by level of schooling. Workers are divided into three groups: high skill, medium skill and low skill occupations. Higher status in employment includes managerial and professional occupations, senior officials. Medium skill occupations includes associate professionals and technical, administrative and secretarial, skilled trade. The last group refers to low skill occupations and it comprises personal services, machines and plant operators, partially skilled, unskilled workers.

The decomposition of earnings into age, period and cohort effects by occupational groups provides relevant information regarding the dynamics of life cycle earnings. This is especially true for French skilled workers as we shall see in the next subsection. Figures 13a and 13b depict the age profiles for different subgroups. I only present age and cohort estimates. Period coefficients are not reported, firstly, because I am mainly interested in age and cohort effects on earnings and secondly, because period effects show that earnings increase at time of high growth and decline with recession.

For French workers (Figure 13a), age effects are in general positive and significant over the working life. Earnings increase until the age of 60. Older workers earn higher wages than individuals at the beginning of their career. Nonetheless, age coefficients for high skilled category are not statistically different from zero. No conclusion can be drawn about the impact of age on earnings profiles. For medium and low skilled categories, the profile is positive upward-sloping and significant in overall. There is no obvious evidence that the earnings decline for older workers. Figure 13b represents the A.P.C decomposition results by skill level for the British sample. For all occupational groups, the profile is concave and increasing, with some differences depending on status. For skilled earners, the trajectory is increasing and becomes flat from the age of 50 until the minimum retirement age. Some one-off reductions are observed along this stagnant phase, one of which happens at the

age of 62 but the profile never really turns down. The age effects are the strongest for this category which suggests that higher skill workers are the category which benefits from greater wage particularly older workers. The medium skill group profile is positive and never declines. In general, it has a positive slope although kinks are observed at around the age of 30. In contrast, the profile for low skilled workers turns down from the age of 54 and earnings decline until the age of retirement. Again, the large confidence intervals for this latter category suggests an uncertainty level about the decline of age-earnings profiles at the end of working life.

Looking at the effects of cohort membership on earnings growth, the trajectories differ according to skill group. First, the French case provides interesting results in terms of difference compared to the aggregate case (Figure 11a). For the skilled workers, coefficients of the cohort dummies are not significant. Cohort effects do not seem to influence earnings life cycle for the skilled workers. For the other two groups, the cohort effect is monotonic and increasing. There is a catch-up in earnings for the most recent generations. This coincides with the “Glorious Thirty” period, characterised by three decades of prosperity with full employment and profound social change, which resulted in improvements in living conditions which has not stopped at the end of that period studied.

The results by skill groups display divergence between the two countries. The French age-earnings profiles entail a continuous earnings growth until the age of 60. This strong increase particularly around the age of 60 could be due to the seniority premium of earnings built in to collective agreements. By contrast to Great Britain, the growth slows at around the age of 50, and is even negative for a certain category of workers. Overall, the generational effects are positive for both countries. An individual born for example in the 1970s will earn more wage than an individual born a few years earlier just because they are born at the right time. Differences in characteristics across cohorts like attainment of specific skills in the later age groups, or enrolment in higher education can explain the increasing cohort effects among generations.

Earnings Trajectories by Gender

When the decomposition is undertaken separately for males and females, further conclusions emerge. For France, there is no real difference between Figures 14a and 14b. The age profile of skilled workers is still flat and, overall, none of the coefficients associated to age dummies are statistically significant, for both gender, which means that age does not explain the growth of earnings. Once again, the main differences occur for medium and low skill categories for which the age profile is increasing until the age of 60 for both males and females. The age effects are particularly strong for females in the low skilled group. These findings must be interpreted with caution due to the small sample size in cross-section data, producing less precise estimates.

While the decomposition for skilled category shows no evidence of the role played by cohort on earnings growth, the decomposition by gender demonstrates its importance. Firstly, only the cohort effects are present

and the effects evolve in the opposite direction within this group. The effects are negative for males, but they become significant for individuals born after 1949 cohort birth. Older generations, at a given age, earn more than the subsequent generations. Cohort effects have the same impact for the females even if the coefficients associated with cohort effects are positive: the profile is declining across generations. Older generations have advantage compared to the following generations. The effects are particularly strong for the individuals born before the 1950s, and then the amplitude diminishes from one generation to the next. Skilled workers born before 1950 have benefited from the period, they probably enjoyed a better situation, with a better education system compared to their elders and combined with a dynamic demand for qualified workers. By contrast, the general trend is increasing for the other two groups, regardless of gender. Cohort effects are positive and significant after the 1940 birth cohort. But for low skilled females, effects are significant for the generations born from the end of the 1970s. The overall trend is increasing, so younger generations are advantaged in terms of wages. They earn more than the older cohorts for both genders. There are little differences in age, cohort and period effects across gender. The most important concerns the cohort effects for the skilled group. The decomposition between occupation groups shows the role played by cohort effects on earnings profiles, and it can explain the inverted-U-shape of cross-sectional age-earnings profiles.

For Great Britain, differences of earnings profiles by gender are not considerable, as displayed in Figures 15a and 15b. As found earlier, age profiles are concave but the decline is more pronounced now, for males in medium and low skill categories. The decline is observed around age of 55, but it is particularly marked for the last group. However, confidence intervals are ample among medium and low skill workers, and therefore the earnings decrease may not be statistically significant. For females, the age profile is increasing for all occupational groups. The cohort effects go up with birth year suggesting that those born recently appear to have better earnings than their predecessors.

5.3. Decomposition of Earnings Trajectories by Sectors

Findings from the previous section indicate that the drop in earnings observed at later ages is related to the occupational skill groups. In this section, the APC decomposition is differentiated by sector to take into account the potential existence of pay differentials between public and private sectors (Gosling (1998)). Tables 3 and 4 illustrate the pay premium for public sector workers compared to their counterparts in the private sector. Public sector offers, on average, a higher level of pay in both countries except for few cases, such as for males in the medium skilled groups and with a least a college degree in France and in Great Britain, respectively. An explanation of these differences in earnings between the public and the private sectors can be found in differences in observed characteristics among workers (i.e human capital variables). For instance, the public sector employs in higher share workers who possess more frequently a college or university degree, and they tend to be older and hence more experienced. These differences between public and private sector wages are

also related to the institutional context. In France, public sector employees are covered by special schemes, and receive defined-benefit pensions in which the pension amount is calculated on the basis of the last six months of the worker's career. The civil service pension also depends on the point on the pay scale, which is often upgraded at the end of career. This may explain why there is a positive public premium late in life.

Overall, the growth of earnings is more important in public sector compared to the private sector. However, the distinction between public and private sectors underlines a significant contribution of the French public sector on earnings growth particularly at the end of working life (Figure 16a). The peak of earnings observed at the end of career in Figure 11a reflects a stronger growth of public sector earnings, and it is attributable to the retirement scheme and the movement to a higher point on the pay scale prior to retirement. The oldest workers are the best paid, they earn more than younger workers. Also, differences in earnings tend to increase with age between the two sectors. Differences between trajectories are not as apparent in Great Britain. Profiles have similar shape in both sectors with a positive and an increasing impact of age over the cycle (Figure 16b).

Added to this, is the fact that private earnings are more sensitive to the business cycle. Poor economic conditions would have a sudden impact on earnings, as for instance during the early 1990s characterized by a recession and an increase in unemployment, while this is less brutal for public earnings. Indeed, social partners which negotiate private earnings have lower bargaining power during a recession while public sector pay depends on policy orientations. For instance, in 1998 the French reforms, "Les Réformes Catégorielles", had been introduced to stimulate earnings after loss of purchasing power. On the contrary, private sector earnings are boosted in periods of economic upturn (in the late 1990s and the early 2000s). It is quite different in the British case where the public sector earnings are also determined by negotiation. Thus, the negative impact of year effects on earnings in the early 1990s reflects the 1991-1995 period of privatisation of public firms, and followed by a sharp reduction of public employment (Bargain and Melly (2008)). Conversely, a few years before the recession (2007-2008) private sector earnings experience a growth less strong compared to the French case explained notably by a weaker union bargaining power.

5.3.1. Differences Between Occupational Groups in France

There is an important increase at the end of career for skilled workers in public sector, regardless of gender (see Figures 19a, 21a and 22a). In private sector, earnings increase to a lesser extent. For highly skilled workers cohort effects are flat overall, except for the oldest generations who benefit the most from social and economic conditions⁵. Highly skilled workers earn as much as their parents did, while the situation is different for the other categories who experience an improvement of earnings across generations.

⁵i.e. a period of great economic prosperity during "The Glorious Thirty" year period

The distinction between gender does not produce different results. Successive generations of skilled workers do not see their situation improved (see Figures 21a and 21b). Yet, further differences between sectors appear for female employees (Figures 22a and 22b). The decomposition reveals that this is in the public sector and especially for the medium skilled group that the earnings improvement is the most pronounced. They benefit the most of the increase of earnings partly due to age effects. The age effects are strongly positive relative to the two other occupational groups. In addition, cohort effects are important and positively significant for this occupational group. There is a significant catch-up of earnings for this category, more generally successive generations of women have experienced a significant improvement of their earnings position.

5.3.2. *Differences Between Occupational Groups in Great Britain*

As before, the decline of earnings is observed for older males but only for private sector workers (see Figure 16b). But again, age effects do not affect all male workers in the same way. Only medium and low qualified workers working in the private sector are affected by this finding. Their earnings decrease at the end of their working life, contrary to skilled workers for whom earnings are significantly rising and become flat at the end of working life. However, the confidence intervals become wider at older ages, suggesting that the last part of the earnings trajectory can be decreasing or not. The decline of earnings profiles for these two occupational groups may not be statistically significant. A further difference occurs with respect to the cohort effects. Generally, Figures 20b, 23a and 23b show a steep upward trend, except for medium skilled males in public sector for which the trend has been levelling from the 1960s generation of male workers. There is a significant improvement in the earnings position over generations of workers, except for middle skilled males in the public sector for which earnings seem to have not evolved since the 1960s generation. Based on the confidence intervals, there is no clear trend in the decline of earnings as the consequence of ageing. For the others, earnings continue to grow until the end of working life or remain stable, but do not decrease. For the females, the distinction public/private sector does not bring any new elements. There is no evidence that earnings decline in the late career whatever the sector and the qualification (see Figures 18b, 24a and 24b). One might added that there is a catch-up effect in women's pay across generations considering the strong and rising cohort effects, regardless of the occupational skill group.

6. Robustness Analysis

In this section, I provide additional analyses to evaluate the robustness of the findings. First, I use an alternative measure to control for the business cycle. I, then, change the definition of the hourly earnings. Finally, I exploit another British dataset which uses a rotating panel sample design as for the French dataset, and which makes the studies more comparable.

6.1. Alternative measure for the cycle

I have also used an alternative measure for the cycle to examine the robustness of the results. Following [Beaudry and Lemieux \(1999\)](#), I re-estimate the models with the unemployment rate of men aged 25-54 to capture short term economic fluctuations. Short term fluctuations of this variable are more likely the results of change of economic conditions while long term fluctuations may be result of structural factors. The results are presented in Figures 25 to 27, and are similar to those obtained with APC decomposition.

6.2. Alternative measure for the hourly earnings

In the main analysis, I have removed the observations for which the hourly earnings were below the hourly minimum wage in France. Excluding observations at the bottom of the earnings distribution can have significant effects on earnings growth. To check for the robustness of the findings, I repeat the estimations by replacing the level of hourly earnings reported with the level of the hourly SMIC, but only for the values below the hourly minimum wage.

The main results are presented graphically in Figures 28, 29 and 30. The trends remain similar over gender, occupation and sector. Trajectories have the same shape than in the baseline study, except for the medium skilled group in private sector for which the earnings decline at older ages. However, I cannot draw clear conclusions on the real decline of earnings, on the basis of the wide confident intervals.

6.3. Alternative Dataset

Until now, I have evaluated the age-earnings profiles using the FLFS for France, and the BHPS for Great Britain. However, the difference between the two datasets used may not provide a meaningful comparison of the earnings growth between the two countries. In order to check the robustness of the results, I use a complementary dataset, the Longitudinal Labour Force Survey (LLFS) for the period 1994 to 2009. As the FLFS, the LLFS is a rotating panel dataset representative of the UK population. Individuals are followed over five consecutive quarters. The LLFS provides information on individual demographic such as age, gender, marital status, on an individual's labour market status, and information on the earnings. I use the hourly rate information in the LLFS as the measure for the hourly earnings to evaluate the earnings trajectories. I do not use survey prior to 1994 because some individual information are only available from Spring 1994.

I present only the main results of the earnings decomposition. As show in Figures 31 to 33, no huge change happens. The earnings are still concave, especially for the men. Nonetheless, some differences appear. There is still some evidence of a decline of earnings for male workers in the medium and low groups, but the decline is moderate compared to that observed from the BHPS. Moreover, the confidence intervals are large in the last part of the earnings profile, and the decline of age-earnings profile could be not significant. For females,

earnings increase over the lifecycle. As regards the generational effects, the cohort effects are increasing for both gender. Cohort effects are a key factor to explain the fall of earnings observed in cross section data.

7. Conclusions

This paper compares life-cycle of earnings of France and Great Britain over the period 1991 to 2007. I use cohort analysis to isolate generational effects from age and period effects. I find no clear evidence that earnings decline for older workers as a result of age. Earnings increase until old age and flatten out. The decline observed at cross-sectional analysis seems to be caused in a large part by cohort effects. Older generations tend to have lower life time earnings compared to the youngest. Changes in characteristics across cohorts and over time are the key to explain the shape of earnings profiles over time and to understand the decline observed in cross-section data. However, a distinction must be made between the two countries. The most important relates to age effects on earnings profile which while increasing overall has a different form. In France, earnings increase linearly until age of 60 with further increase that occurs right at the end of a career. In contrast, British earnings profiles have the typical concave shape flattening out, but without a decline at later ages.

I also investigate the age-earnings profiles by occupational status in order to take into account the heterogeneity of workers. In France, the earnings have been boosted over generations except for the skill category of workers, and with more significant effects in the public sector. Successive generations of women are also concerned by the increase in earnings with the most dynamic growth observed for medium skilled women. For Great Britain, there is no clear evidence that ageing may contribute to the decline of earnings profiles. However, cohort effects are still important in explaining the decline in earnings at later ages observed on cross-section analysis.

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Table 1: Cohort numbers by year, France

Year of survey	Cohort (Birth year)										
	1932-35	1936-40	1941-45	1946-50	1951-55	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85
1991	769	1,535	1,917	3,084	3,319	3,594	3,948	2,577	201	0	0
1992	566	1,332	1,786	3,101	3,188	3,390	3,747	3,032	429	0	0
1993	368	1,488	1,997	3,180	3,308	3,624	4,105	3,491	715	1	0
1994	147	1,253	1,914	3,074	3,310	3,443	3,854	3,704	1,047	2	0
1995	0	1,157	1,813	2,851	3,139	3,341	3,988	3,850	1,490	33	0
1996	0	881	1,73	2,968	3,096	3,458	3,714	3,862	2,004	119	0
1997	0	579	1,578	2,768	3,001	3,155	3,445	3,627	2,301	200	0
1998	0	311	1,446	2,719	3,013	3,211	3,502	3,623	2,954	464	0
1999	0	139	1,381	2,730	2,897	3,211	3,391	3,640	3,290	867	8
2000	0	0	1,267	2,798	3,205	3,434	3,591	3,882	4,162	1,654	64
2001	0	0	926	2,662	2,858	3,261	3,539	3,820	4,128	2,290	228
2002	0	0	671	2,479	2,854	3,249	3,417	3,727	3,869	2,762	502
2003	0	0	328	2,040	2,706	2,912	3,101	3,114	3,244	2,664	1,087
2004	0	0	151	2,000	2,809	3,045	3,193	3,046	3,231	2,944	1,589
2005	0	0	0	1,607	2,465	2,793	2,931	2,889	2,989	2,774	1,705
2006	0	0	0	1,224	2,460	2,903	2,905	2,927	2,985	2,771	2,049
2007	0	0	0	996	2,485	2,956	3,143	3,036	3,118	2,996	2,636

Table 2: Cohort numbers by year, Great Britain

Year of survey	Cohort (Birth year)										
	1931-35	1936-40	1941-45	1946-50	1951-55	1956-60	1961-65	1966-70	1971-75	1976-80	1981-85
1991	594	642	814	975	857	1,018	1,044	882	796	0	0
1992	535	570	723	870	781	928	948	758	703	139	0
1993	489	520	672	816	718	868	881	716	651	274	0
1994	470	500	666	799	712	843	860	682	620	403	0
1995	447	478	635	762	682	796	823	647	596	516	0
1996	361	475	642	769	688	799	828	657	604	678	0
1997	247	466	621	751	673	783	805	640	584	668	117
1998	178	454	612	729	643	762	776	615	569	634	234
1999	87	433	603	708	625	731	764	599	533	607	347
2000	5	425	589	685	606	712	738	581	514	568	455
2001	0	346	565	657	580	702	719	565	499	533	544
2002	0	261	543	636	568	681	708	544	471	497	486
2003	0	172	532	623	549	670	671	536	446	467	466
2004	0	82	502	610	536	650	647	515	417	455	439
2005	0	8	495	591	522	630	621	485	413	440	425
2006	0	0	401	578	504	609	610	481	402	431	396
2007	0	0	281	557	489	584	583	473	390	411	370

Table 3: Sample descriptive statistics, France and Great Britain

	France			Great Britain		
	Public	Private	All	Public	Private	All
Occupation						
Skill	0.29	0.15	0.20	0.32	0.24	0.26
Medium skill	0.60	0.47	0.51	0.39	0.51	0.48
Low skill	0.11	0.38	0.29	0.29	0.25	0.26
Education						
Baccalauréat-A level	0.16	0.14	0.15	0.45	0.42	0.43
College/university	0.38	0.23	0.28	0.26	0.12	0.16
Brevet/CAP/BEP-Gcse	0.32	0.38	0.36	0.16	0.22	0.21
No qualification	0.14	0.25	0.21	0.13	0.24	0.20
Men						
Age	40.11	37.59	38.25	41.33	38.21	38.75
Hourly earnings	11.09	9.52	9.95	12.45	10.82	11.11
Occupation						
Skill	0.30	0.17	0.21	0.34	0.29	0.30
Medium skill	0.50	0.31	0.36	0.34	0.45	0.43
Low skill	0.20	0.52	0.43	0.32	0.26	0.27
Education						
Baccalauréat-A level 0.15	0.12	0.13	0.49	0.45	0.45	
College/university	0.32	0.21	0.24	0.27	0.14	0.17
Brevet/CAP/BEP-Gcse	0.36	0.41	0.40	0.13	0.19	0.18
No qualification	0.17	0.26	0.23	0.11	0.22	0.20
Women						
Age	39.50	37.15	38.10	41.19	37.40	38.65
Hourly earnings	10.01	8.79	9.30	9.90	7.46	8.28
Occupation						
Skill	0.28	0.13	0.19	0.30	0.18	0.23
Medium skill	0.69	0.70	0.70	0.43	0.57	0.52
Low skill	0.03	0.17	0.11	0.27	0.25	0.25
Education						
Baccalauréat-A level	0.17	0.17	0.17	0.45	0.37	0.41
College/university	0.41	0.27	0.33	0.25	0.10	0.15
Brevet/CAP/BEP-Gcse	0.28	0.34	0.32	0.17	0.27	0.23
No qualification	0.14	0.22	0.18	0.13	0.26	0.21

Note: The data is pooled across the first seventeen waves of the BHPS Data–1991–2007

Source: own calculations based on FLFS and BHPS, 1991–2007

Table 4: Descriptive statistics of (mean) hourly earnings, France (€) and Great Britain (£)

	France			Great Britain		
	Public	Private	All	Public	Private	All
Occupation						
Skill	15.03	14.79	14.94	14.80	14.03	14.28
Medium skill	8.73	8.88	8.83	9.79	8.78	9.00
Low skill	7.93	7.41	7.48	8.28	7.01	7.38
Education						
Baccalauréat- A level	9.83	9.38	9.54	10.75	9.85	10.10
College/university	13.31	12.07	12.64	14.63	15.12	14.92
Gcse	8.74	8.30	8.43	8.01	7.79	7.83
No qualification	7.79	7.87	7.86	6.83	6.80	6.81
Cohort						
1931-35	13.92	11.62	12.42	9.52	8.41	8.63
1936-40	12.79	10.51	11.36	9.31	8.43	8.63
1941-45	12.55	10.68	11.40	9.72	9.17	9.33
1946-50	12.23	10.65	11.30	11.25	9.06	9.76
1951-55	10.97	9.71	10.22	11.57	10.56	10.89
1956-60	10.10	9.26	9.59	11.56	10.44	10.78
1961-65	9.79	9.10	9.33	11.11	10.67	10.79
1966-70	9.35	8.32	8.61	10.00	9.42	9.57
1971-75	8.94	8.36	8.53	10.07	8.04	8.36
1976-80	9.37	8.88	9.00	9.26	7.56	7.82
1981-85	9.05	8.18	8.35	7.79	6.74	6.83
Men						
	11.09	9.52	9.95	12.45	10.82	11.11
Occupation						
Skill	15.95	15.37	15.63	16.33	15.39	15.59
Medium skill	9.29	9.61	9.50	10.86	10.12	10.22
Low skill	8.18	7.51	7.60	10.36	8.23	8.68
Education						
Baccalauréat-A level	10.67	9.99	10.20	12.17	11.22	11.40
College/university	14.72	13.25	13.80	16.25	16.52	16.44
Brevet/CAP/BEP-Gcse	9.22	8.54	8.70	9.27	8.98	9.02
No qualification	8.35	7.82	7.93	8.32	7.92	7.96
Women						
	10.01	8.79	9.30	9.90	7.46	8.28
Occupation						
Skill	14.24	13.55	14.01	13.85	11.39	12.52
Medium skill	8.40	8.38	8.39	9.34	7.46	7.98
Low skill	6.38	6.95	6.91	7.02	5.36	5.99
Education						
Baccalauréat-A level	9.21	8.70	8.91	9.96	7.90	8.66
College/university	12.42	10.70	11.59	13.70	12.60	13.22
Brevet/CAP/BEP-Gcse	8.24	7.84	7.99	7.51	6.78	6.96
No qualification	7.25	7.97	7.75	7.51	5.67	6.36

Note: The data is pooled across the first seventeen waves of the BHPS Data–1991-2007

Source: own calculations based on FLFS and BHPS, 1991-2007

Figure 1: Typical cross-section earnings profile

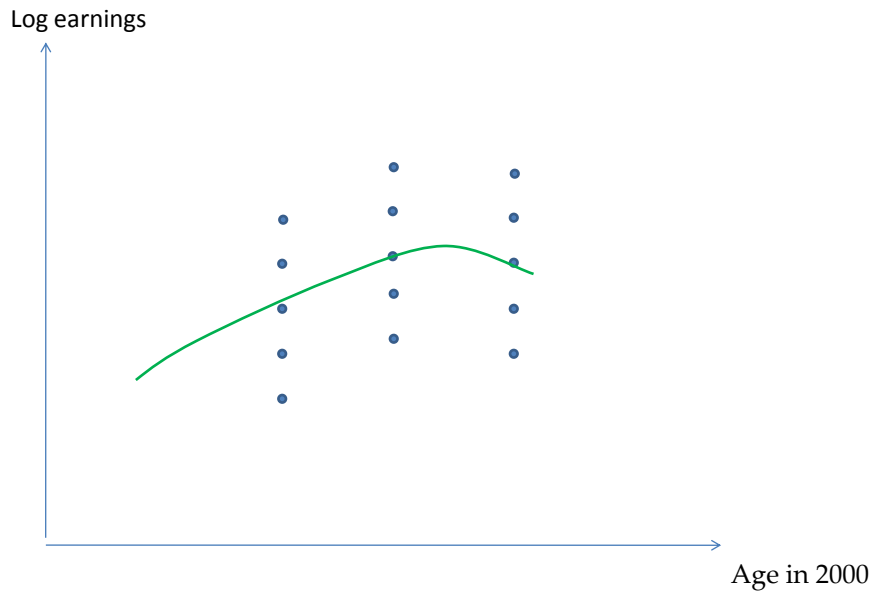


Figure 2: Human capital depreciation

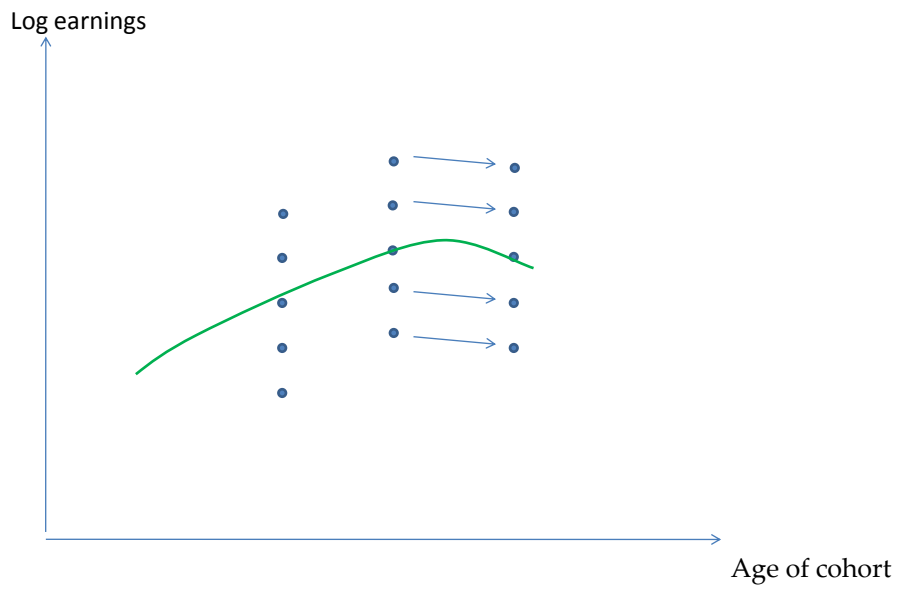


Figure 3: Overlapping cohort profiles

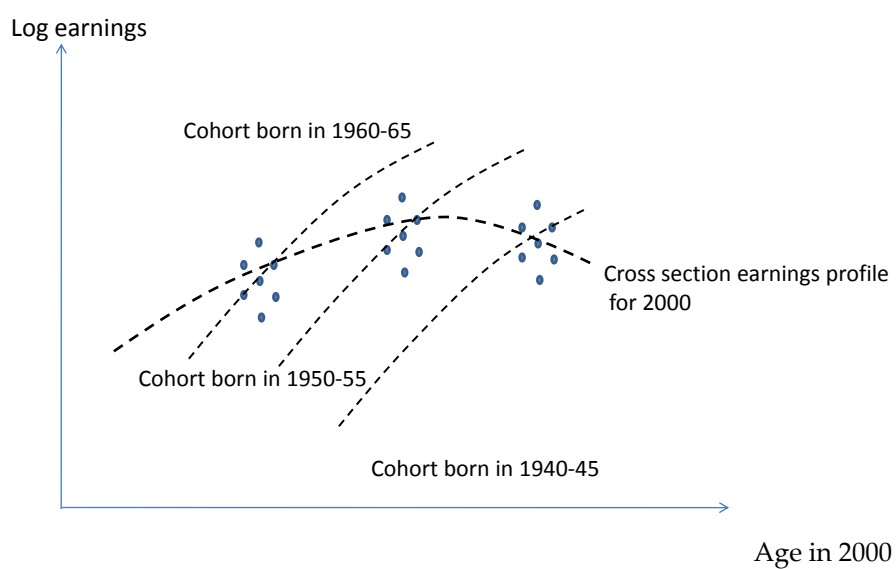
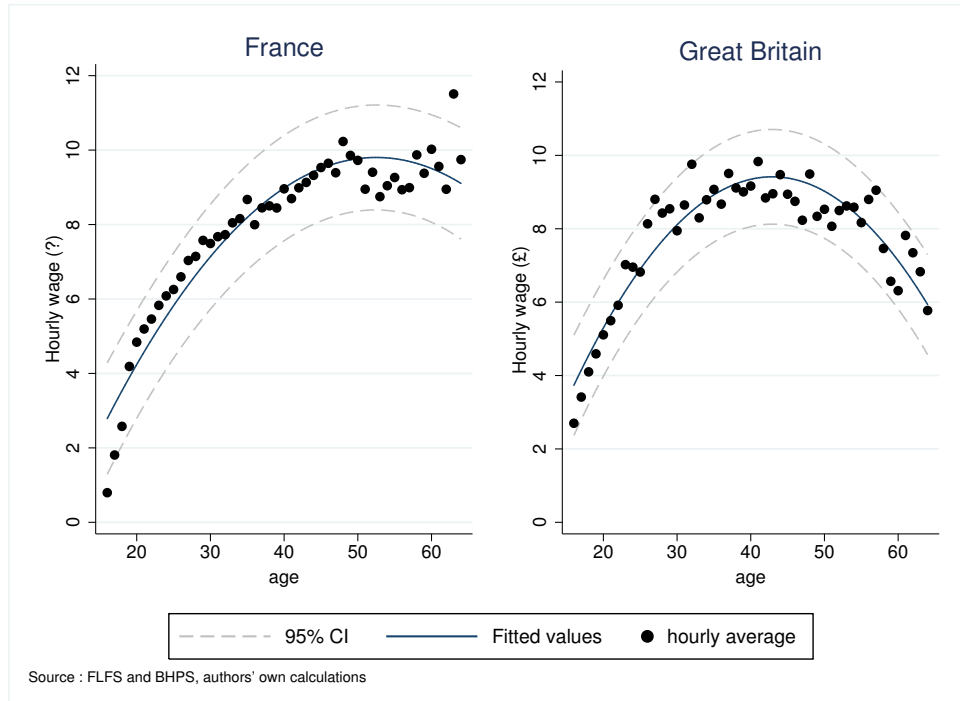
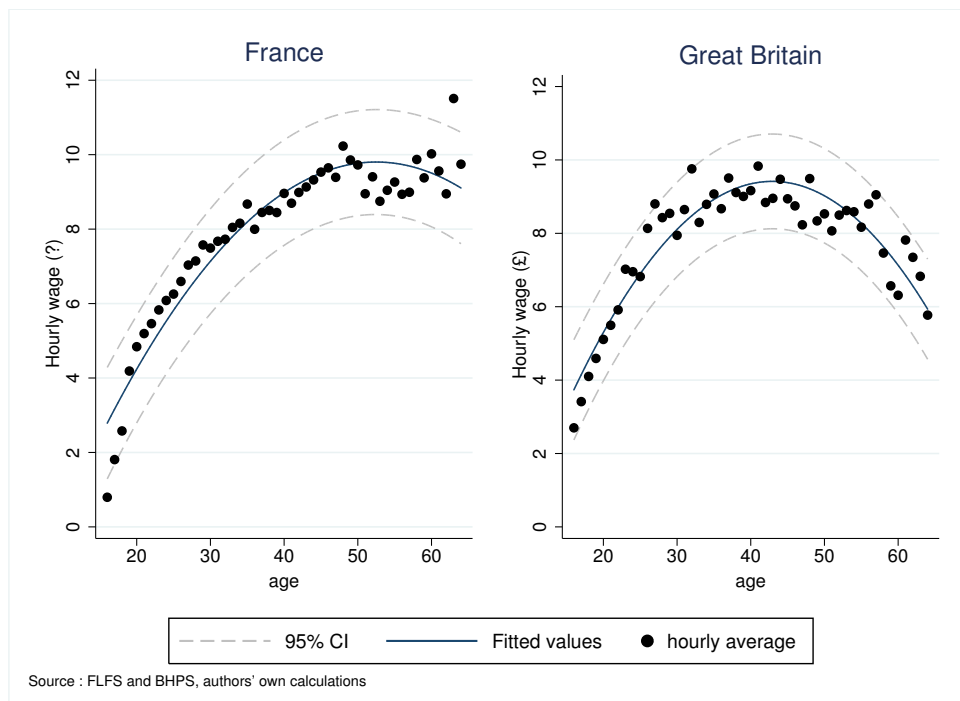


Figure 4: Cross section age-hourly earnings profiles for France and Great Britain



(a) in 1991



(b) in 2007

Figure 5: Education level by cohort in France and Great Britain

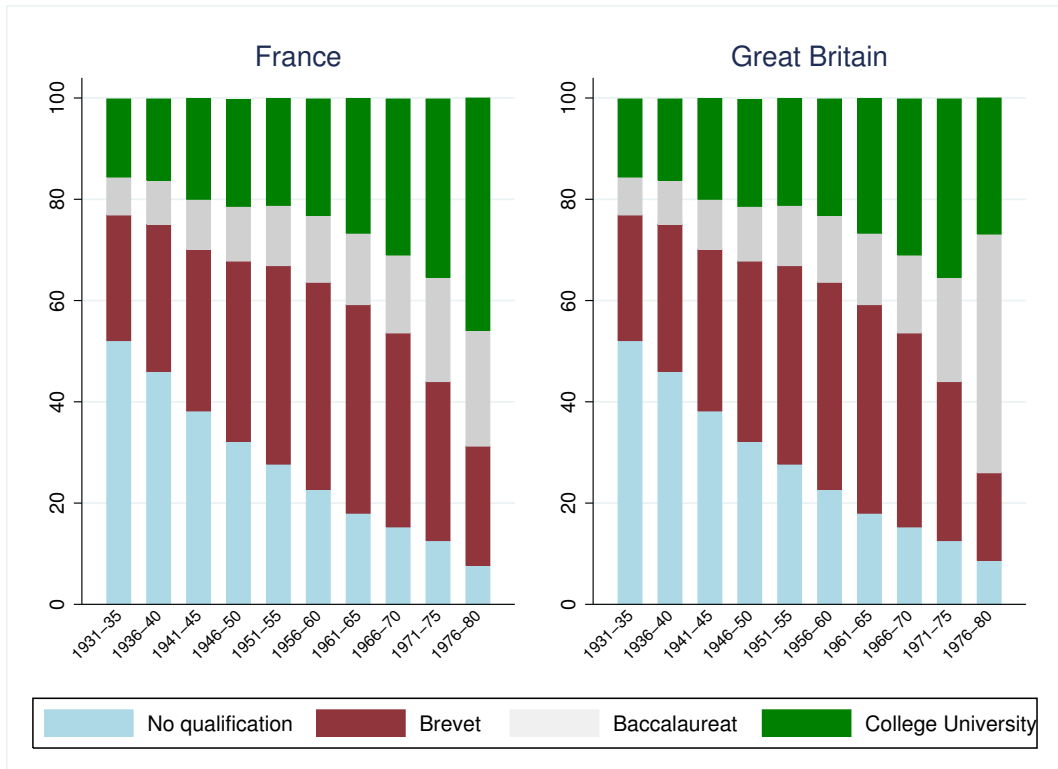


Figure 6: Skill levels in France and Great Britain

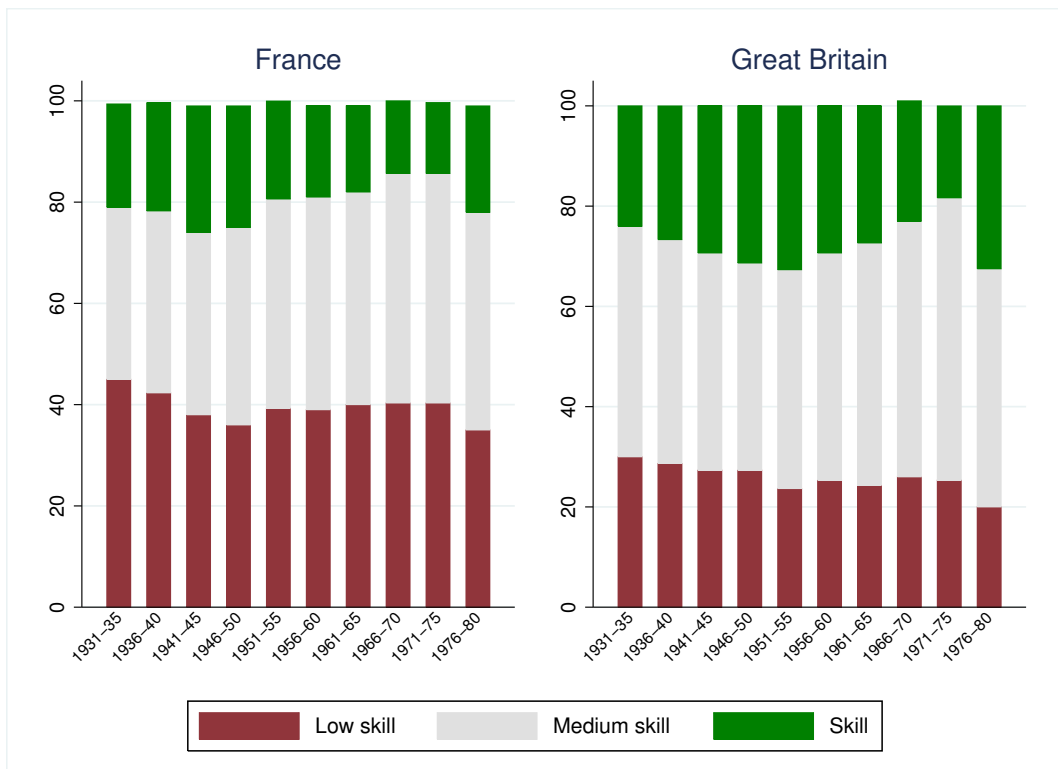


Figure 7: Cohort participation rate in France and Great Britain, 1991-2007

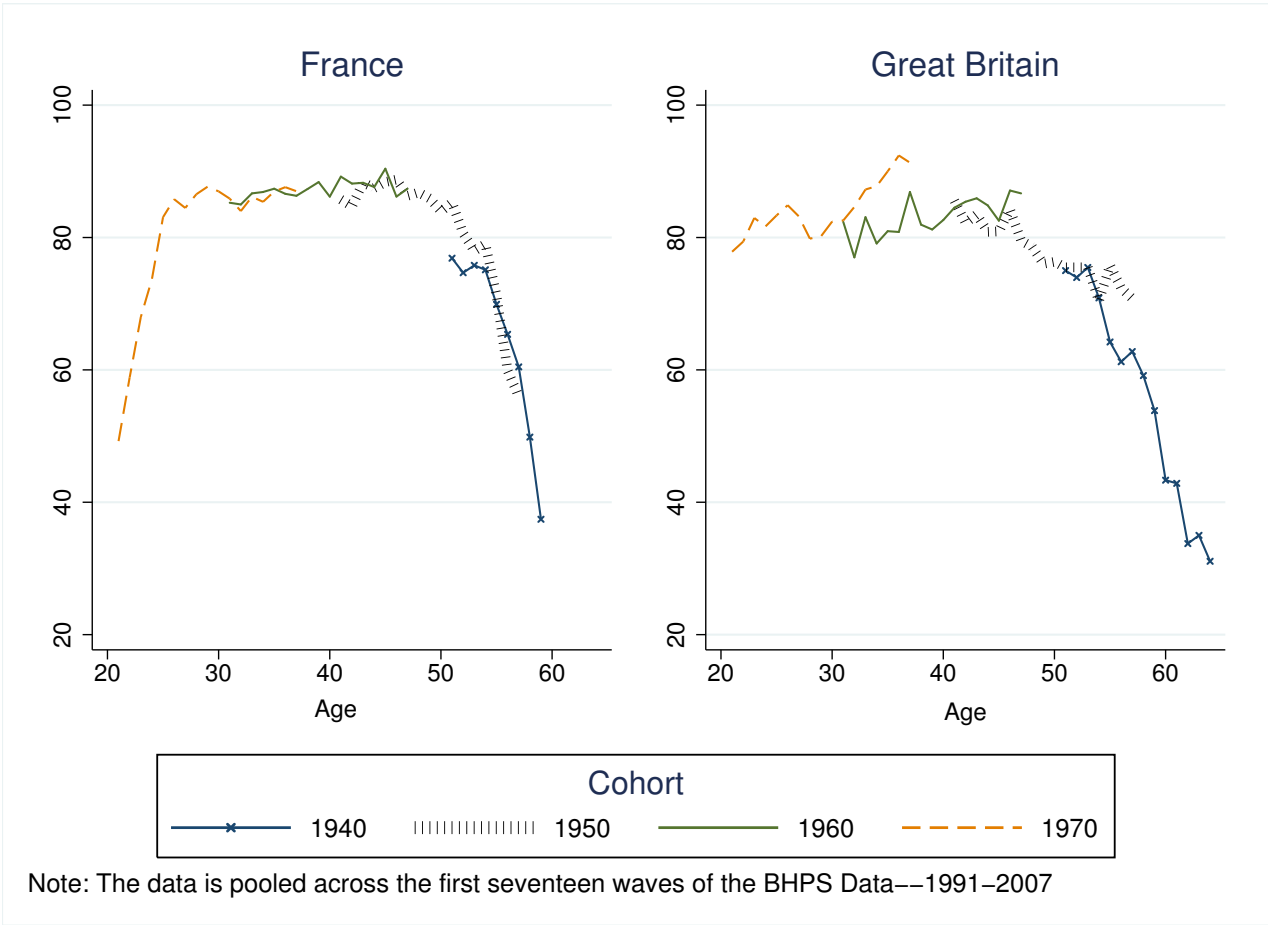


Figure 8: Cohort participation rate by gender in France and Great Britain, 1991-2007

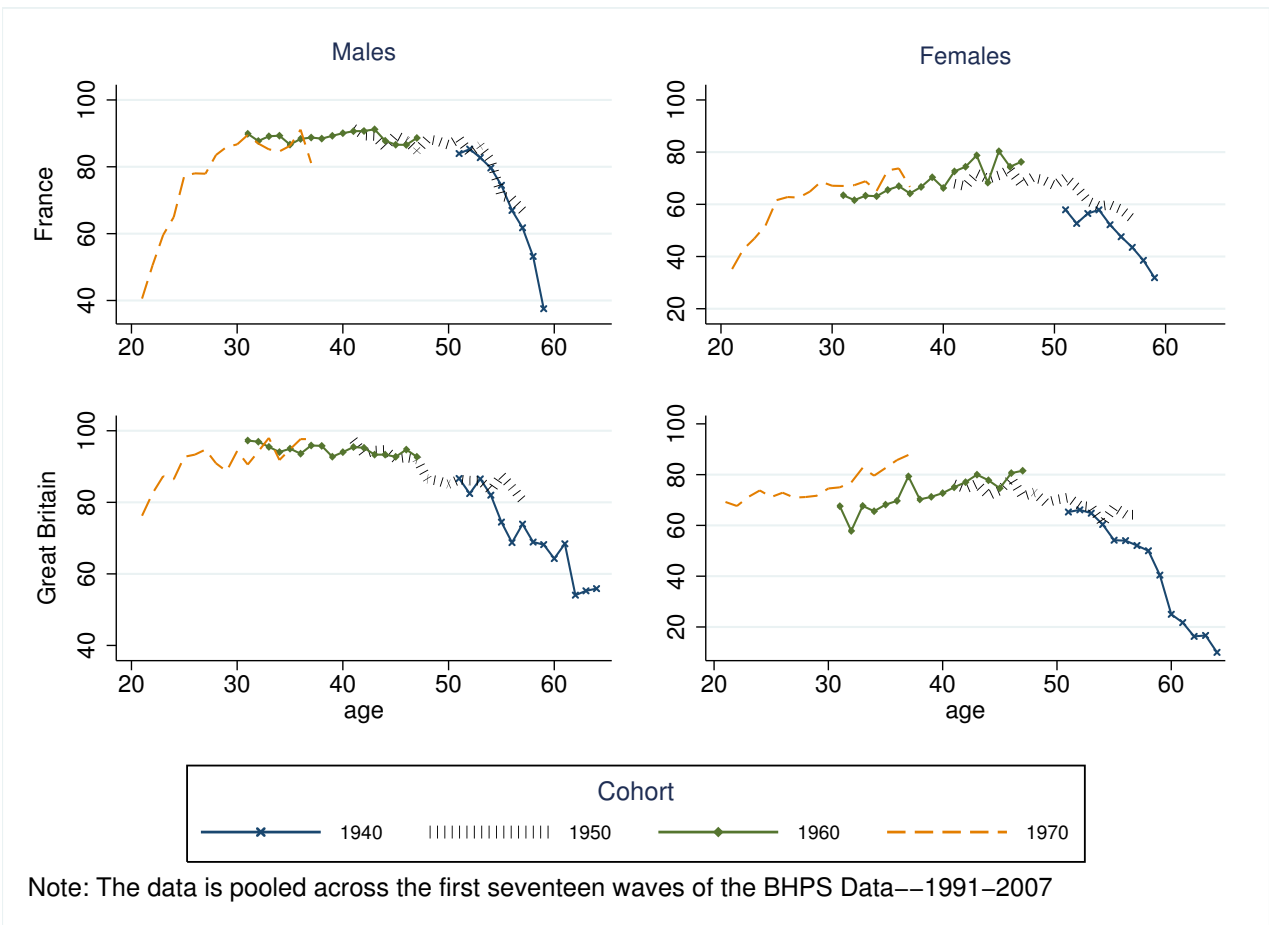
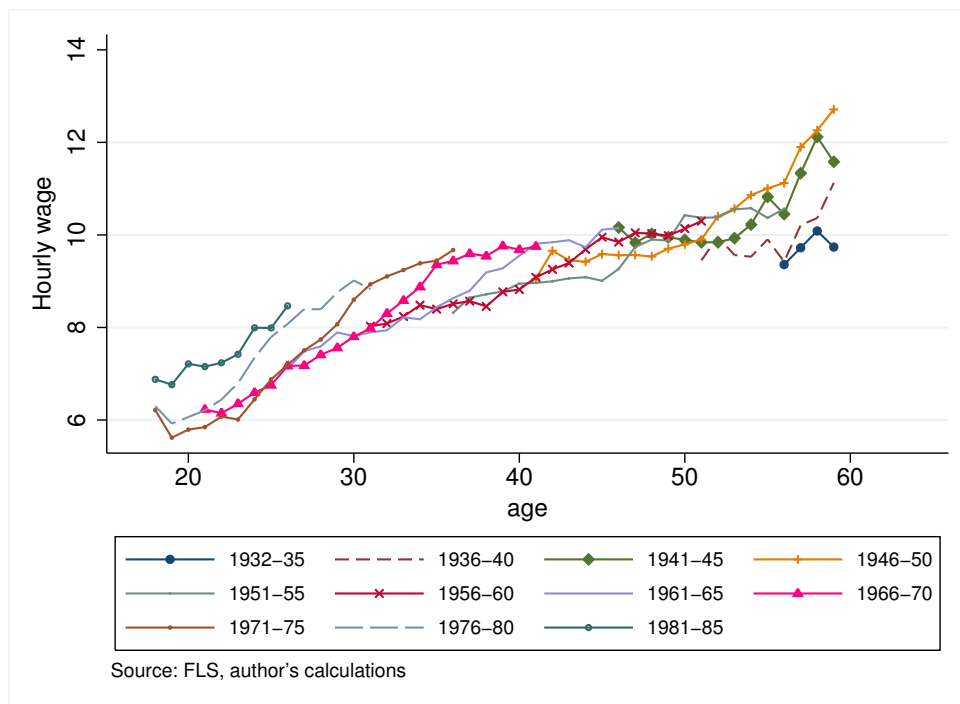
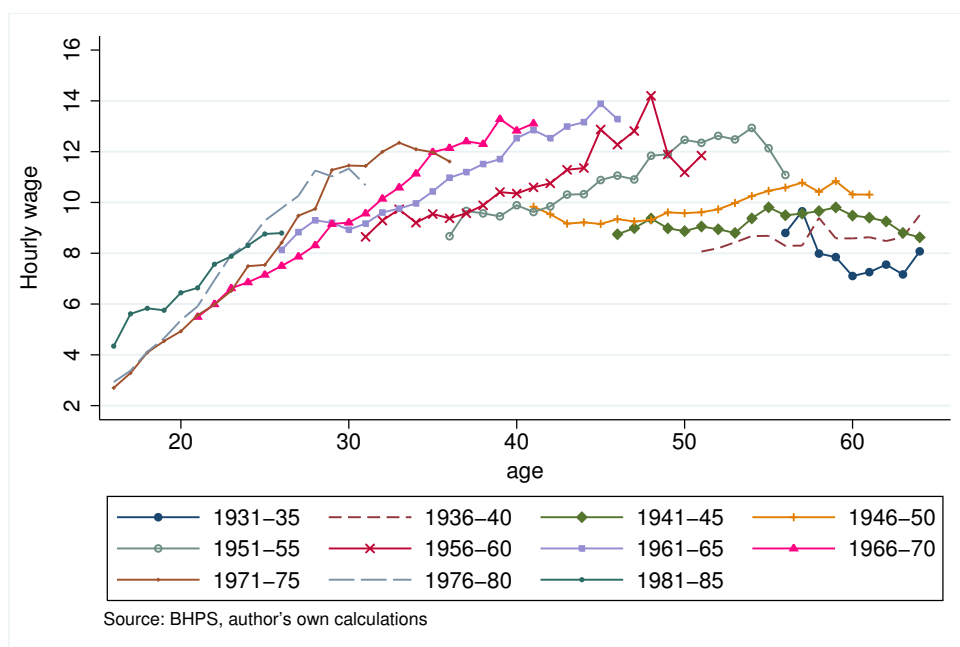


Figure 9: Cross section age-hourly earnings profiles for France and Great Britain

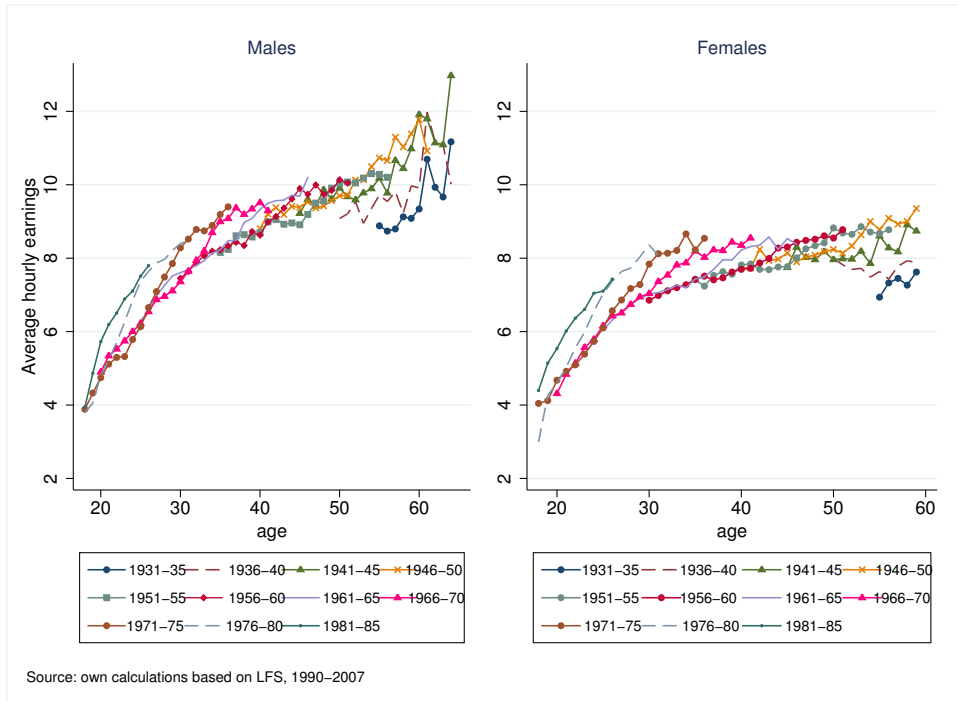


(a) France



(b) Great Britain

Figure 10: Cross section age-hourly earnings profiles for France and Great Britain, by gender

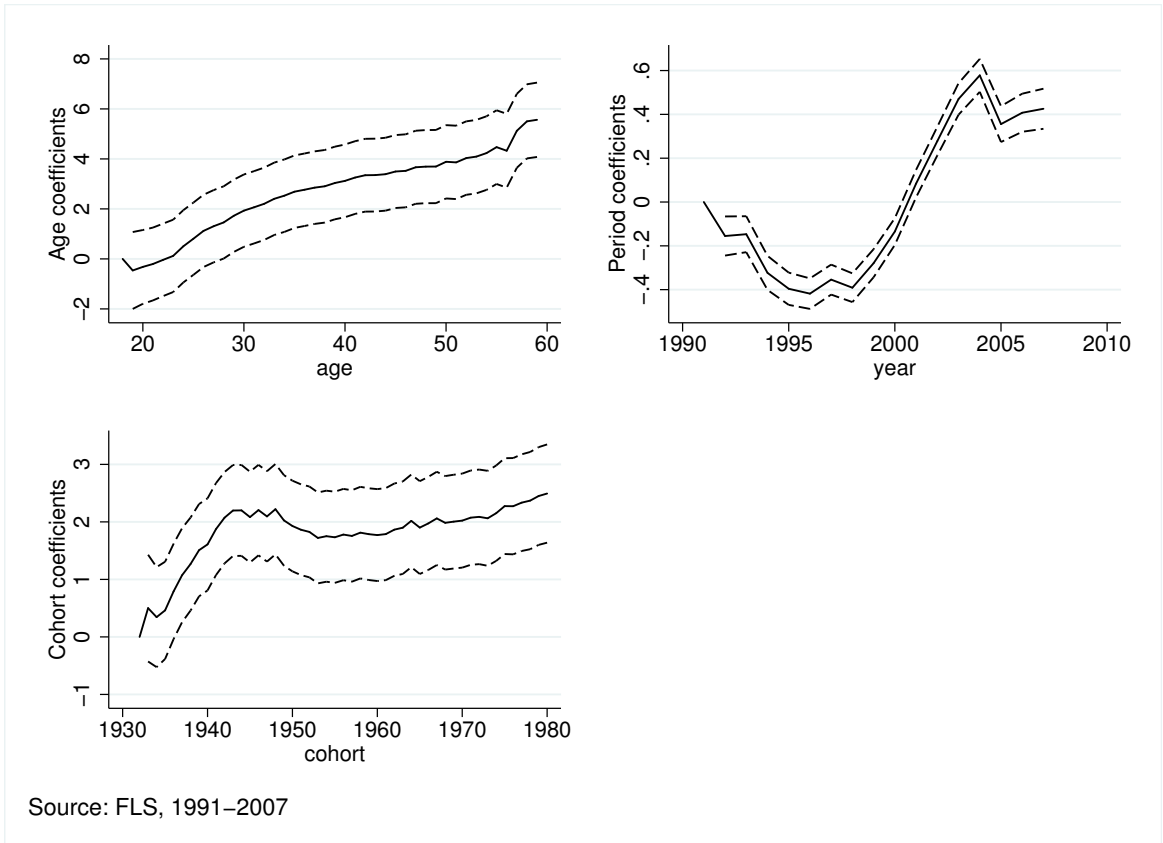


(a) France

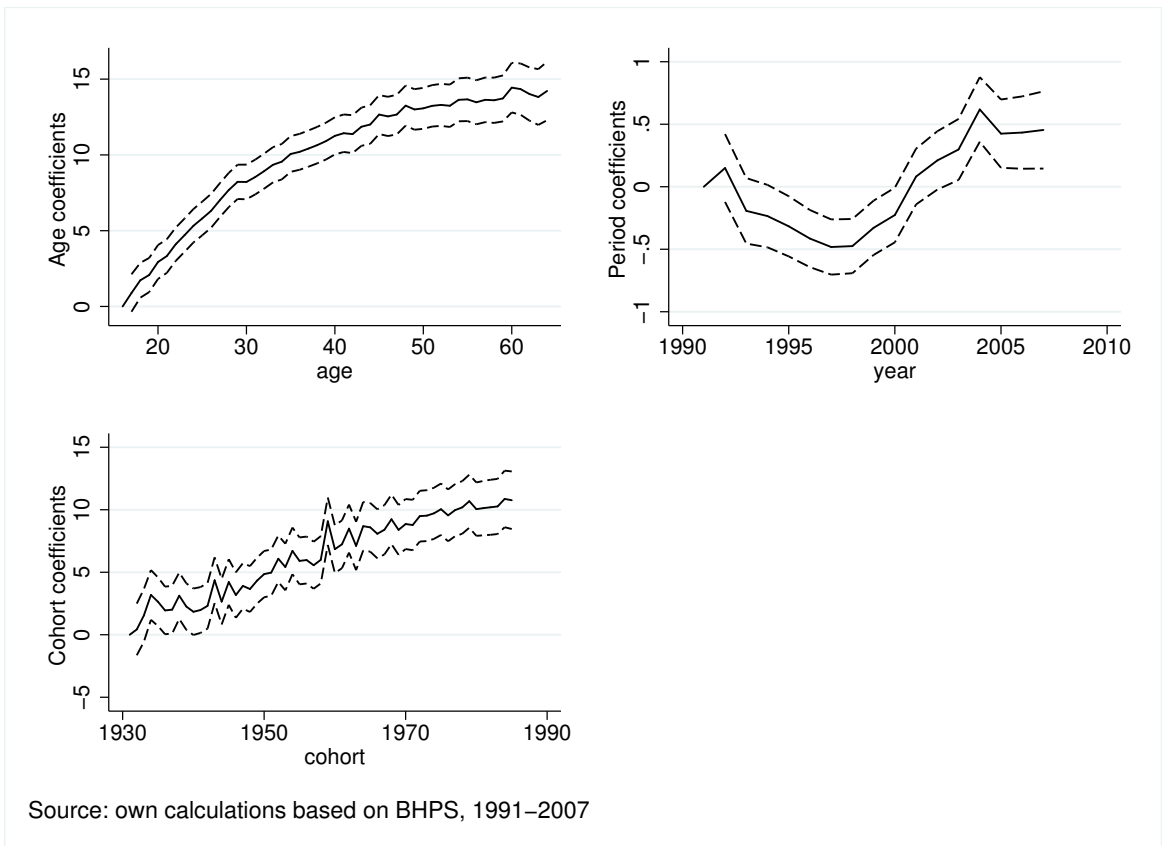


(b) Great Britain

Figure 11: Decomposition by age, period and cohort effects

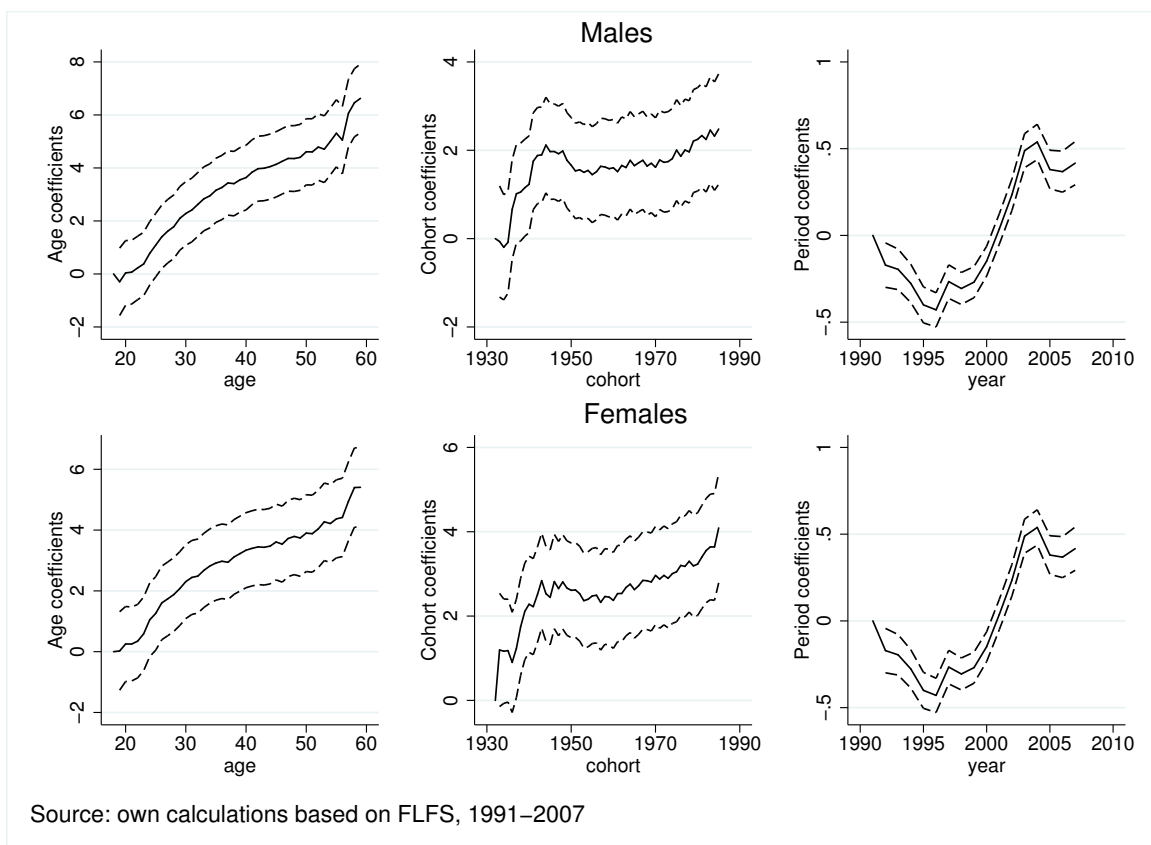


(a) France

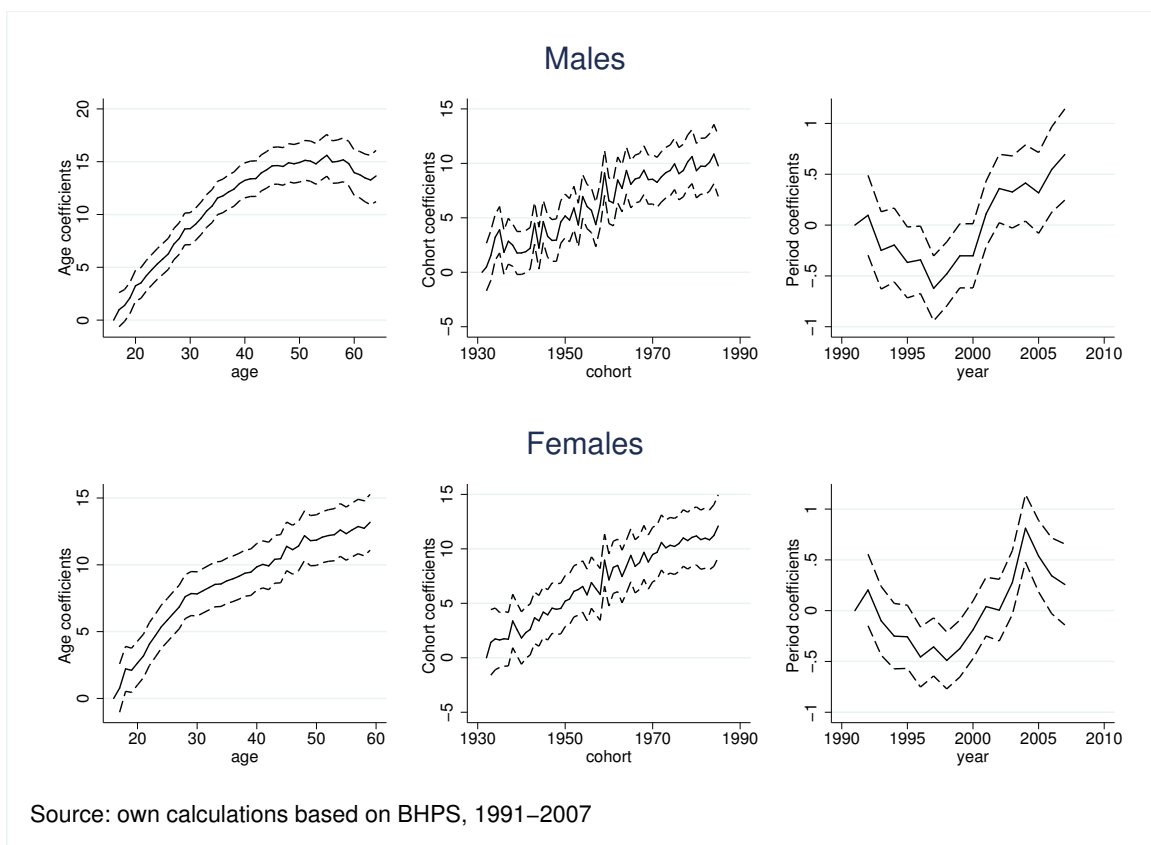


(b) Great Britain

Figure 12: Decomposition by age, period and cohort effects, by gender

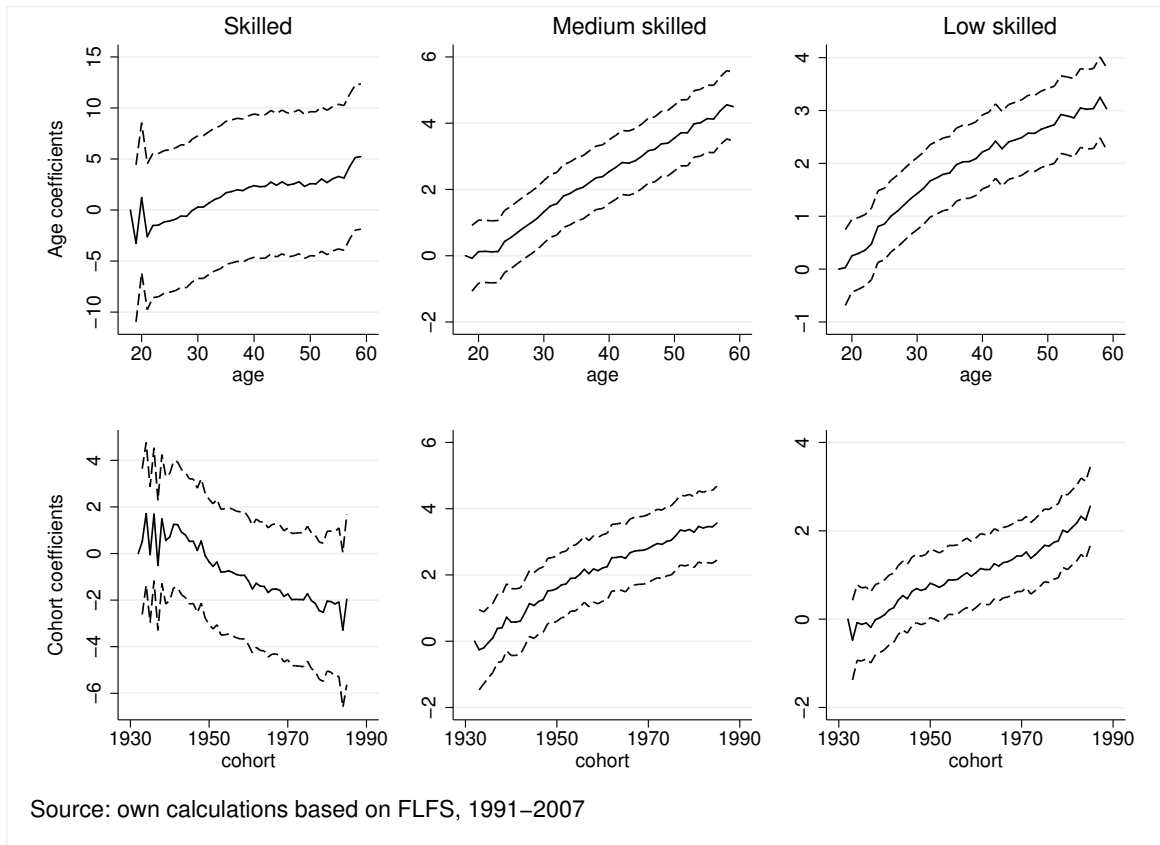


(a) France

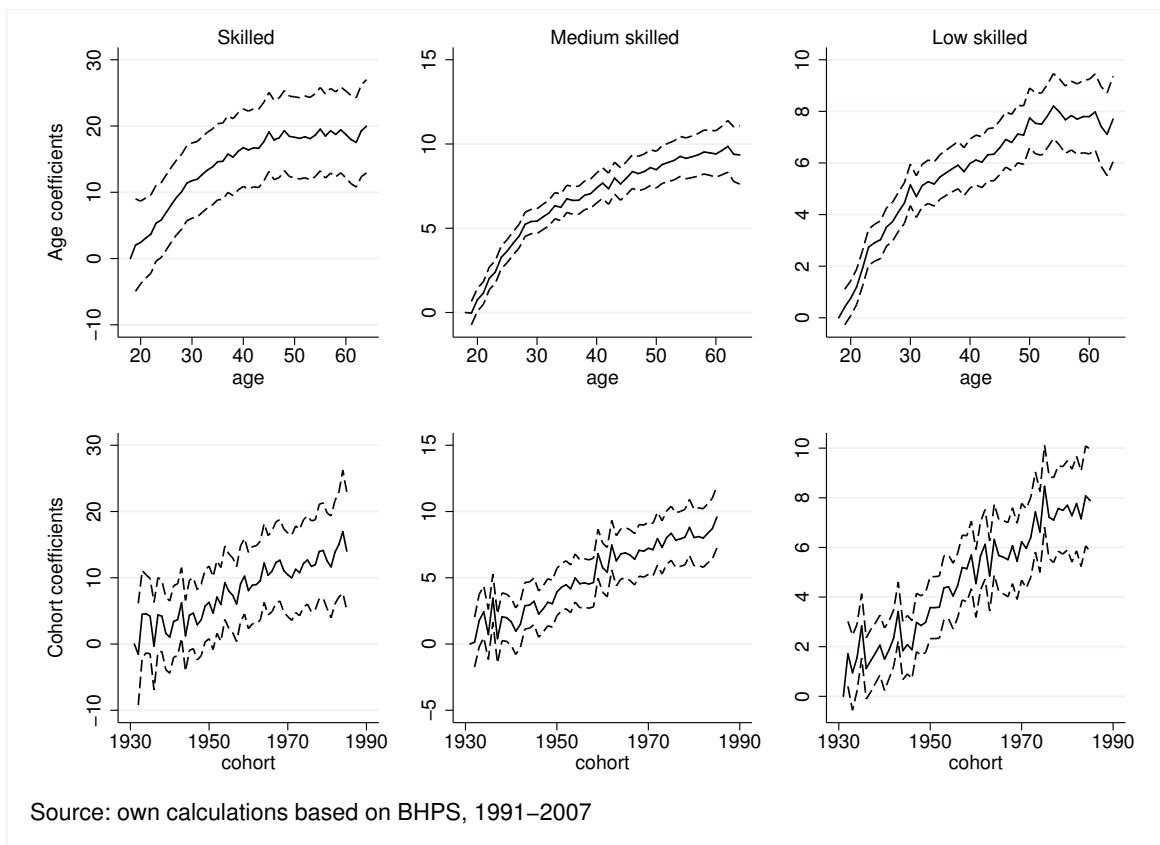


(b) Great Britain

Figure 13: Age and cohort effects on earnings by occupational group

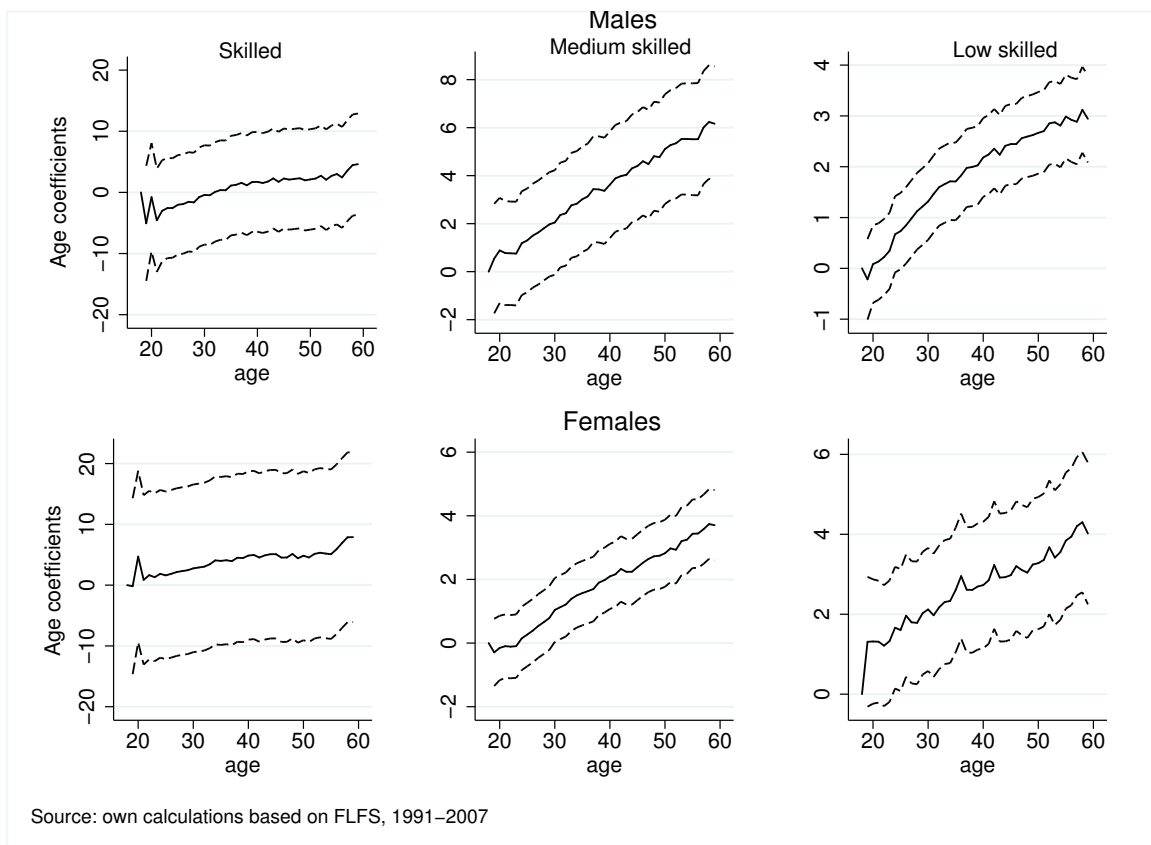


(a) France



(b) Great Britain

Figure 14: Age and cohort effects on earnings by occupational group and gender, France

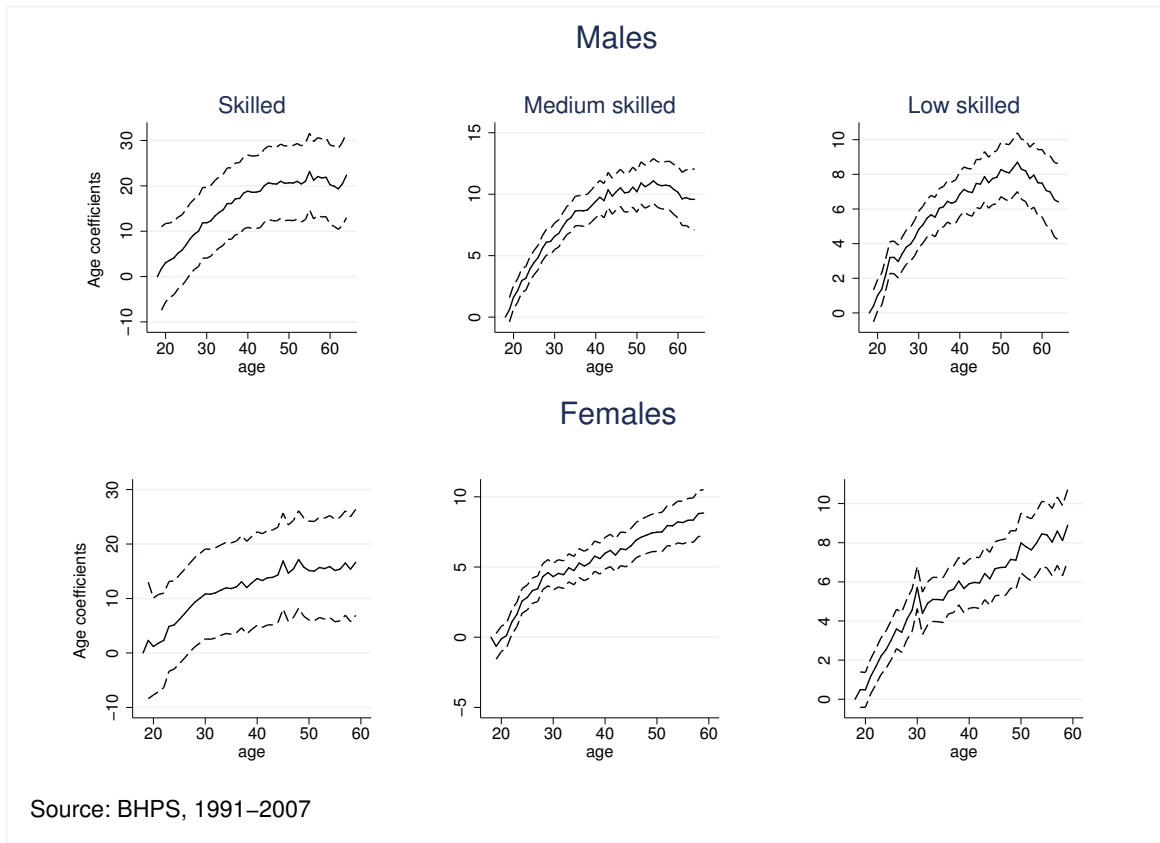


(a) Age

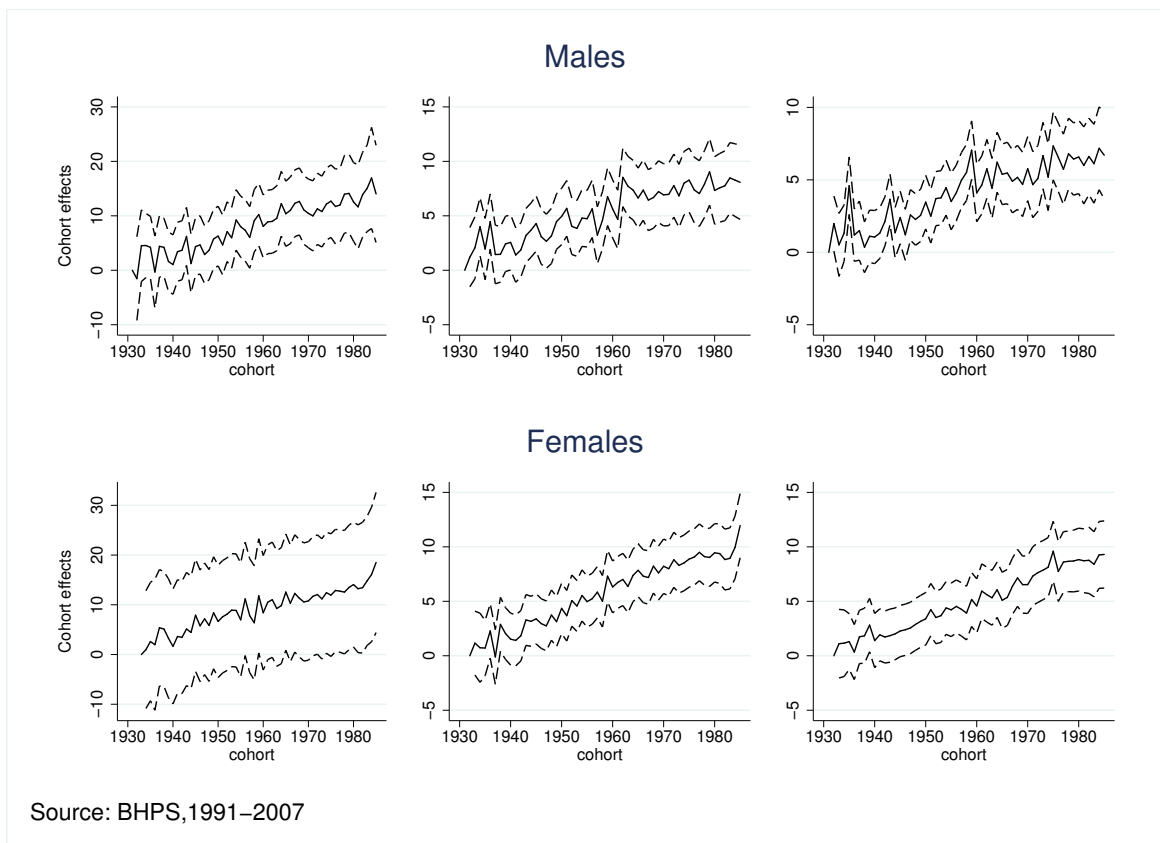


(b) Cohort

Figure 15: Age and cohort effects on earnings by occupational group and gender, Great Britain

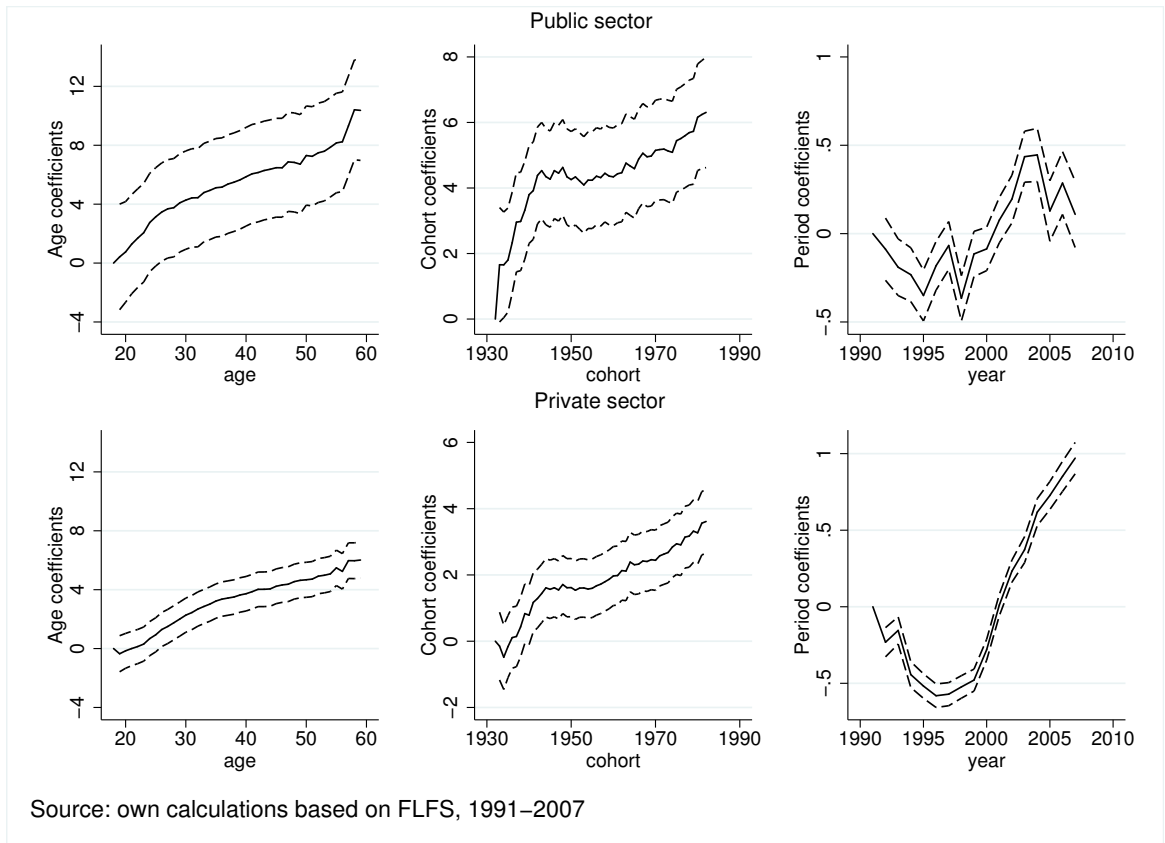


(a) Age

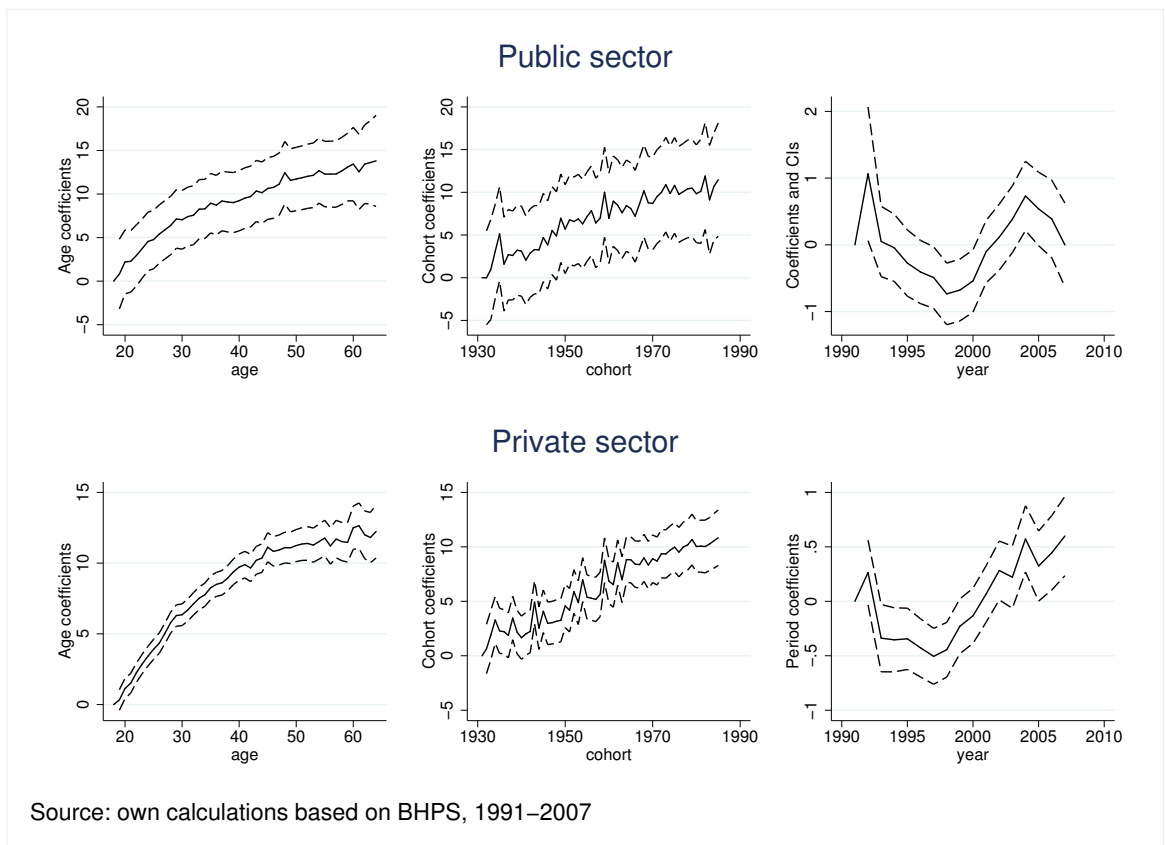


(b) Cohort

Figure 16: Age, cohort and period effects on earnings, by sector

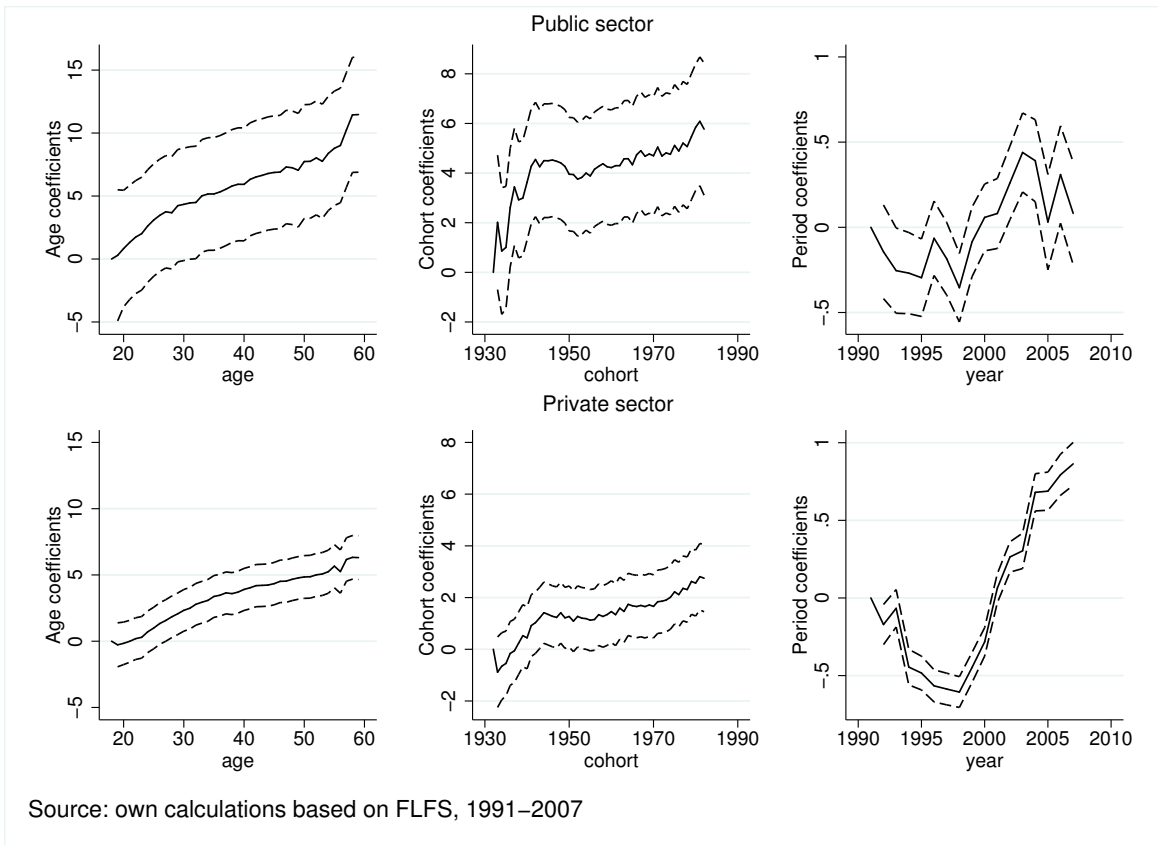


(a) France

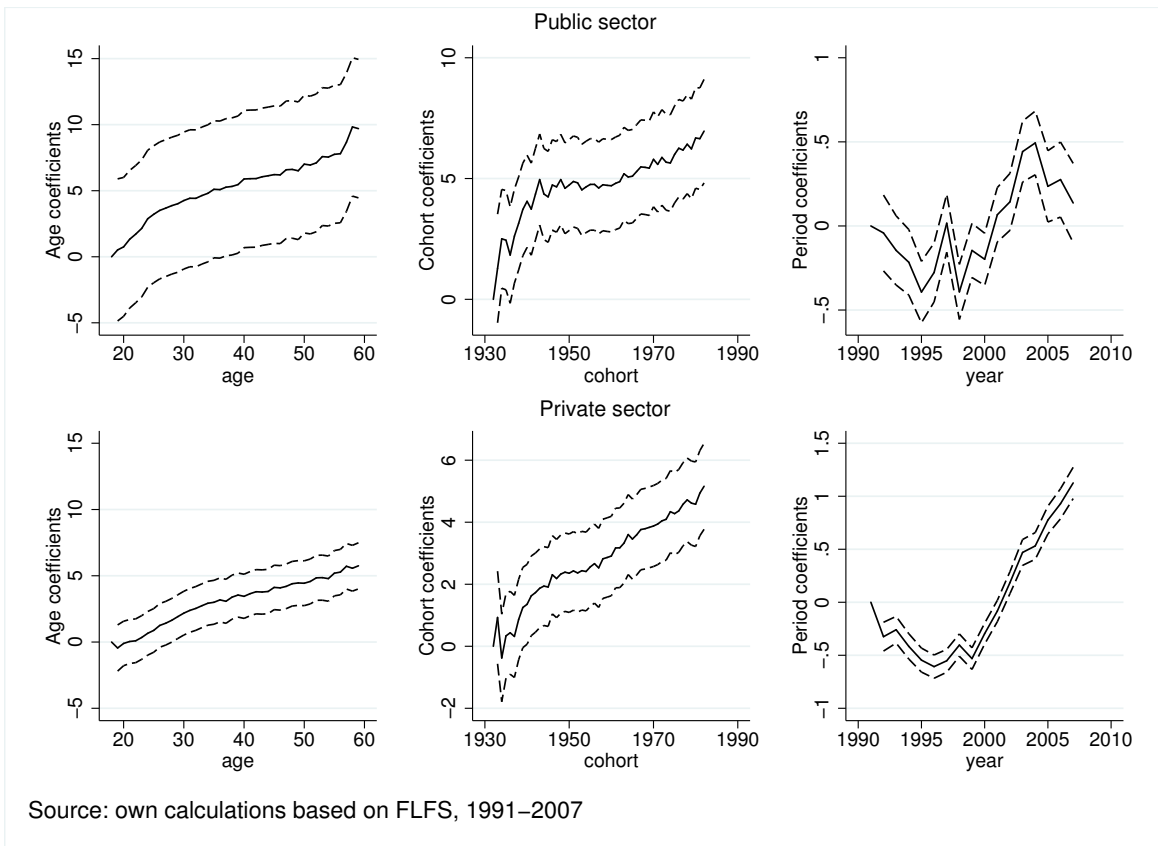


(b) Great Britain

Figure 17: Age, cohort and period effects on earnings by sector and gender, France

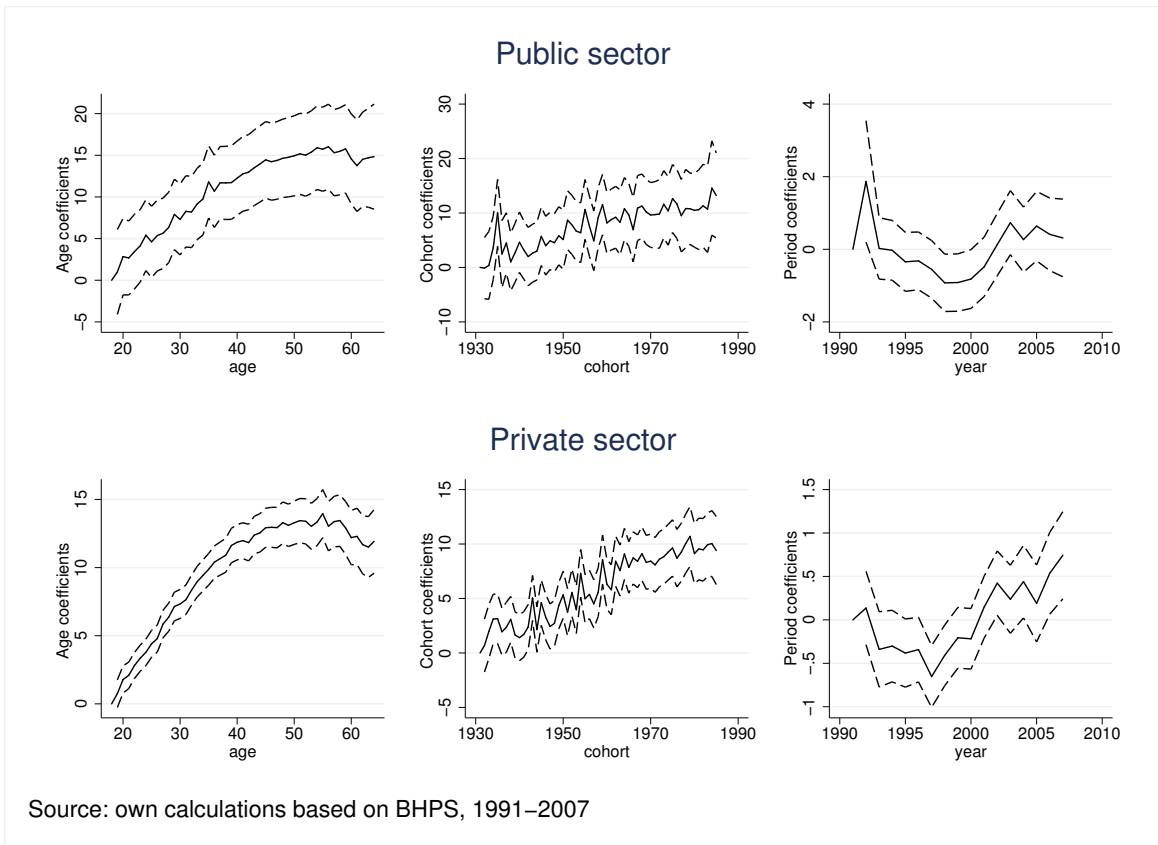


(a) Males

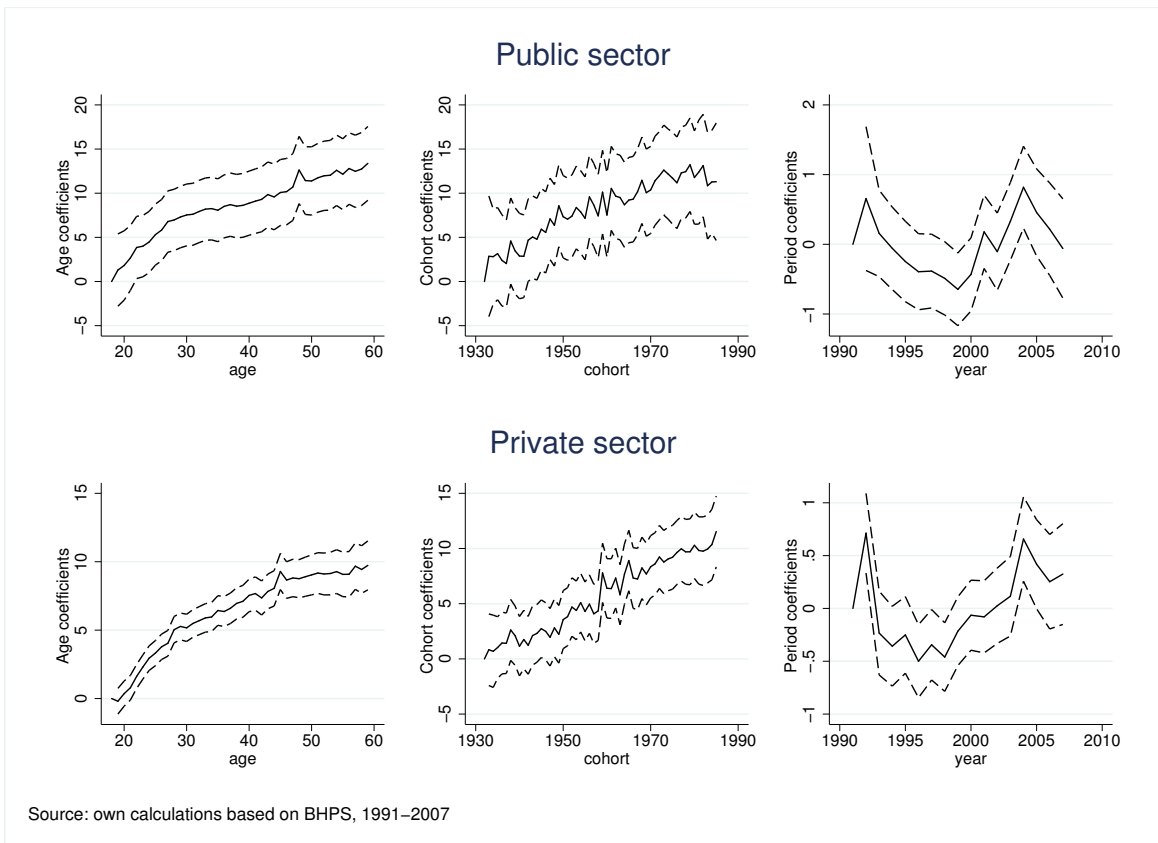


(b) Females

Figure 18: Age, cohort and period effects on earnings by sector and gender, Great Britain

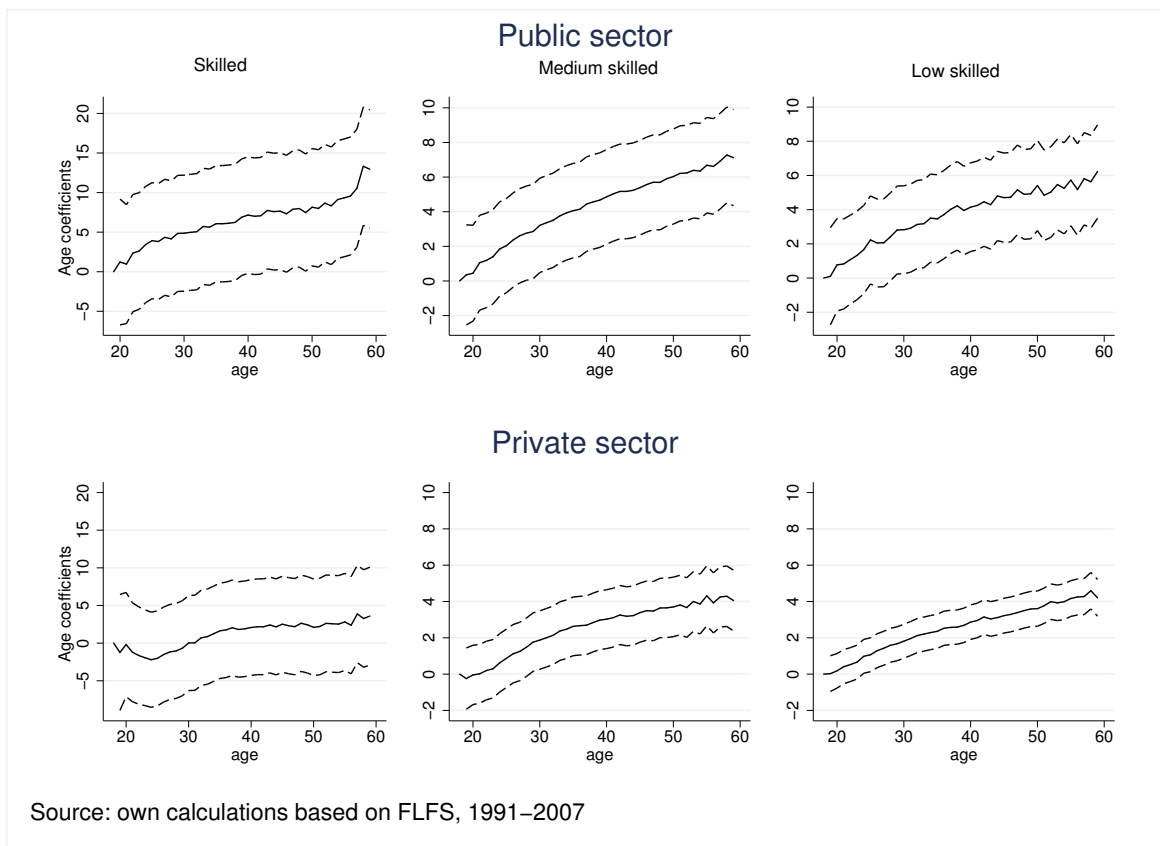


(a) Males

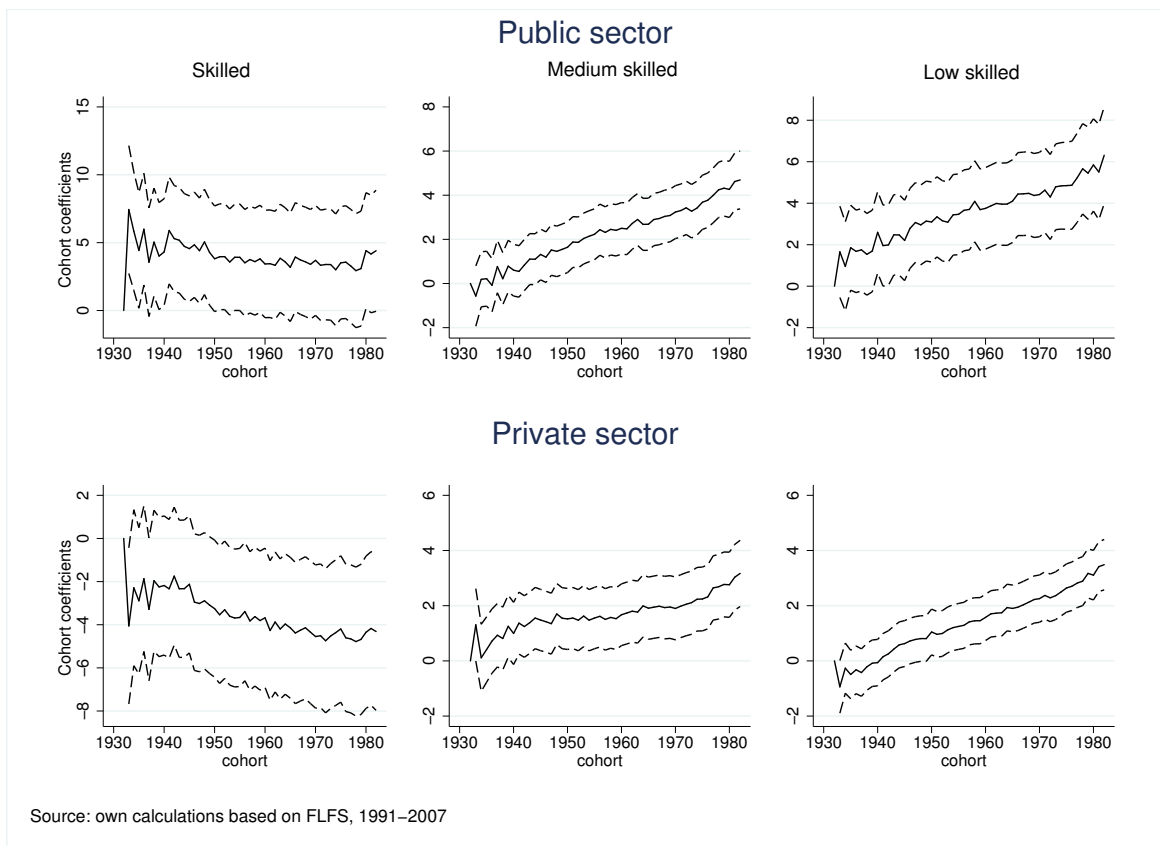


(b) Females

Figure 19: Age, cohort and period effects on earnings by occupational categories and gender, France

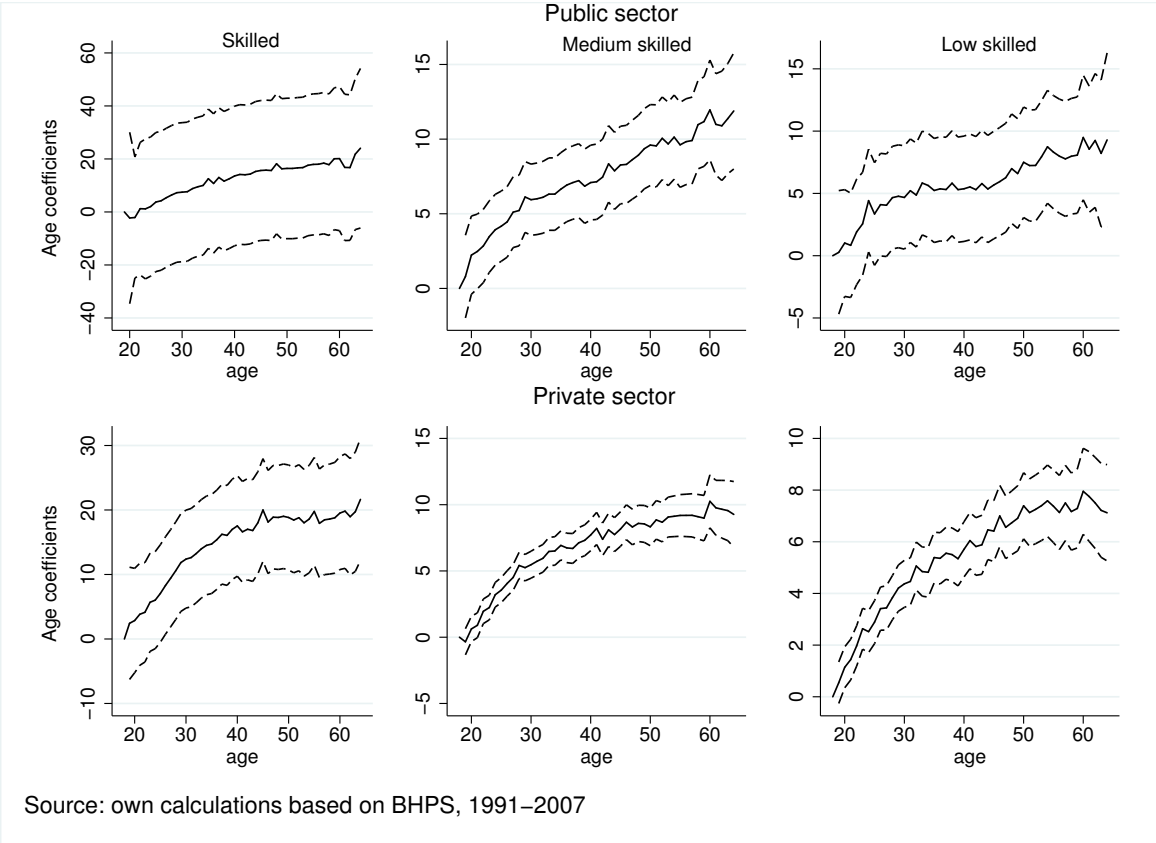


(a) Age

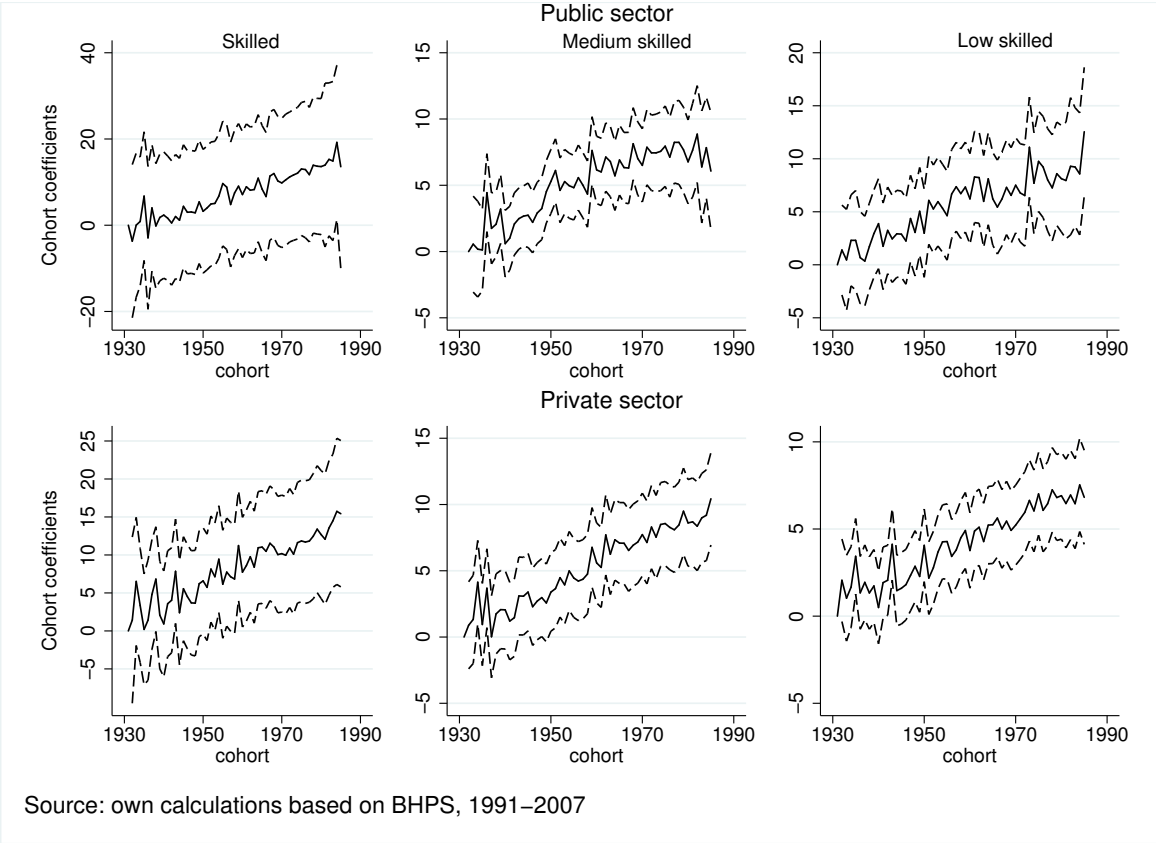


(b) Cohort

Figure 20: Age, cohort and period effects on earnings by occupational categories, Great Britain

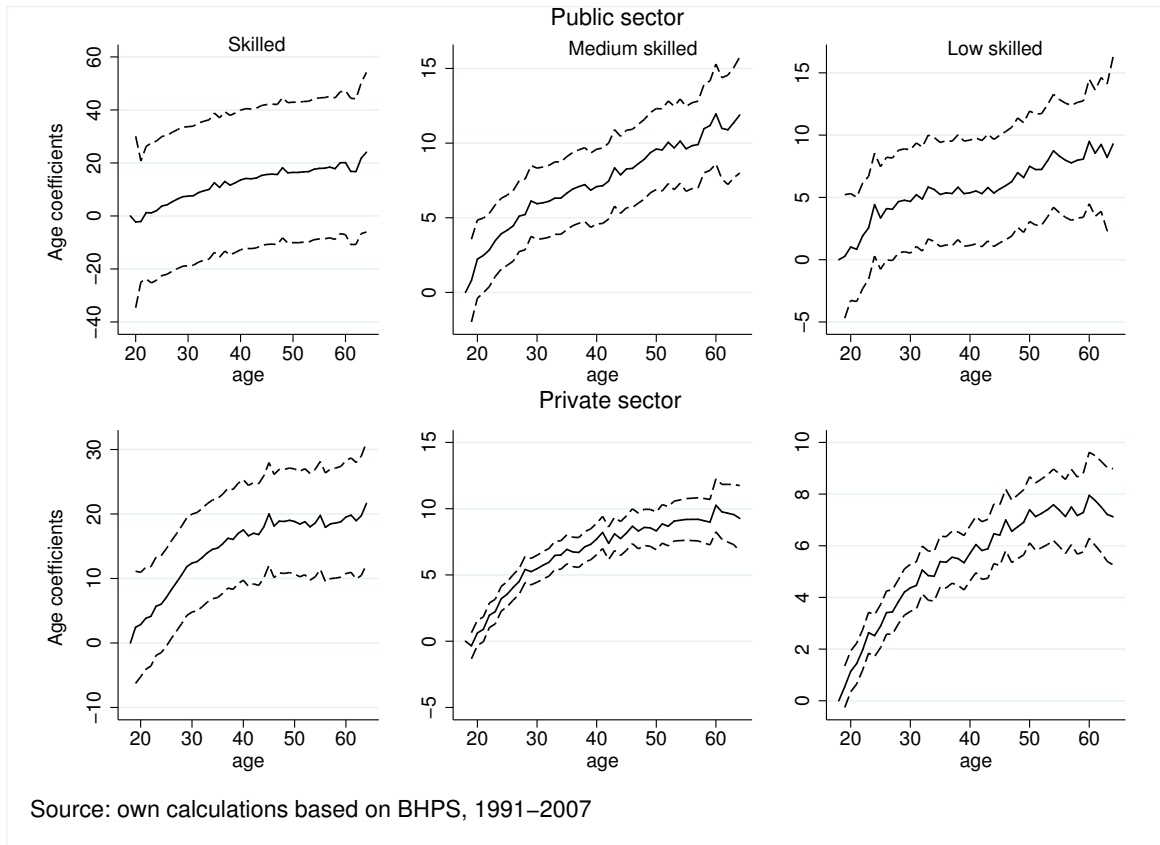


(a) Age

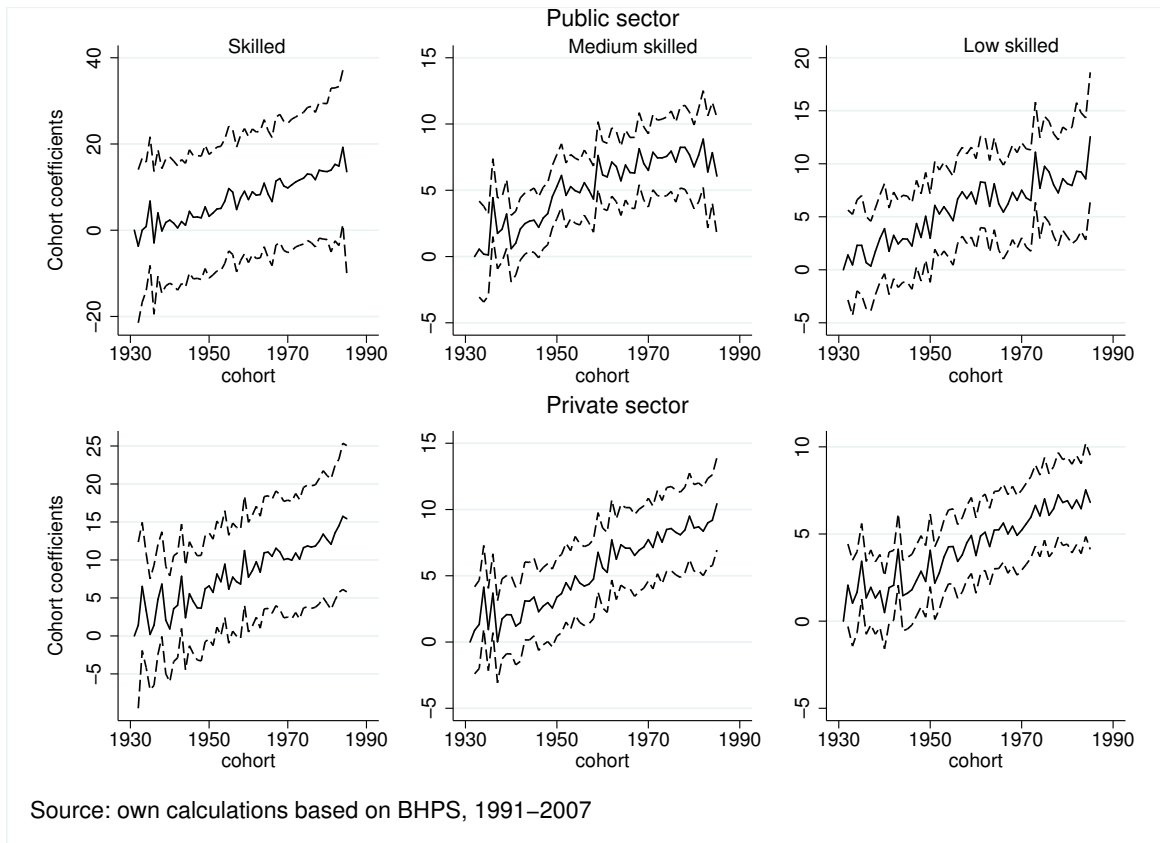


(b) Cohort

Figure 21: Age and cohort effects on earnings for males by occupational group, France

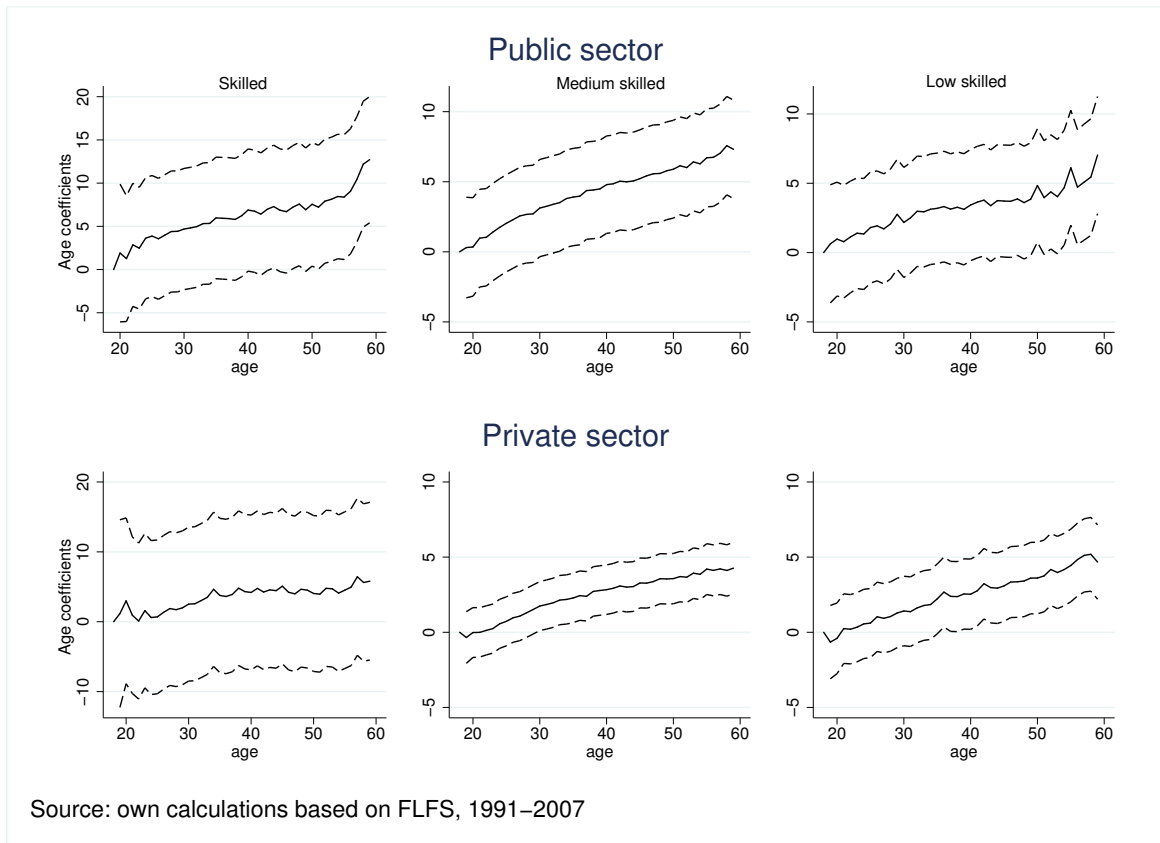


(a) Age

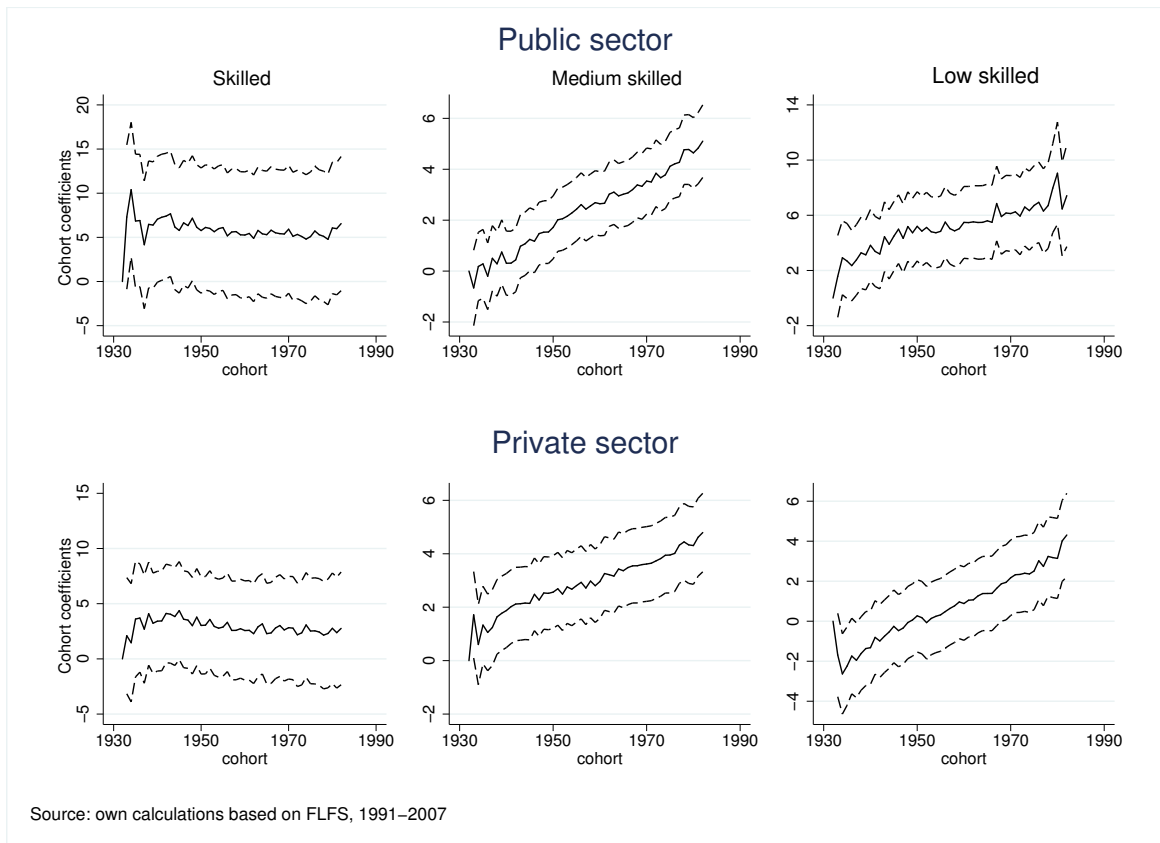


(b) Cohort

Figure 22: Age and cohort effects on earnings for females by occupational group, France

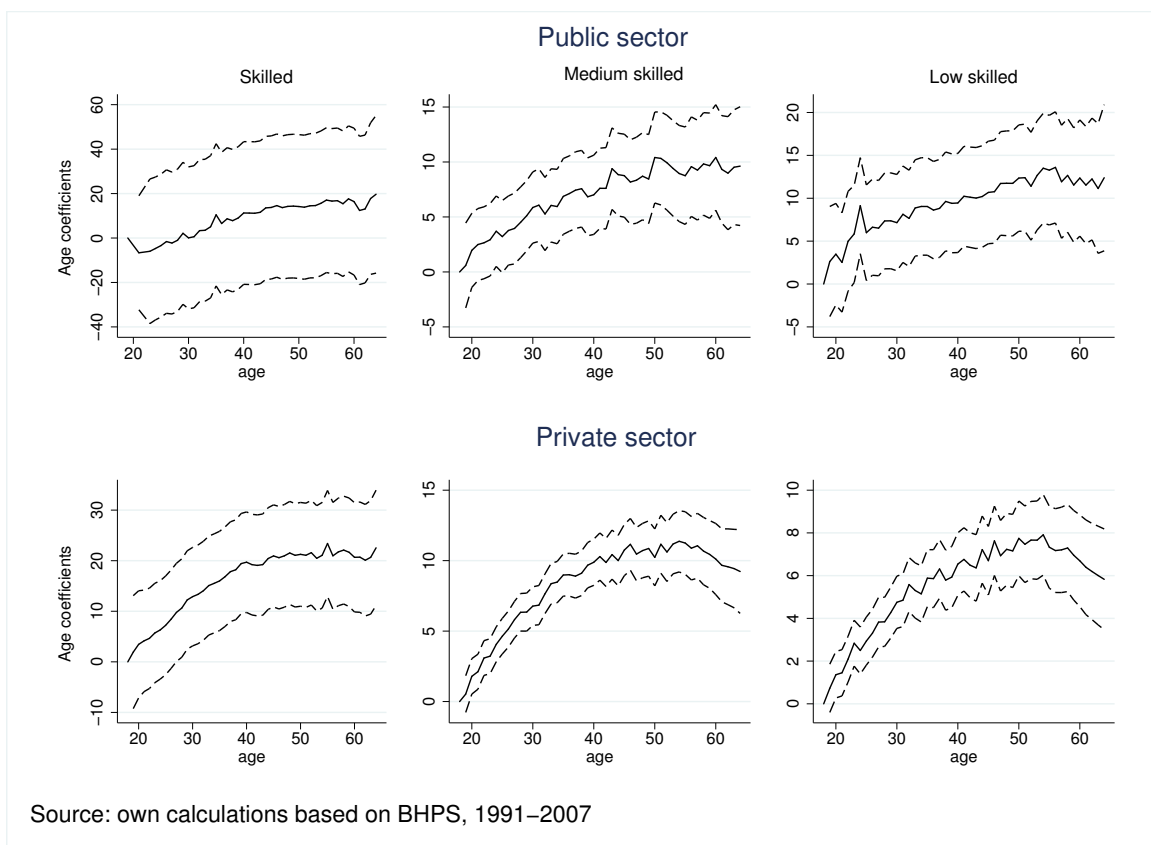


(a) Age

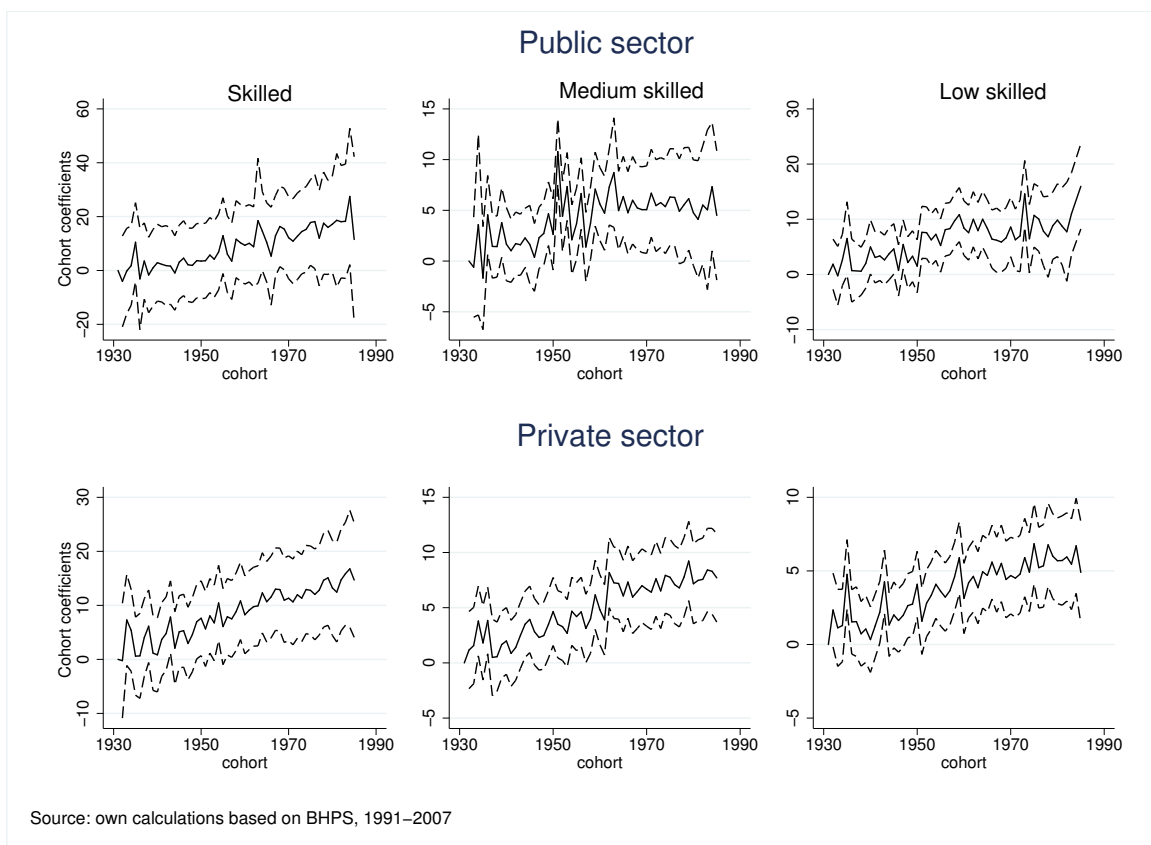


(b) Cohort

Figure 23: Age and cohort effects on earnings for males by occupational group, Great Britain

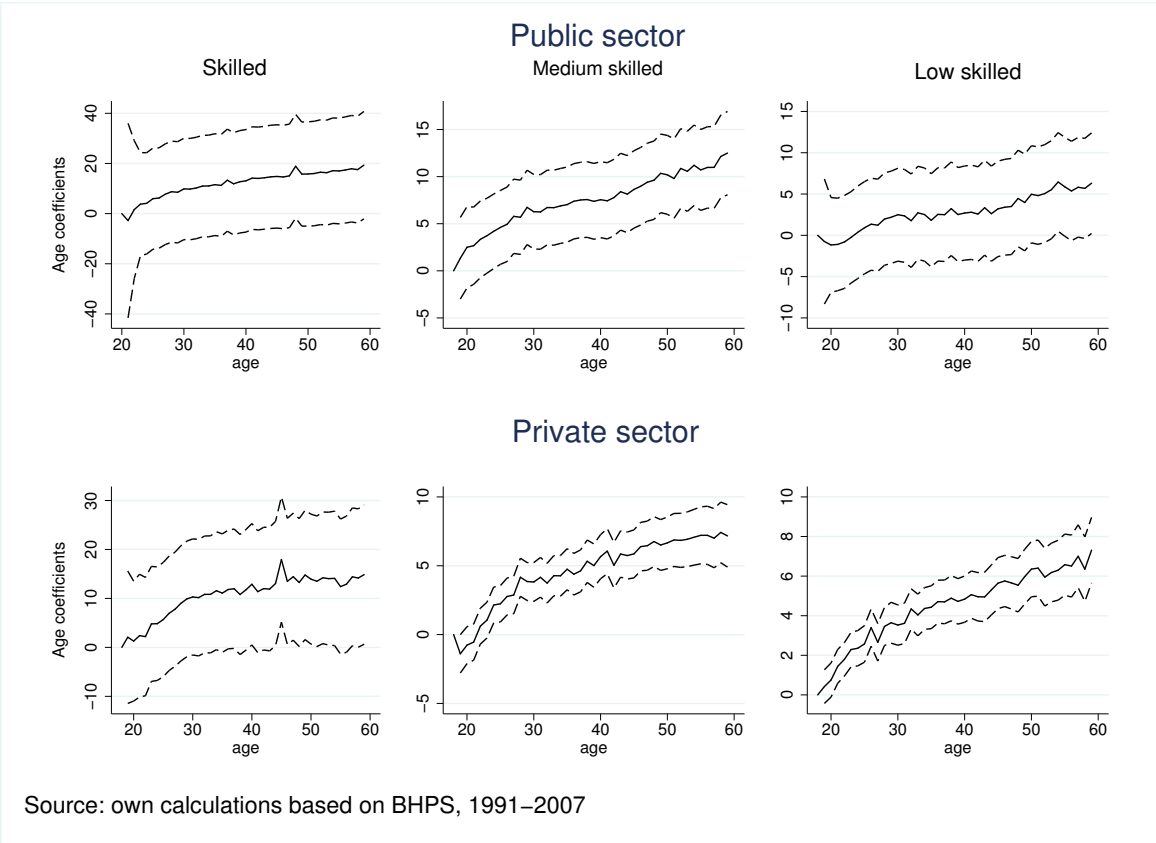


(a) Age

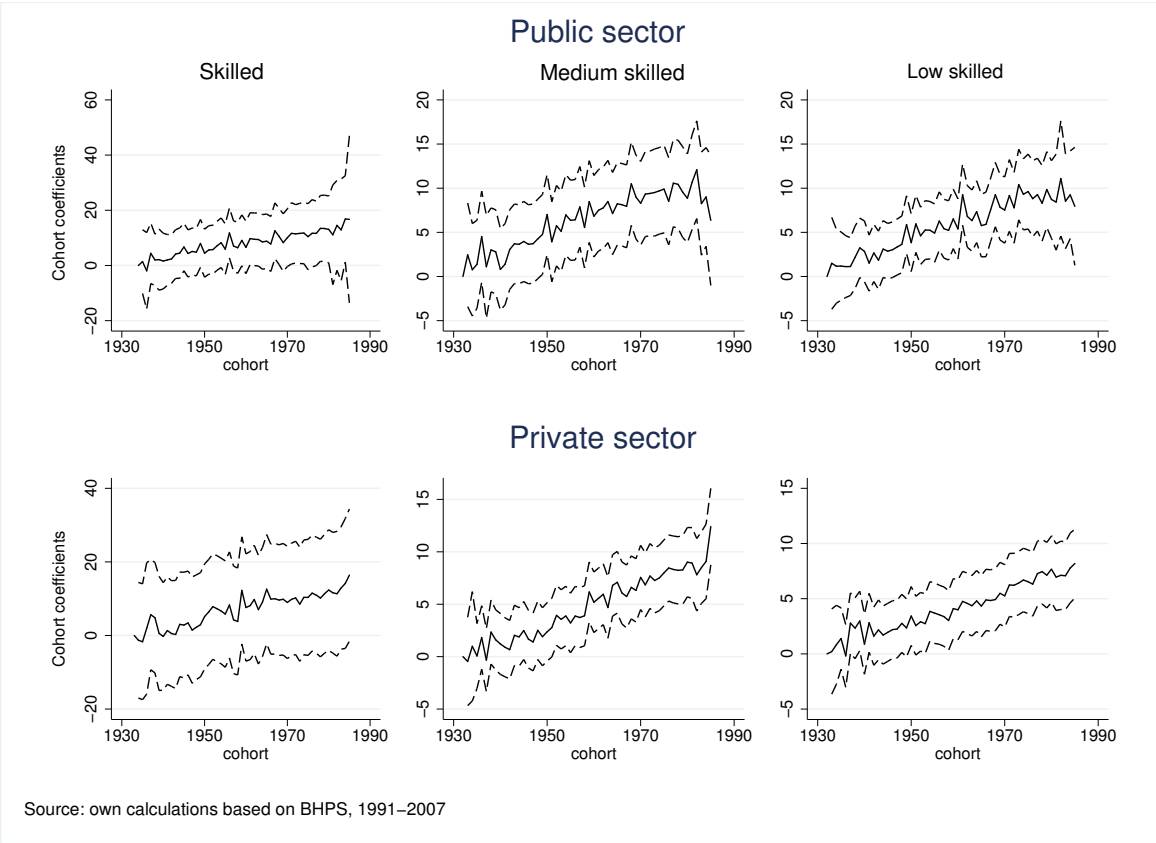


(b) Cohort

Figure 24: Age and cohort effects on earnings for females by occupational group, Great Britain

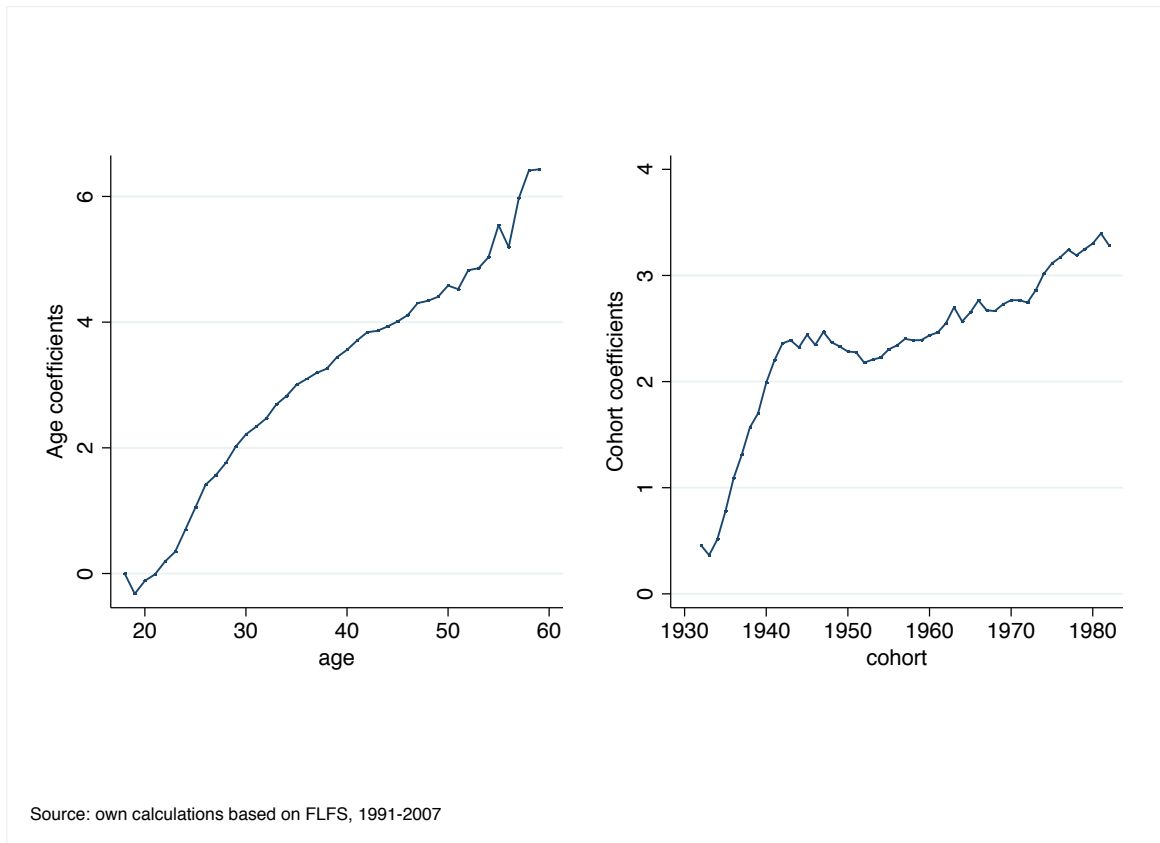


(a) Age

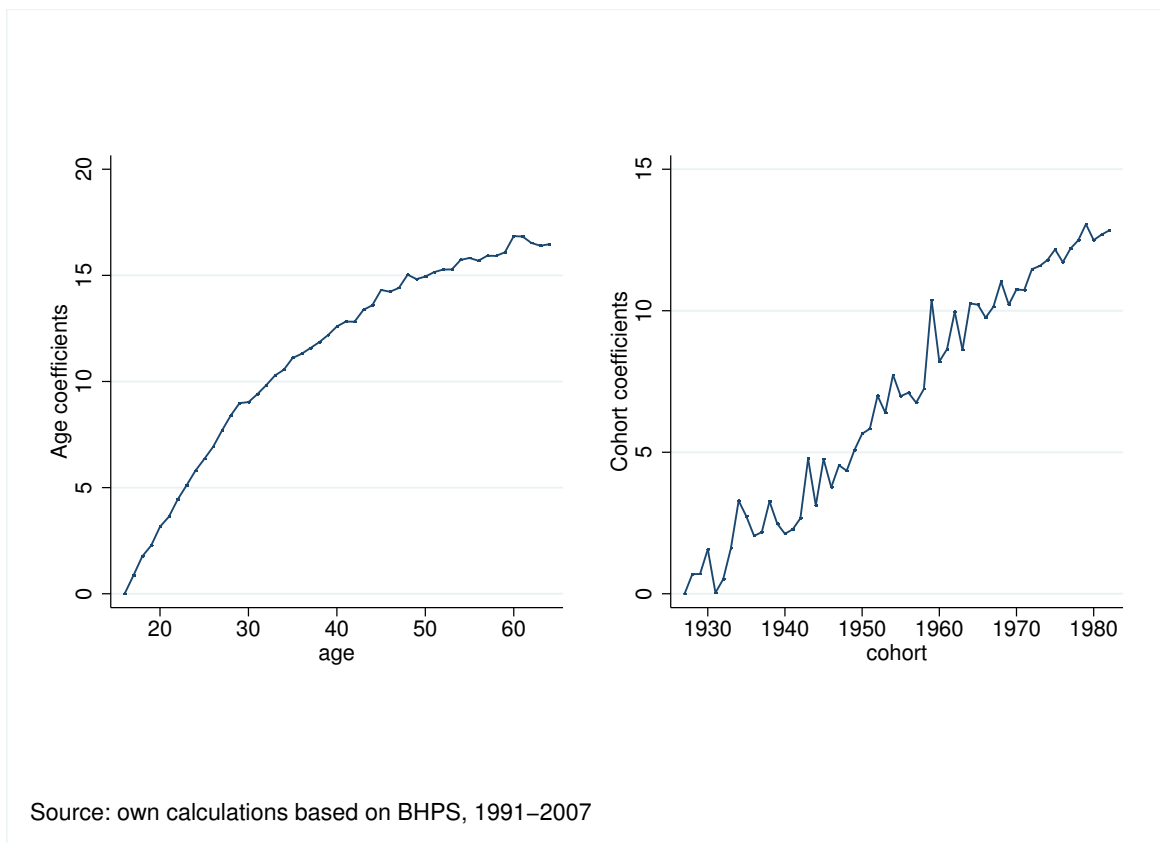


(b) Cohort

Figure 25: Sensitivity Analysis using an alternative measure for the cycle

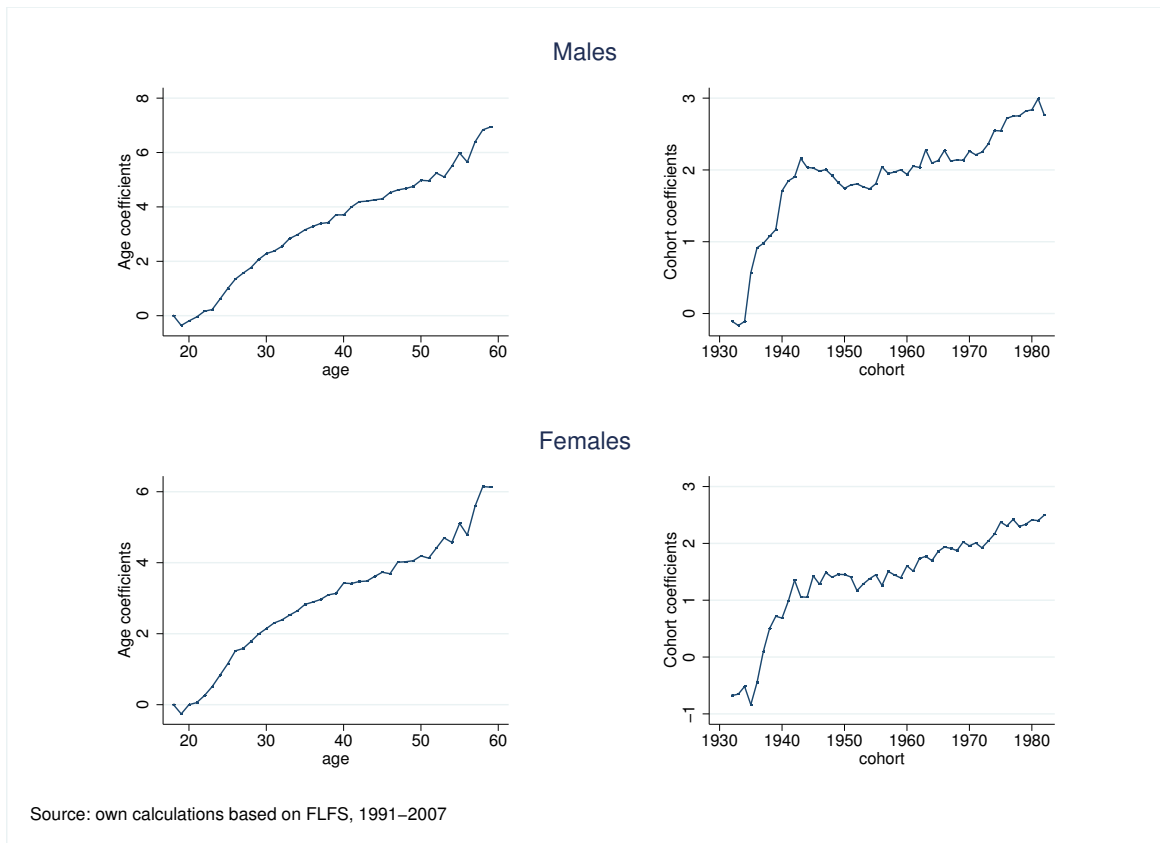


(a) France

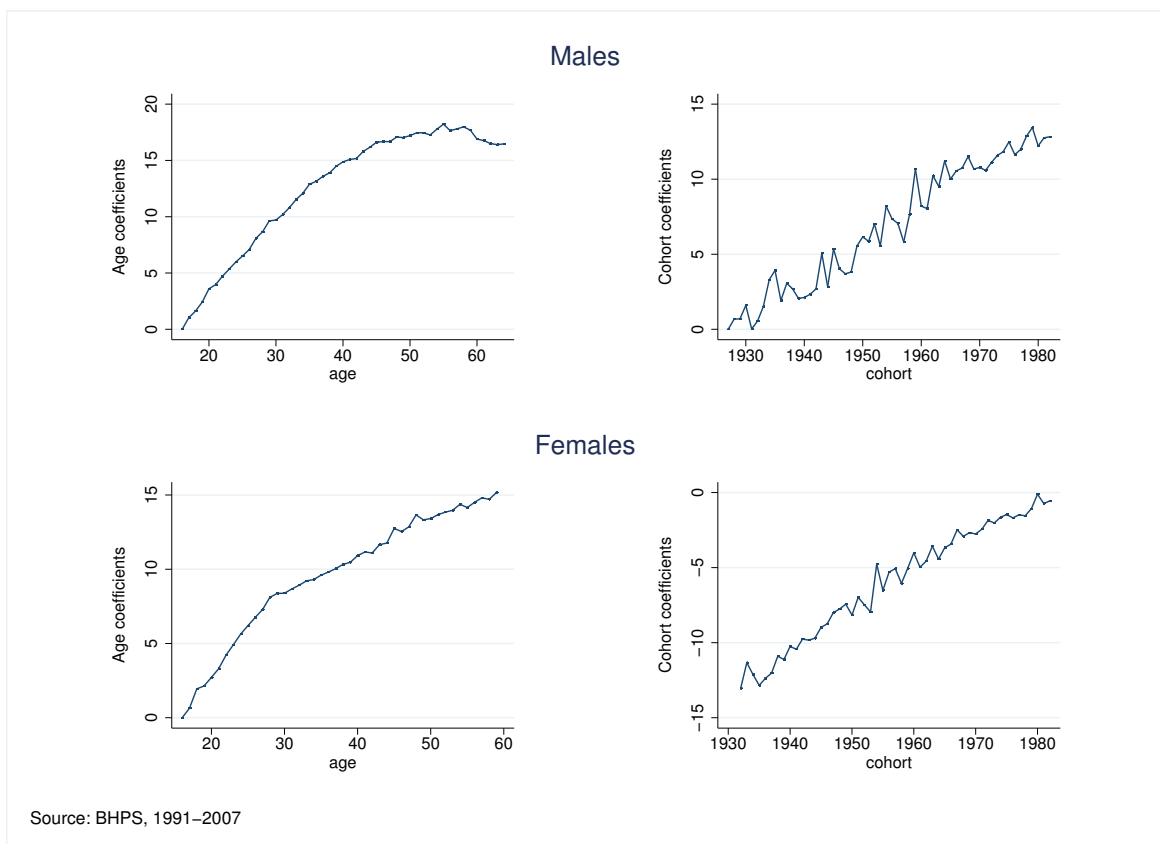


(b) Great Britain

Figure 26: Sensitivity Analysis using an alternative measure for the cycle, by gender

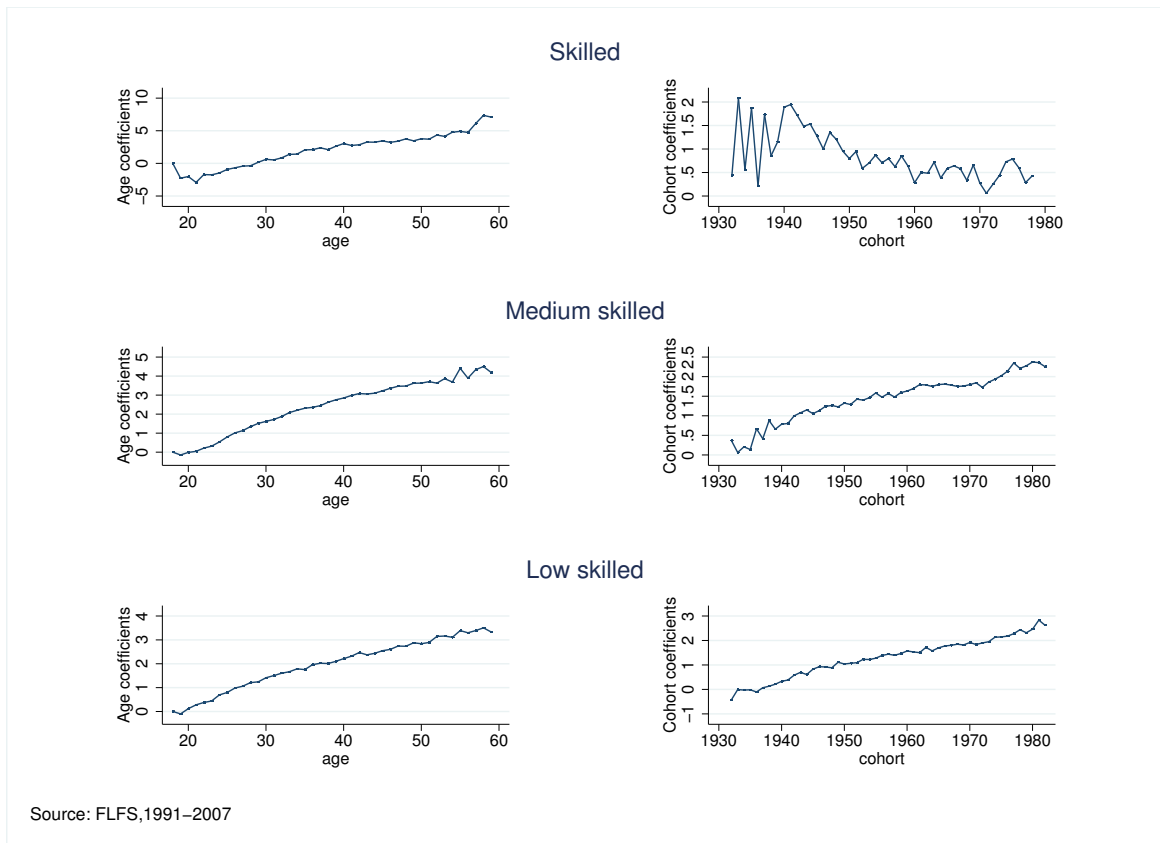


(a) France

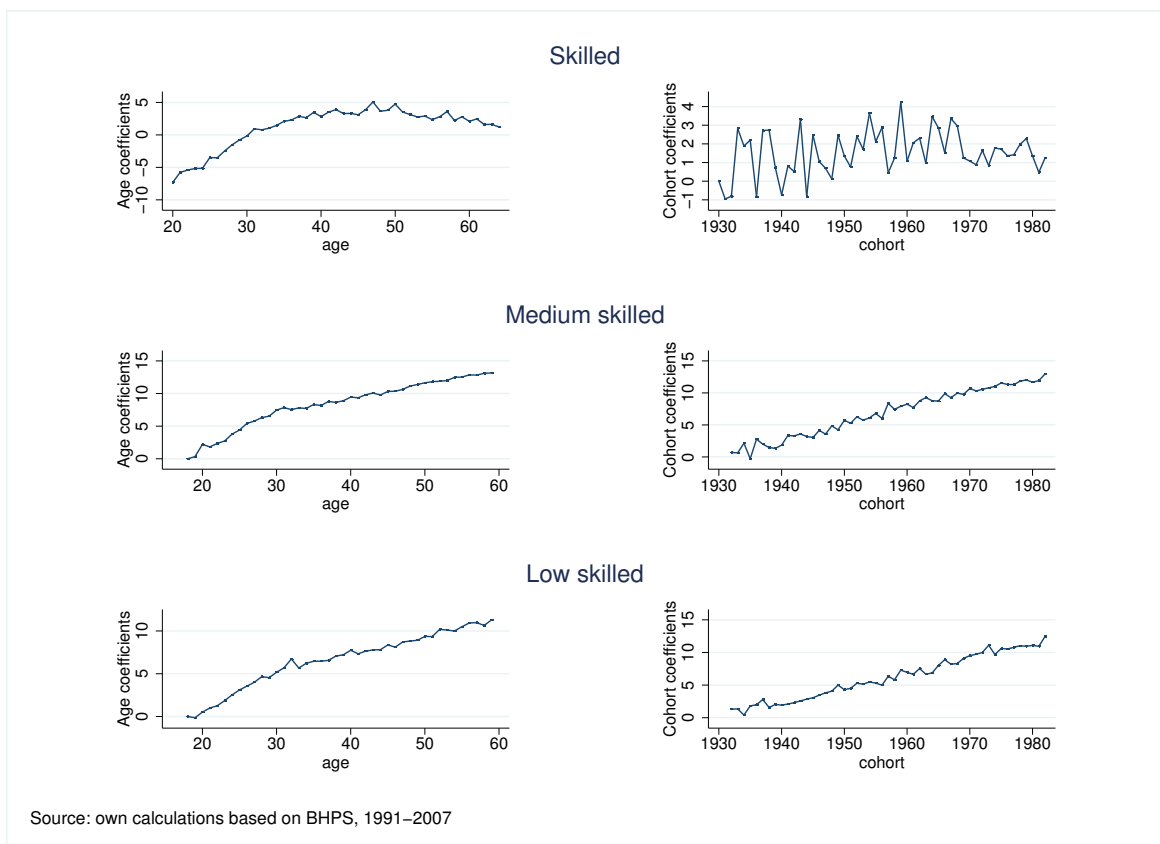


(b) Great Britain

Figure 27: Sensitivity Analysis using an alternative measure for the cycle, by gender and skill

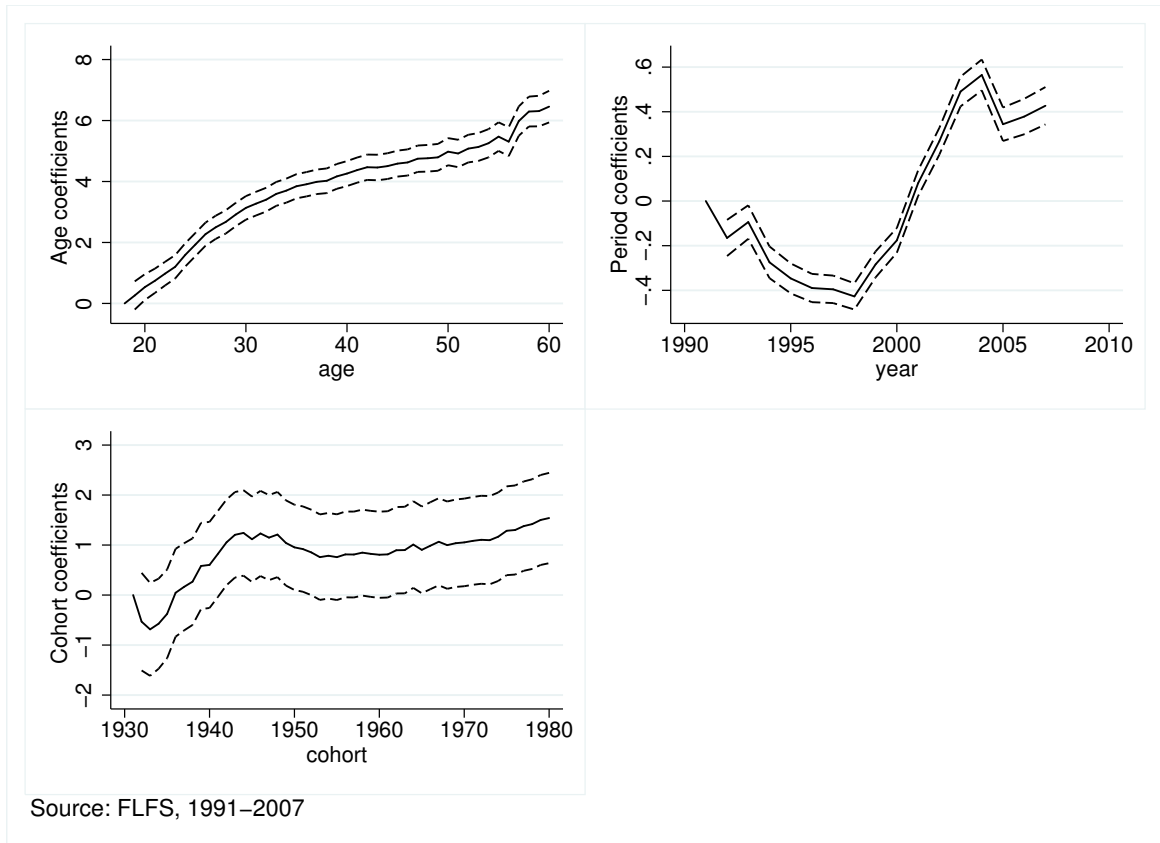


(a) France

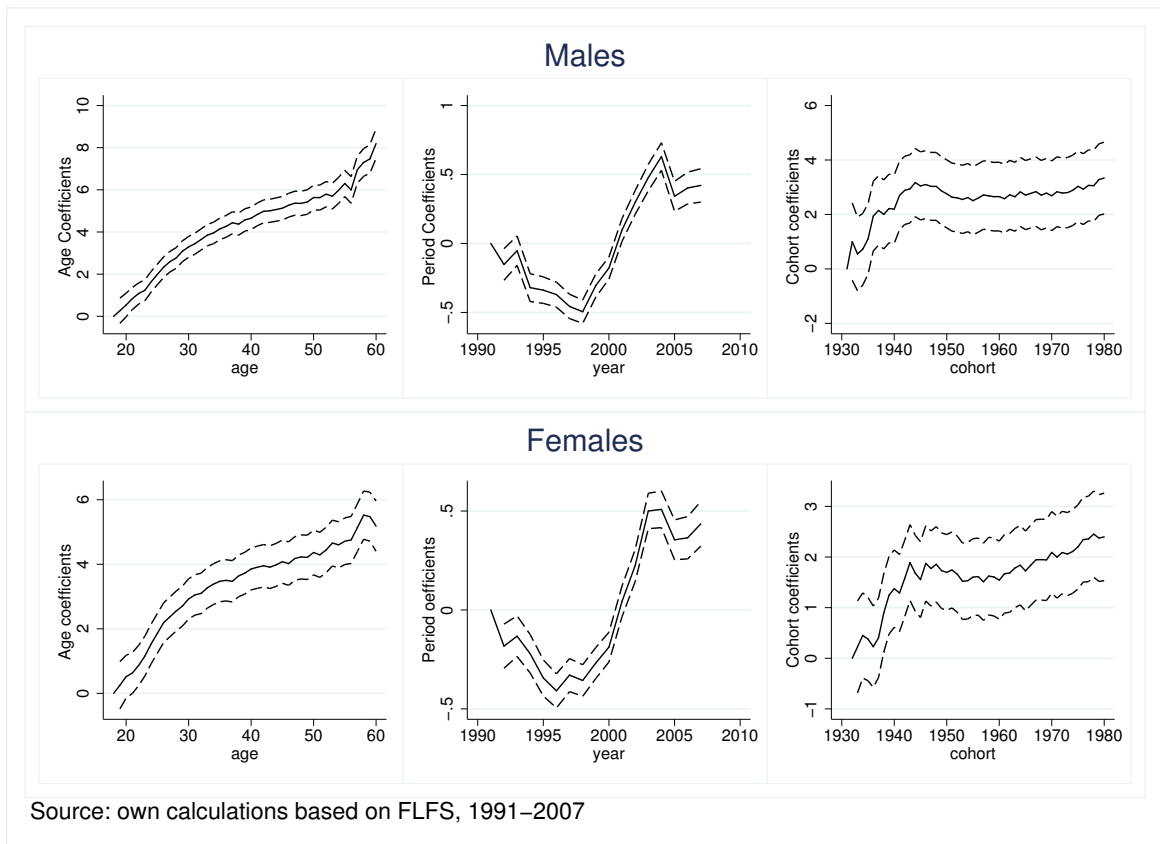


(b) Great Britain

Figure 28: Sensitivity Analysis using an alternative measure for the hourly earnings, France

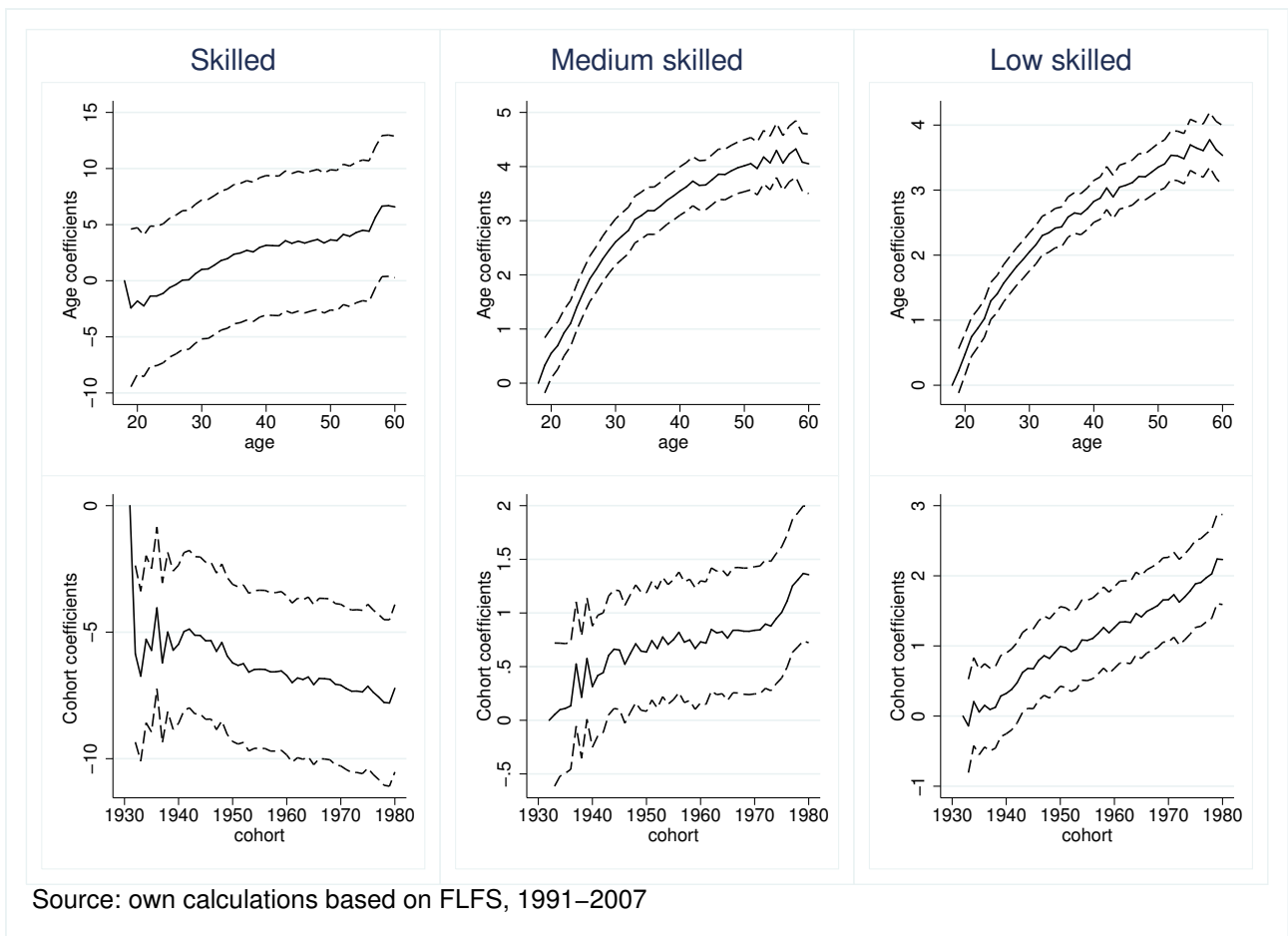


(a) Males and Females



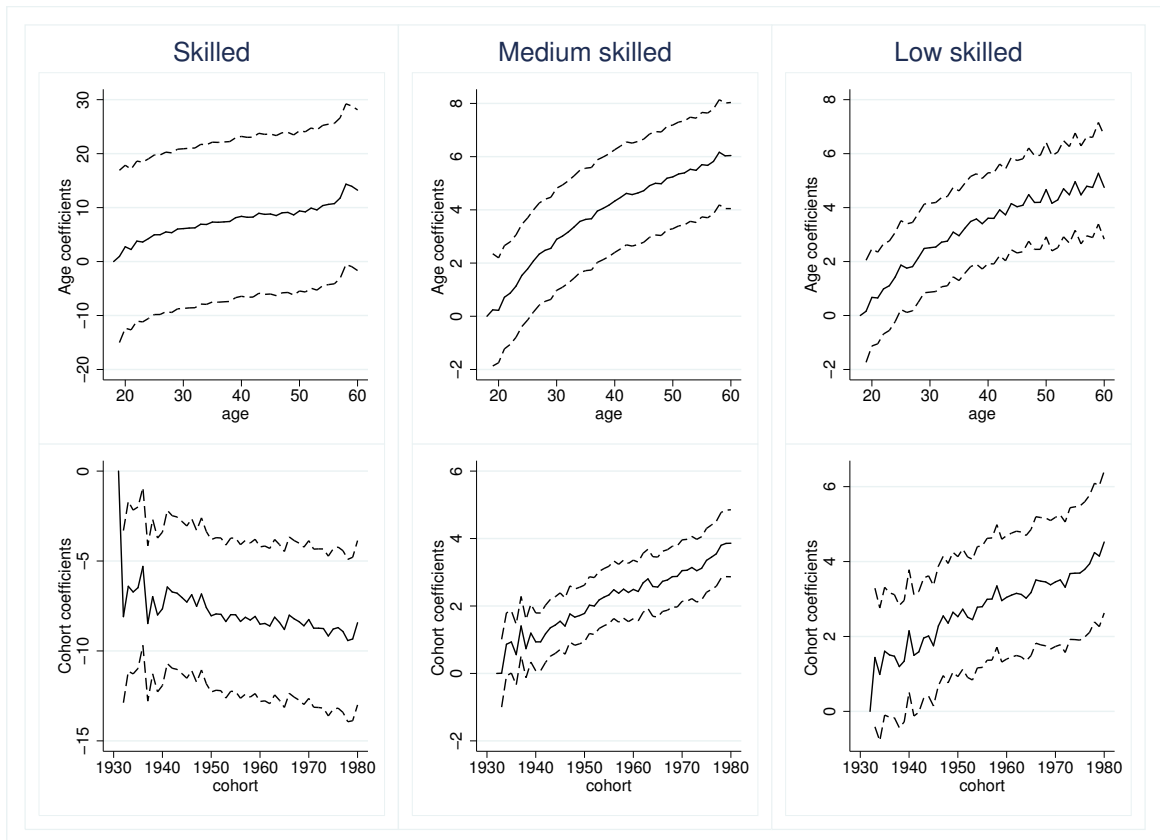
(b) by gender

Figure 29: Sensitivity Analysis using an alternative measure for the hourly earnings by occupational group, France

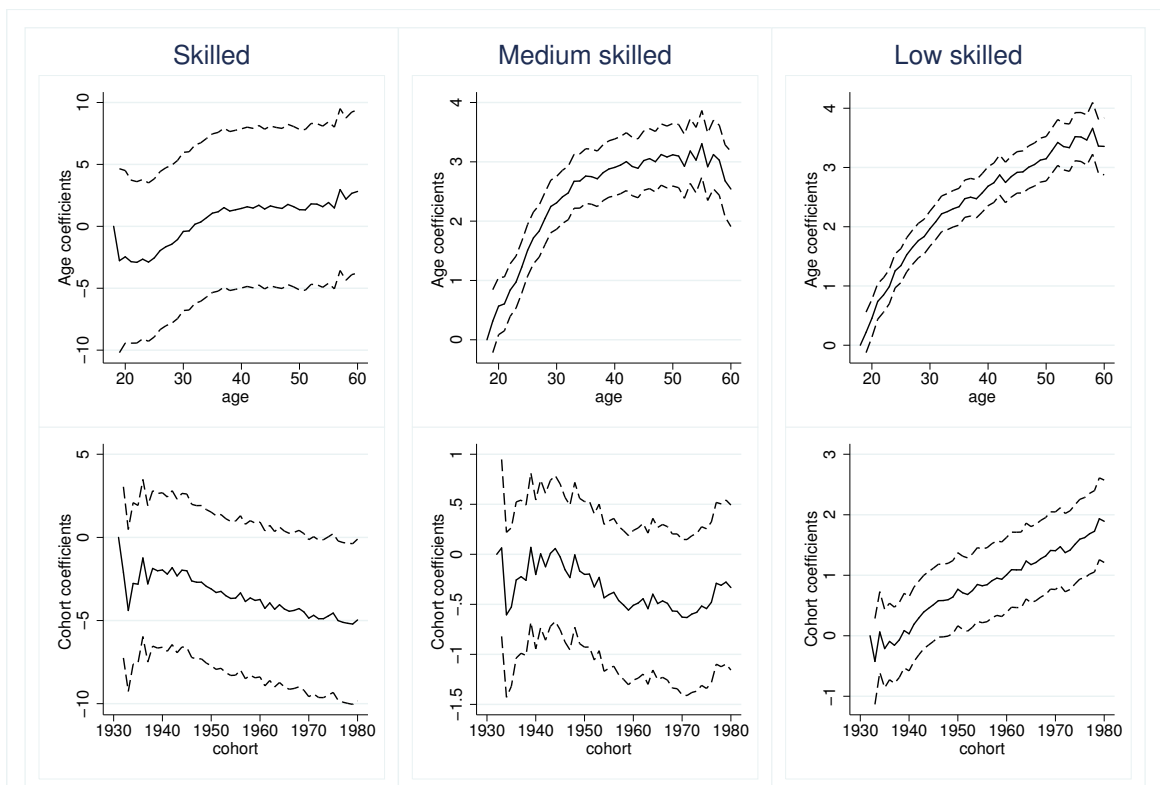


Source: own calculations based on FLFS, 1991–2007

Figure 30: Sensitivity Analysis using an alternative measure for the hourly earnings by sector, France



(a) public



Source: own calculations based on FLFS, 1991–2007

(b) private

Figure 31: Sensitivity Analysis using alternative dataset by gender, Great Britain

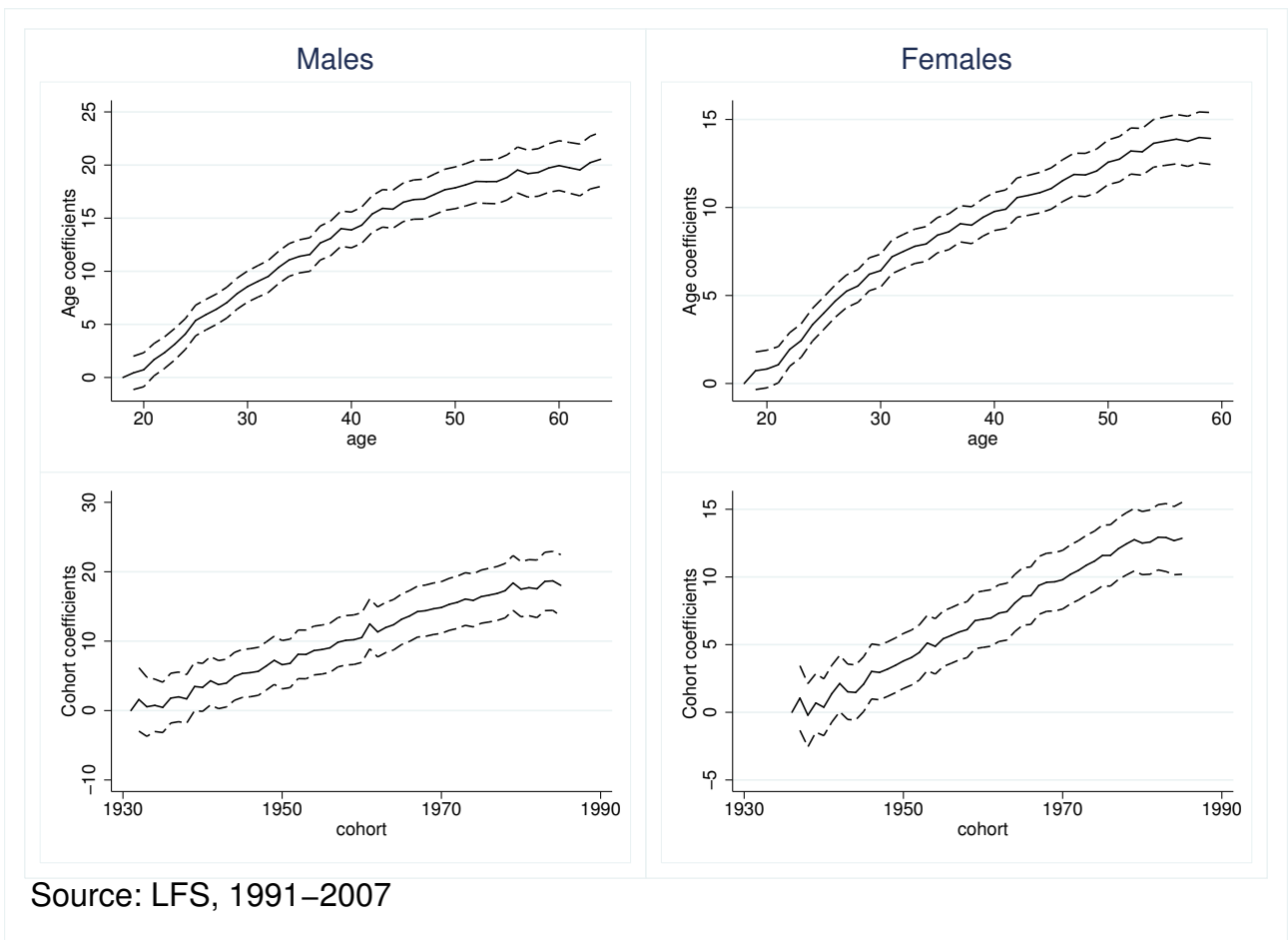
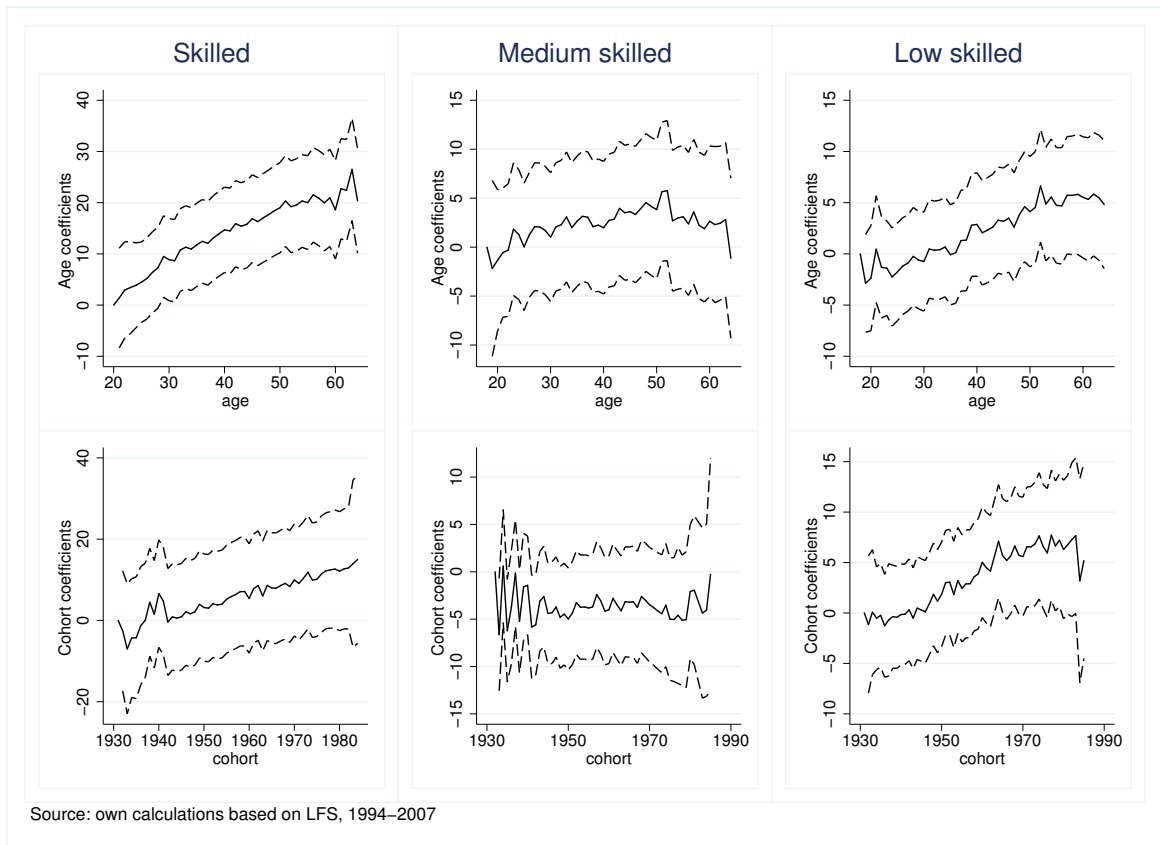
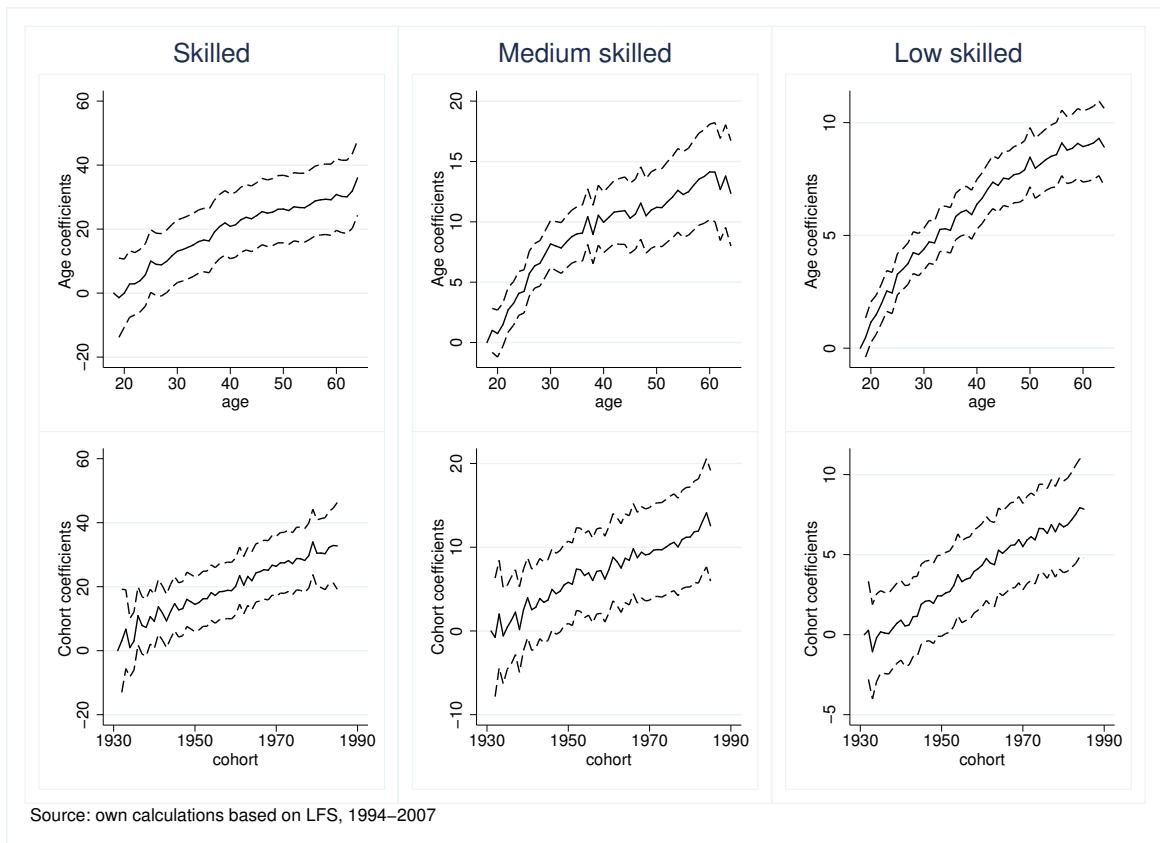


Figure 32: Sensitivity Analysis using alternative dataset for males, by occupational group, Great Britain

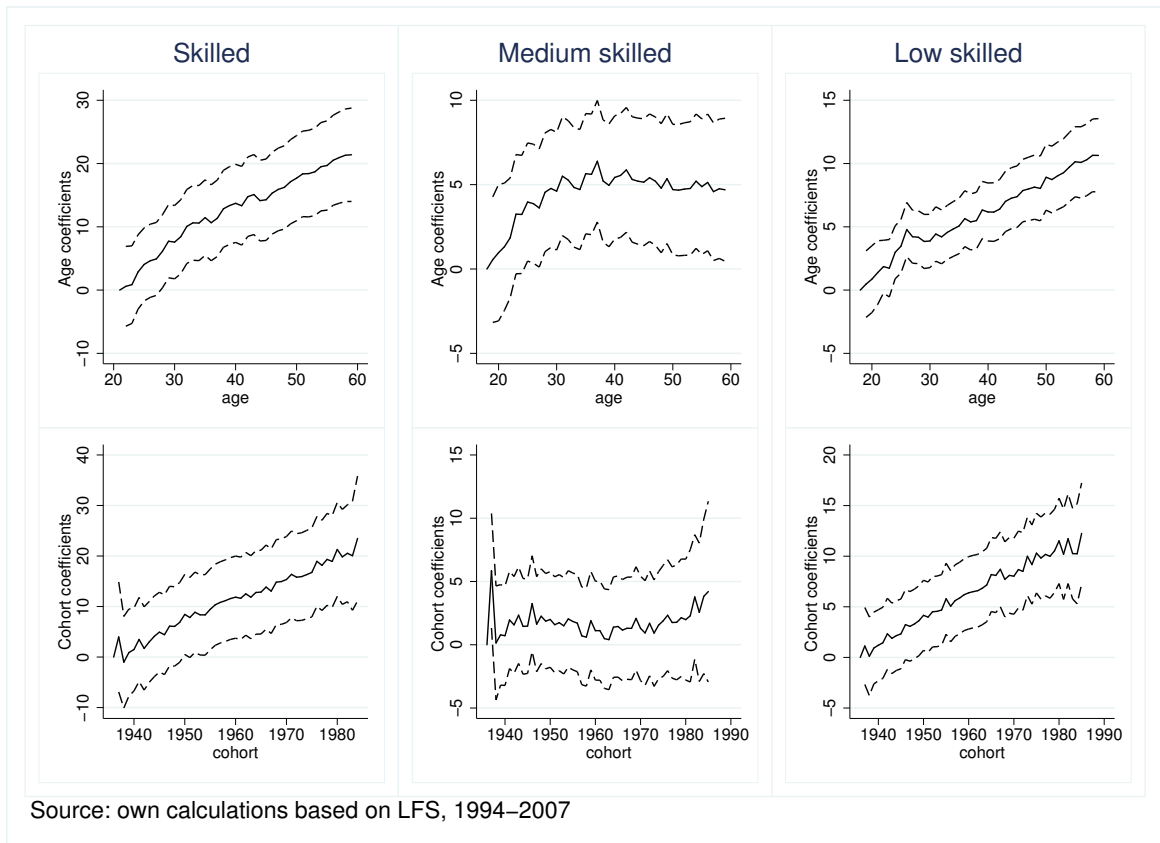


(a) public

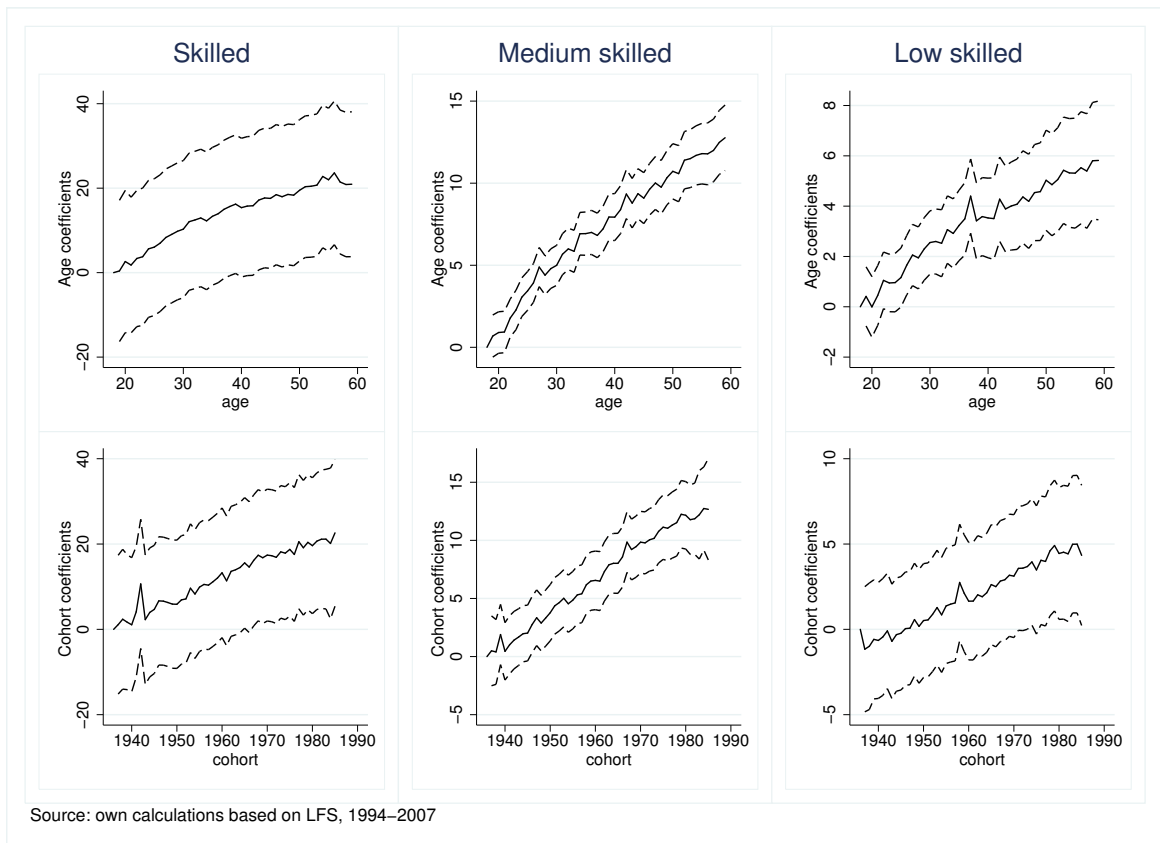


(b) private

Figure 33: Sensitivity Analysis using alternative dataset for females, by occupational group, Great Britain



(a) public



(b) private

Appendix

Appendix 7.A Variable Definitions for France

Educational level: highest qualification obtained

No qualification: Aucun diplôme ou CEP

Brevet or equivalent: CAP, BEP ou autre diplôme de ce niveau, BEPC seul

Baccalauréat: Baccalauréat ou brevet professionnel ou autre diplôme de ce niveau

College or University: Diplôme supérieur, Baccalauréat + 2 ans

Occupational group

Skilled: Cadres et professions intellectuelles supérieures, Instituteurs et assimilés

Medium skilled: Employés (de la fonction publique, administratifs, de commerce), Professions intermédiaires de la santé et du travail social, Professions intermédiaires administratives de la fonction publique, Professions intermédiaires administratives et commerciales des entreprises, Techniciens, Contremaîtres, agents de maîtrise

Low skilled: Ouvriers

Appendix 7.B Variable Definitions for Great Britain

Educational level: highest educational qualification

No qualification: Commercial QF, No O, CSE Grade 2-5, Scot G, Apprenticeship, Other QF, No QF

Gcse or equivalent: GCE, O Levels or Equivalent

A level or equivalent: Teaching qualification, Other higher qf, Nursing qf, Gce, A levels

College or University: Higher Degree, first degree

Occupational group

Skilled: managers and senior officials, professional occupations

Medium skilled: associate professionals and technical, administrative and secretarial, skilled trade, sales and customer service occupations

Low skilled: personal services, process, plant and machine operators, and elementary occupations

Sector

The definition for *Public sector* is the same in the both countries. It includes Central and Local Administrations, Health and Education.