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B. Ben-Halima
Nathalie Chusseau
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Ben-Halima
Nathalie Chusseau
EQUIPPE, University of Lille 1, France

Joël Hellier†
EQUIPPE, University of Lille 1 and LEMNA, IEMN-IAE, France

Abstract

In the case of France, we analyse the changes in the wage value of each education level and the impact of parents' education and income upon the education attainment of children, sons and daughters. We find a critical decline in the skill premium of the Baccalauréat ('bac') in relation to the lowest educational level, and an increase in the skill premia of higher education degrees in relation to the bac, which is however not large enough to erase the decrease in all the skill premia relative to the lowest education. We also find a significant rise in the impact of family backgrounds upon education from 1993 to 2003, i.e. a decrease in intergenerational education mobility, which primarily derives from higher impact of parental incomes. Finally, the gender wage gap is particularly large for the lowest and the highest education degrees, and intergenerational persistence is greater for sons than for daughters.

Keywords: Family backgrounds, intergenerational education mobility, skill premium.

JEL Classification: I2, J24, J31.

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†**Corresponding author**: Joël Hellier, EQUIPPE and LEMNA, 28 rue de Sévigné 75004 Paris, France. E-mail: joel.hellier@wanadoo.fr. Tel.: +33 (0)6 75 49 32 97.

1 Introduction

The aim of this article is twofold. We firstly determine the values of, and changes in the wage values and the skill premia related to each level of education in France over the period 1977-2003. From this first result, we subsequently analyse the changes in intergenerational education mobility.

The French education system exhibits several specificities. The complexity and the elitist orientation of its higher education are two of its most prominent characteristics. The *baccalauréat* (‘bac’) is the access road to tertiary education. The bac is the examination taken at the conclusion of secondary school. There are now three types of bac (‘general’, ‘technical’ and ‘professional’). In its present form of a general examination constituting a prerequisite to tertiary education, the bac was introduced by Napoleon. The technical bac was created in 1968 and the professional bac in 1985. The purpose of the last two was to set special accesses to tertiary vocational studies. Since World War II, the proportion of a generation obtaining the bac has critically increased, passing from about 10% in the early 1950s up to 20% in 1970 and more than 70% now.

Having obtained the bac, a student can select several lines. Broadly speaking, three roads are open. The first is short tertiary education (two years) which is essentially technical and vocational. However, until the introduction of the European system LMD in 2003 there was a two-year tertiary degree in general education (the ‘DEUG’) issued by the university system.

The second road is the university which is open to all candidates having succeeded the bac, whatever the type of bac they obtained. The organization of university studies has significantly changed since World War II, with a succession of reforms. Despite the multiplication of vocational subjects, the university can be seen as providing ‘general’ tertiary education. As in other countries, this comprises a large range of subjects: pure and applied sciences, business, humanities, laws, arts etc. One shortcoming of the lack of selection (apart the bac) to enter French universities, whereas there is indeed a selection to enter the short vocational tertiary courses, is that students who have failed coming in other studies enter the university, which typically leads to very high rates of failure at the end of the first year.

A key specificity of French tertiary education is the existence of ‘*Grandes Ecoles*’. These are highly selective tertiary establishments (they recruit less than 4% of a generation) that aim at training the French ‘elite’. There are two main types of *Grandes Ecoles*, i.e., business schools and engineering schools, both leading to top executive positions. In addition, ‘Science

Po' and the ENA (*Ecole Nationale d'Administration*) aim at training high level civil servants and the political elite, and the ENS (*Ecole Normale Supérieure*) top researchers. If the first *Grandes Ecoles* were created at the begining of the XIXth century, a number of new and less prestigious *Grandes écoles* have been subsequently opened, particularly since World War II.

Finally, and similar to what exists in other countries, there are links that allow passing from one course of study to another.

An implication of this complex and elitist system is that individuals with the same number of schooling years can possess very different skills even in the same field, and thereby very uneven incomes. For instance, both University Master levels and *Grandes Ecoles* are typically characterised by 5-year training programmes after the bac, but they lead to very uneven professional positions with very uneven pays (Jarousse and Mingat, 1986).

Disentangling the different types of studies and establishments can thus be seen as essential when assessing the wage value of schooling attainment in France because the differentiation in terms of schooling years or education cycle can lead to misinterpretations. This inadequacy of years to measure schooling in the case of France was already underlined by Card (1999, p.1806). This militates in favour of the selection of an 'extended (dummy) earnings function method' based on different types of curriculum within a given educational level (Psacharopoulos, 1994), which is what we do here.

Another issue is linked to the substantial increase in the proportion of a generation that succeeds the bac and enters tertiary education. Has this induced a decrease in the 'value' of the bac, which can be seen as the common belief, or has this value remained broadly unchanged? And has the premium linked to tertiary education compared to the bac increased?

In addition, the determination of the wage value of each education level provides bases to calculate intergenerational elasticities in terms of education attainment. This allows measuring intergenerational education mobility by taking into account the fact that, in the French system, the number of schooling years is not a sound indicator of educational attainment.

In this article, we firstly use Mincerian equations to determine the wage value of the different stages that compose the French education system. We subsequently utilise the wage value of each education degree to assess the levels and changes in intergenerational mobility. The calculations are brought about from different waves of the French survey FQP (*Formation Qualification Professionnelle*).

This study is original in several respects. In its first stage, it provides a clear picture of the wage value of the different education degrees in France from 1977 to 2003, which reveals significant modifications. It secondly allows assessing the changes in intergenerational human capital mobility between 1993 and 2003. The originality of this second stage is that each type of study is measured by its wage value on the labour market. This allows accounting for the above-mentioned fact that, in the French education system, the same number of schooling years can correspond to large differences in skill and earnings. An additional specificity consists in dividing the parental influence between the intra-family human capital transfers and the impact of parents' income. Finally, the estimations are carried out both for all working individuals and by gender.

Our calculations firstly show that the skill premium linked to the bac[1] has critically decreased from 1977 to 2003. This decrease has been only partially offset by the increase in the skill premia of the different degrees of tertiary education in relation to the bac. Consequently, all the skill premia have decreased in relation to the lowest skill, which is in line with the decrease in earnings inequality observed in France in this period.

As regards intergenerational mobility, our calculations reveal an increase in the impact of the family backgrounds upon the educational achievement from 1993 to 2003. This rising influence of family backgrounds (i.e., a decrease in intergenerational mobility) primarily derives from the impact of parents' income, even if the impact of intra-family human capital transfers has also risen. Finally, our calculations reveal non-negligible differences between genders. In particular, the gender wage gap displays a clear V-shape in terms of education level, men being significantly better paid than women at each extremity of the education spectrum (primary education and *Grandes écoles*), but not in the intermediate levels. Secondly, the influence of family backgrounds seems to be larger for male than for female.

Section 2 presents a survey of the literature on the subject. Section 3 exposes the empirical model and Section 4 the data and the decomposition of the French education system. Section 5 presents and justifies the econometric strategy and the chosen variables. We present and discuss the results in Section 6. We conclude in Section 7.

2 Literature

Our work rests upon two foundations, namely, the human capital earnings functions and the intergenerational mobility approaches. Both are based on the fact that individuals decide for their education from the earnings return to human capital. In addition, the intergenerational

[1] i.e., the ratio of the earnings of individuals with the bac on the earnings of the least skilled individuals.

approach assumes that an individual's human capital depends on her/his parents' human capital, the latter being a key element of the education function.

2.1. Human capital earnings functions

From a theoretical point of view, human capital earnings functions were introduced in the pioneering works of Mincer (1958), Becker (1964) and Ben-Porath (1967). The basic idea is that individuals invest in education so as to maximise their lifetime earnings that depend on human capital. The return to education is thus at the core of the analysis. To our knowledge, there is however no theoretical approach to the education decision which is based upon education courses consisting of a succession of stages that display uneven earnings returns. A simple model of this type is presented in Appendix A.

From an empirical point of view, the pioneering work is that of Mincer (1974). Since then, a large body of empirical literature has analysed the impact of education upon earnings. These works typically diagnose a large and significant impact (see the reviews of Psacharopoulos, 1985 and 1994; Cohn and Addison, 1998 and 2003; Card, 1999; Psacharopoulos and Patrinos, 2004; Black and Devereux, 2011). Mincer's human capital earnings function can be presented in the synthetic form (Card, 1999): $y_i = a + bS_i + cX_i + dX_i^{\,2} + e_i$, where y_i is the log of earnings, S_i the number of years of completed education, X_i the working years since the end of schooling (X_i depicts experience and $X_i^{\,2}$ obsolescence), and e_i the residual term. In a broader presentation, Mincer's equation can be defined as $y_i = a + bS_i + c'Z_i + e_i$, with Z_i being a vector of individual characteristics, including experience and obsolescence (Dickson, 2009). In a further extension, human capital earnings functions have been estimated by the extended (dummy) equation $y_i = a + bE_i + c'Z_i + e_i$, where E_i is a vector of dummies representing all the education stages (Psacharopoulos, 1994; Cohn and Addison, 1998). In this case, it is possible to discriminate between several types of studies with the same number of schooling years but different qualities or specificities (e.g., vocational versus general education).

In line with Mincer's equation, most empirical studies have measured the education level by the schooling years above a lower limit of 6 or 7 years. In their review of the empirical works on France, Hanchane and Moullet (2000) present eight studies, all of them measuring human capital by the number of schooling years. As already mentioned in the introduction, this measure gives the same weight to all schooling years regardless of the uneven quality of the different studies, which can be seen as controversial in the French case. In fact, a number of studies have found decreasing returns to the schooling years (Psacharopoulos, 1994, and Wössmann, 2003a). In their analyses of the French case, Jarousse and Mingat (1986) and Goux and Maurin (1994) have improved the measure based on schooling years by accounting for repeated years and by distinguishing the certified from the non-certified years. Introducing qualitative variables, Jarousse and Mingat (1986) also find that, compared to the average return to the related schooling years, the University '*Deuxième Cycle*' (master level) suffers a wage deficit of 9% whereas the *Grandes Ecoles* benefit from a wage surplus of 30%. These results suggest that the wage value of one schooling year can critically differ depending on the stage and the type of study that are considered.

2.2. Human capital intergenerational mobility

The impact of family backgrounds on intergenerational mobility has been for a long time a key concern of sociologists. In the economic literature, there has been an increasing interest in the subject since the seminal works of Becker and Tomes (1976, 1979) and Loury (1981).

In the basic theoretical framework, individuals decide for their investment in human capital (education) so as to maximise their utility or lifetime income, with the education function depending, amongst others, on their parent's human capital (see the reviews by Piketty, 2000, and Chusseau and Hellier, 2013). This maximization programme determines an optimal education strategy, and thus an optimal human capital, at each generation of each dynasty. This optimal human capital typically displays the following form:

$$H_{it} = H_t\left(G_{it}, F_{it}, H_{it-1}\right) \tag{1}$$

where H_{it} is the optimal human capital (and thus education strategy) selected by the individual belonging to the *t*-th generation of dynasty *i*, $H_t(\bullet)$ a function that depicts the education technology at generation *t*, H_{it-1} the parents' human capital, F_{it} the family expense for the child's education, and G_{it} the public expenditure in the education of the considered individual. If we suppose that (i) the education technology is given and constant over time, (ii) the public expenditure is the same for each individual and unchanged over time, and (iii) the family expense for the child's education is directly related to parents' human capital ($F_{it} = F(H_{it-1}),\ \partial F_{it} / \partial H_{it-1} > 0$), then relation (1) becomes:

$$H_{it} = H\left(H_{it-1}\right) \tag{2}$$

Assuming the concavity of function (2) and a few additional conditions,[2] all dynasties tend towards the same human capital in the long term. An improvement in the education technology that is identical for everyone does not modify this result, but then the human capital to which all dynasties converge increases with time.

Within a perfectly competitive World, the theory thus predicts that all dynasties tend towards the same human capital in the long term, and that this convergence should not take too many generations (Becker and Tomes, 1979). Assuming imperfection in the credit market, Loury (1981) and Becker and Tomes (1986) showed that the convergence was preserved, but that it required a larger number of generations. Finally, the theoretical literature has analysed the factors that generate lasting under-education traps (situations in which certain dynasties remain lastingly or perpetually under-educated, resulting in social stratification). These factors are many[3]: a fixed cost of education with a credit constraint (Galor and Zeira, 1993; Barham et al., 1995); an *S*-shaped education function (Galor and Tsiddon, 1997); local externalities and neighbourhood effects (Benabou, 1993, 1994, 1996; Durlauf, 1994, 1996); differences in altruism (Das, 2007) etc.

It must be underlined that the influence of parents on their children's human capital runs through several channels. Firstly, intra-family human capital externalities and transfers impact upon both the children's human capital and their capacity to learn. In this respect, a number of empirical works have emphasized the influence of parental characteristics upon children's performance at school (Acemoglu and Pischke, 2001, for the US; Ermisch and Francesconi, 2001, for the UK; Lauer, 2003, for Germany and France; Wössman, 2003b, for 39 countries; Checchi et al., 2008, and Brunello and Checchi, 2005, for Italy; Liu et al., 2000 and 2006, for Taiwan). A second channel of influence comes from the impact of parents' income on the funding of their children's education. Highly skilled parents have higher incomes and can thereby invest more in their offspring's education (Solon, 2004). Family funding is essential when credit market imperfections prevent the young from borrowing for education (Becker and Tomes, 1986; Mulligan, 1997; Han and Mulligan, 2001; Grawe and Mulligan, 2002; Grawe, 2004). In addition, children with educated parents are more and better informed (Entwistle and Alexander, 1992). Finally, the literature has pointed to the genetically transmitted differences in ability (Miller et al., 1995; Ashenfelter and Krueger, 1994; Rouse, 1999; Bowles and Gintis, 2001, 2002).

[2] Convergence is always realised when: $\partial H_{it} / \partial H_{it-1} > 0; \partial^2 H_{it} / \partial H_{it-1}{}^2 < 0; H(0) > 0; \partial H_{it} / \partial H_{it-1} \xrightarrow[H_{it-1} \to \infty]{} c < 1$.

[3] Chusseau and Hellier (2013) for a review.

The impact of parents' position upon children has typically been estimated, either by intergenerational elasticities of earnings and education, or by the intergenerational correlation coefficient.[4] High intergenerational elasticities and correlation indicate low mobility.

An abundant empirical literature has analysed the impact of parent's income upon the child's income through the intergenerational earnings elasticity (IGE)[5]. A major finding of this literature is that IGEs critically differ across countries, the lowest values (less than 0.3) being found in Nordic countries (Björklund and Jäntti, 1997; Österberg, 2000; Jäntti et al., 2006) and the highest (between 0.4 and 0.6) in the US (Solon, 1992; Jänti et al., 2006; Mazumder, 2005), the UK and France being in-between (Nicoletti and Ermisch, 2007 and Blanden et al., 2004 for the UK; Lefranc and Trannoy, 2005 for France). A similar diagnosis can be made from the calculations of correlation coefficients (Chadwick and Solon, 2002, for the US; Björklund et al., 2006, for Sweden).

A limited number of works have calculated IGEs in the case of France (Lefranc and Trannoy, 2005; Lefranc et al., 2008; Lefranc, 2011). As regards changes over time, Lefranc and Trannoy (2005) diagnose no particular trend and conclude that the IGE remained broadly unchanged, whereas Lefranc (2011) finds a U-curve in the long run (thus a decrease in intergenerational mobility in recent years). In addition, several works have found a decrease in intergenerational mobility in recent years in the UK (Blanden et al., 2004, 2007; Nicoletti and Ermisch, 2007) and the US (Aaronson and Mazumder, 2008), two countries who share with France the specificity of having elitist tertiary education systems.

Intergenerational education mobility has also been assessed. In these works, education is typically measured by the number of schooling years, and OLS are used to estimate intergenerational human capital elasticity. For the US, Mulligan (1997) finds an intergenerational elasticity of 0.32 between father and son, and 0.33 between father and child. For the UK, Dearden et al. (1997) find 0.424 for the father-son elasticity and 0.415 for the father-daughter elasticity. Using the French database *Formation Qualification Professionnelle* (FQP) in 1993, Fabre and Moullet (2004) find an intergenerational education elasticity of 0.31 between father and son and a mother-son coefficient of 0.29. As regards correlation coefficients, Couch and Dunn (1997) find a father-son intergenerational elasticity of 0.42 in the US and 0.24 in Germany, Behrman and Rosenzweig (2002) found a coefficient of 0.45

[4] The relation between the estimated intergenerational elasticity $\hat{\beta}$ and the intergenerational correlation r is: $r = \hat{\beta}\left(\sigma_p / \sigma_c\right)$, σ_p and σ_c being respectively the standard deviations for parents and for children.

[5] Solon (2002), Grawe (2004), Jäntti et al. (2006), Mazumder (2005), Corak (2006), Nicoletti and Ermisch (2007), Björklund and Jäntti (2009), Blanden (2009), Black and Devereux (2011) etc.

between father and sons in the US, and Björklund et al. (2006) a coefficient of 0.24 for Sweden. As for earnings, education intergenerational mobility appears to be significantly higher in Scandinavia compared to the US. By using the number of schooling years to measure human capital, a majority of empirical works are exposed to the already mentioned critique of allocating the same weight to qualitatively different schooling years.

3 The model

A basic theoretical model that defines the optimal education strategy of individuals when education consists of a succession of studies with different returns in terms of earnings is exposed in Appendix A. We now present the empirical model which is estimated in the following sections.

This model comprises two functions corresponding to the two stages of the empirical strategy. The first determines the wage value of the different education levels that compose the French education system. This is made by estimating Mincerian wage equations. At the end of stage 1, we can thus assign a 'value' to each education level. In the second stage, we utilise these values to assess the intergenerational mobility in terms of education attainment.

3.1. First stage: Human capital earnings equation

Let us suppose a Mincerian wage equation of the following form (in logarithm):[6]

$$w_i = w + h_i + x_i \tag{3}$$

where w_i is the log of individual *i*'s wage, *w* the log of wage per unit of human capital, h_i the log of individual *i*'s human capital H_i, and x_i a composite value that gathers the different personal characteristics that impact on wage.

We suppose that the education system consists of a succession of studies with possible divisions in several branches at certain stages of the course of study[7]. In addition, each study provides a specific contribution to human capital accumulation. Then, the individual's human capital H_i consists of a succession of studies, each of which providing a specific contribution to human capital accumulation. This can be written:

$$h_i = \sum_{k=1}^{\bar{k}} a_k e_{ik} \tag{4}$$

[6] Presented in the form of an extended (dummy) earnings function (see below).
[7] In the French case depicted in Figure 1, the system is divided into four branches after the bac.

In Equation (4):

1. $k = 1, 2, ..., \bar{k}$ depicts a stage of study, $k_i \in K = \{1, 2, ..., \bar{k}\}$ the highest study completed by individual *i*, and $\bar{k}$ the highest stage[8]. $K = \{1, 2, ..., \bar{k}\}$ is the ordered succession of possible studies (stages), with stage *n* being compulsorily completed to enter stage (*n*+1).

2. a_k measures the contribution of stage *k* to human capital, i.e., its 'human capital value'.

3. $e_{ik} = 1, 0$ according to whether individual *i* has completed cycle *k* or not.

We finally suppose that x_i (in log) is defined by:

$$x_i = \sum_j b_j x_{ji} \tag{5}$$

where subscript *j* depicts individual characteristics, b_j measures the impact of characteristic *j* on wage and x_{ji} is either the value (in log) of *j*, or $x_{ji} = 1, 0$ according to whether individual *i* possesses this characteristic or not.

By inserting (4) and (5) into (3), we obtain the relation: $w_i = w + \sum_{k=1}^{\bar{k}} a_k e_{ik} + \sum_j b_j x_{ij}$, which is an extended (dummy) earnings function. The stochastic form of this model is:

$$w_i = w + \sum_{k=1}^{\bar{k}} a_k e_{ik} + \sum_j b_j x_{ji} + \mu_i \tag{6}$$

where μ_i is the error term that encompasses all the unobservable characteristics and *w* is the wage of reference.

The estimation of Equation (6) makes it possible to calculate the vector $a' = \left(a_1, a_2, ..., a_{\bar{k}}\right)$ of the contribution of each education level to the accumulation of human capital. Individual *i* who has completed the course of study $e_i' = \left(e_{i1}, e_{i2}, ..., e_{i\bar{k}}\right)$, $e_{ik} = 0,1$, possesses the human capital (in logarithm):

$$h_i = a' \times e_i \tag{7}$$

Equation (7) shows that two individuals who pursue the same course of study possess the same human capital, i.e., each course of study determines one unique level of human capital.

[8] When there are several branches in the education system, there are several $\bar{k}$ and the $\bar{k}$ in equation (4) corresponds to the education branch the individual has chosen.

At the end of this first stage, we can assign to each individual of our sample the human capital value which corresponds to her/his course of study.

3.2. Second stage: Estimation of the education function

The individual's human capital, determined by her/his educational choice, depends on the following elements:

1. The general efficiency of the education technology that is given for the individual and identical for a given generation.
2. The wage per unit of human capital (i.e., corresponding to the human capital of reference) that is also given for the individual and identical for a given generation.
3. The intra-family human capital transfers that directly depend on the parent's human capital.
4. The family funding for the education of their child that is assumed to directly depend on the parents' income.
5. The public education expenditure from which the individual benefits during her/his schooling time. It must be noted that we assume here that public education expenditure differs according to individuals. This assumption is logic within an approach in which individuals differ in their course of study and thus in the education services they receive from the State.

Let us place ourselves at a certain moment of time *t* (*t* is omitted to simplify). Individual *i*'s human capital (in log) h_i can be written:

$$h_i = \alpha + \alpha_{IF} h_{i,-1} + \alpha_{\Omega} \omega_{i,-1} + \alpha_G g_i \tag{8}$$

with $h_{i,-1}$ the parents' human capital that depicts intra-family human capital transfers, $\omega_{i,-1}$ the parents' real income that determines their expense on their child's education, and g_i the real public funding for education the individual has benefited from (all variables are in log).

In equation (8), α_{IF} measures the contribution of intra-family human capital transfers to the education of individuals, α_{Ω} measures the contribution of the family expense for education, α_G the contribution of public expenditure, and α is the constant term that combines the determinants common to all individuals at period *t*.

The individual's human capital h_i and her/his parents' human capital $h_{i,-1}$ are calculated from equation (7). As we know the father's highest educational attainment, we can easily calculate the related human capital value. We must however select the vector $\left(a_1, a_2, ..., a_{\bar{k}}\right)$ utilised for measuring human capital, given that this vector differs with time and gender. This choice is made and discussed in Subsection 5.2.

The calculation of $\omega_{i,-1}$ and the related problems in the estimation are also exposed and discussed in Subsection 5.2.

Finally, the variable $g_i = \log G_i$ depicts the impact of public expenditure for the educational cycles followed by individual *i* upon her/his human capital. The total public expenditure G_i for an individual who has the education level k_i is:

$$G_i = G(k_i) = \sum_{k=1}^{k_i} n_k \frac{D_{ki}}{N_{ki}} \tag{9}$$

with n_k the number of years necessary to complete cycle *k*, D_{ki} the yearly public spending allocated to cycle *k* when individual *i* was participating in this cycle and N_{ki} the average yearly number of students in *k* at the time when individual *i* followed cycle *k* (the expenditure and the number of pupils/students in each cycle change every year). The precise construction of G_i and the related problems are discussed in Subsection 5.2.

4 The data

4.1. Database

The data used for the micro-econometric estimations are taken from the French surveys *Formation Qualification Professionnelle* (*FQP*, Education-Training-Occupation) constructed by the French national statistical institute INSEE[9].

There were six waves of FQP realised in 1964, 1970, 1977, 1985, 1993 and 2003, and each wave corresponds to a new sample (there is no panel structure). Each wave provides a representative sample of the French working population. These surveys give a large number of characteristics for individuals over 16 y.o. (20 y.o. in 2003) belonging to households. In addition to the usual personal characteristics (age, gender, family structure etc.), the survey focuses on the description of individual labour market characteristics (occupation, annual earnings in the previous year, career, sector, number of months worked full time and part time, etc.) and education (highest attainment at the conclusion of 'initial' training, on-the-job

[9] Institut National de la Statistique et des Etudes Economiques.

training). Since 1977, the survey provides information on the parents' occupation and education. The size of the sample changed at each wave (32,078 in 1977; 30,387 in 1985; 10,479 in 1993; 15,727 in 2003)[10].

FQP has been utilised for most empirical works on both the return to education and intergenerational earnings mobility in France. This survey allows studying the two issues tackled here, i.e., (i) the wage value of each level of the French education system, and (ii) the impact of family backgrounds upon the individual's education attainment.

Finally, our approach requires the utilization of identical classifications for education levels and professional occupation in the different years. In consequence, we have limited our study to the five surveys for which a unified detailed classification was available (1977, 1985, 1993 and 2003).

4.2 Education levels

From the French database FQP, we build a classification of ten levels of studies ranked in ascending order of skill. The succession of levels is depicted in Figure 1.

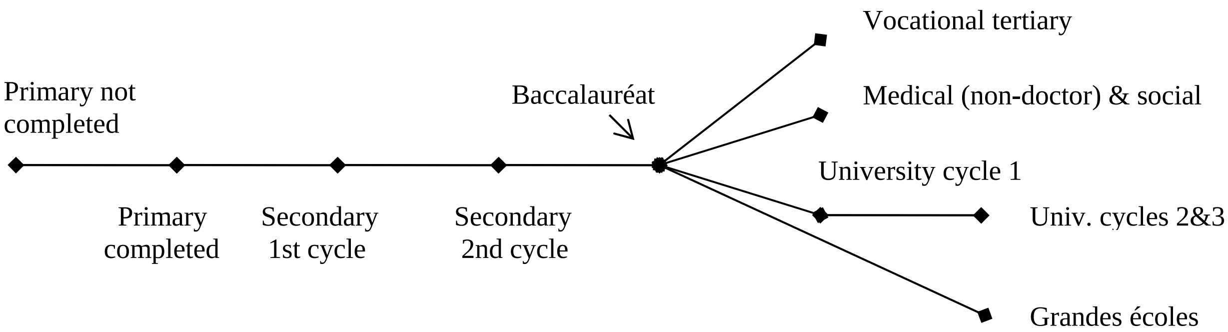

Figure 1. The structure of the French education system

4.3 Descriptive statistics

Table 1 depicts the distribution between the different education levels of the individuals in the sample, as well as the average age, the average monthly wage, and the average number of years at work (experience). These statistics are given for the overall sample, for men and for women. In Table 1, the data are limited to the years 1977 and 2003. The years in-between (1985, 1993) are provided in Appendix B.

Finally, the number of selected observations differs from the size of the total sample (23,369 out of 32,078 in 1977; 21,091 out of 30,387 in 1985; 8,604 out of 10,479 in 1993 and

[10] Outliers and non-response being removed.

10,660 out of 15,727 in 2003). This is because the wage equation estimated in stage 1 only concerns those individuals who are both wage earners and full-time workers, which induces the removal of a number of observations.

Table 1: Descriptive statistics (Overall sample, Male and Female)

	1977			2003		
	Overall	*Male*	*Female*	*Overall*	*Male*	*Female*
The education levels (% of the sample)						
1. Primary education not completed	22,41	24,32	18,72	16,05	18,74	12,2
2. Primary education completed	25,75	25,74	25,77	6,28	6,14	6,49
3. Secondary education 1st cycle	28,19	27,88	28,79	34,66	37,21	30,99
4. Secondary education cycle 2	4,52	4,7	4,18	4,24	4,15	4,36
5. Baccalaureate	7,17	6,14	9,15	12,71	10,81	15,43
6 .University 1st cycle (2 years)	2,33	1,71	3,52	1,84	1,47	2,38
7. Vocational tertiary (BTS, DUT)	1,32	1,39	1,18	8,25	8,09	8,49
8. Medical & social lower than doctor degree	0,91	0,1	2,48	1,64	0,37	3,45
9. University cycles 2 or 3	4,62	4,09	5,63	11,51	9,32	14,63
10. Grandes écoles	2,78	3,93	0,58	2,82	3,7	1,58
Bac and more	19.3	18.17	22.54	38.77	33.76	42.96
More than bac	12.3	12.0	13.4	26.1	23.0	27.5
Others variables						
Average age (years)	37,1	37,91	35,54	40,23	40,17	40,33
Average monthly wage (current Francs)	3054	3393	2401	12686	13736	11041
Average experience (years at work)	19,41	20,76	16,81	19,69	19,91	19,35
Number of observations	**23369**	**15387**	**7982**	**10660**	**6268**	**4392**

The descriptive statistics reveal certain key variation from 1977 and 2003.

First, the proportion of the lowest education attainments (primary education completed and beneath) substantially decreased from 46.7% in 1977 to 22.3% in 2003. This came with a significant increase in the proportion of those having a tertiary degree (bac and more[11]), from 19.3% to 38.8%. The most noticeable increase is found for the proportion of the population with a degree higher than the bac, that moved from 12.3% up to 26.1%. It must however be underlined that this increase did not concern the *Grandes écoles* since the proportion in the working population of individuals with a *Grande école* degree remained broadly unchanged.

Finally, the average age of the working population increased, which essentially resulted from the general increase in the schooling years.

5 Methods and variables

We estimate a two-stage econometric model that corresponds to the approach exposed in Section 3. From a Mincerian wage equation, the first stage determines the human capital wage

[11] In France, the bac is considered as the first tertiary education degree.

value linked to each education level. At the second stage, the values of the different education levels defined in stage 1 are utilised to estimate the elasticity of the individual's education in relation to her/his parent's education and to her/his parents' income.

5.1. Stage 1: Estimation of the wage equation

The explained variable of the wage equation is the (log of the) monthly wage for full time workers. This creates a self-selection bias: the wages and individual characteristics are only selected for full time working wage earners. In this case, the OLS method provides biased estimations. This selection bias can be treated through the Heckman selection model.

The Heckman selection model (Gronau, 1974; Lewis, 1974; Heckman, 1976 and 1979) assumes an underlying relationship between two regressions: the outcome equation (the wage equation here) and the selection equation. This model is implemented in one step by using maximum likelihood methods to estimate simultaneously both equations.

The selection equation

Individual i's wage is selected only if individual i is a full time worker, i.e., under the following condition (selection equation):

$$P_i^* = z_i\eta + \mu_{0i} \ , \qquad P_i = \begin{cases} 1 & \text{if } P_i^* > 0 \\ 0 & \text{if } P_i^* \leq 0 \end{cases}$$

P_i^* is the probability of being a full time wage earner, z_i the vector of explanatory variables utilised in the selection equation and μ_{0i} the error term. We add an instrumental variable that is linked to the probability of participating in the labour market and being a full time worker, but bears no influence on the level of wage. This variable is *the presence in the household of children of less than 6 years old*. As a matter of fact, this presence lowers the probability of participating in the labour market, and especially the probability of choosing a full time job.

The outcome equation (wage equation) is:

$$w_i = \begin{cases} a_0 + \sum_{k=1}^{\bar{k}} a_k e_{ik} + \sum_j b_j x_{ij} + \mu_i & if \ P_i^* > 0 \\ - & if \ P_i^* \leq 0 \end{cases}$$

w_i is the log of individual i's monthly wage, $e_{ik} = 1, 0$, $k = 1...\bar{k}$, are the successive cycles s/he has followed, the x_{ij} s her/his personal characteristics, and μ_i is the error term.

The variables x_{ij} selected for the wage equation are: Gender; Marital status (Married / Single / Widowed / Divorced); Nationality (French / naturalized French / Foreign); working sector (11 sectors); Size of the working district (9 levels); Training[12] (11 levels; see the explanation below); experience (number of years in work) and obsolescence (square of the preceding).

Concerning the training variables, we introduce (i) dummies for the skill level obtained at the end of the training programme when this level is higher than the skill at the end of initial education and (ii) an additional dummy that accounts for training when this yields a skill level which is not higher than that obtained at the end of initial schooling.

Finally, the estimation of the wage function provides the vector $\hat{a}'=\left(\hat{a}_1,\hat{a}_2,...,\hat{a}_{\bar{k}}\right)$ of the contribution of each education level to the human capital value. As a consequence, this makes it possible to calculate the value of one individual's human capital once her/his course of study $e_i'=\left(e_{i1},e_{i2},...,e_{i\bar{k}}\right)$, $e_{ik}=0,1$, is known.

5.2. Stage 2: estimation of the education function

In stage 2, we estimate the education function (8) in which the individual's human capital depends on her/his father's human capital, on her/his father's income, and on the public education expenditure from which s/he has benefited. The stochastic form of (8) is:

$$\hat{h}_i = \alpha + \alpha_{IF}\hat{h}_{i,-1} + \alpha_{\Omega}\omega_{i,-1} + \alpha_G g_i + \nu_i$$

where $\hat{h}_i$ is the log of the individual's human capital, $\hat{h}_{i,-1}$ that of her/his father, $\omega_{i,-1}$ the log of her/his parents' real income, g_i the log of education public expenditure the individual benefits from, and ν_i the error term.

The parents are identified by the father because of the availability in the database of the variables required for the estimations.

The parents' income

The measurement of parents' incomes induces two difficulties:

(i) We must construct a variable that adequately represents the parents' real income.

(ii) We must account for the fact that parents' incomes are to a large extent determined by parents' human capital, which generates a problem of correlation between $\hat{h}_{i,-1}$ and $\omega_{i,-1}$.

[12] Antonelli *et al.* (2010) point to the importance of on-the-job training, particularly in innovative contexts.

The database FQP does not provide the parents' income. It however provides the father's occupation and the father's education in the surveys from 1977.

For the individuals surveyed in 1993, the (log of) parents' income $\omega_{i,-1}$ is represented by the (log of) father's wage ($w_{i,-1}$) which is itself approximated by (the log of) the average wage corresponding to their fathers' occupation in 1977. Similarly, for individuals surveyed in 2003 the parents' income is approximated by the average wage corresponding to their father's occupation in 1985. The database provides 6 professional occupations for fathers (see Appendix C).[13]

As $w_{i,-1} = w_{-1} + h_{i,-1} + x_{i,-1}$ (Equation (3) for fathers), we can thus rewrite equation (8):

$$h_i = \alpha + \alpha_H h_{i,-1} + \alpha_\Omega \left(w_{-1} + x_{i,-1} \right) + \alpha_G g_i$$

with $\alpha_H = \alpha_{IF} + \alpha_\Omega$.

It is thus sufficient to calculate $\left(w_{-1} + x_{i,-1} \right)$ so as to disentangle the impact of the parents' income measured by coefficient α_Ω from the impact of intra-family human capital transfers α_{IF}, calculated from the difference $\alpha_{IF} = \alpha_H - \alpha_\Omega$.

Finally, the value $\left(w_{-1} + x_{i,-1} \right)$ is calculated by subtracting $h_{i,-1}$ to the approximated value of $w_{i,-1}$ described above: $w_{-1} + x_{i,-1} = w_{i,-1} - h_{i,-1}$. The value of $h_{i,-1}$ can be calculated since FQP provides the education level of fathers.

Public expenditure

In equation (8), $g_i = \log G_i$ depicts the impact of public expenditure in the education cycles completed by individual *i* upon her/his human capital. Relation (9) defines G_i as the sum of the (real) public expenditure per pupil in the cycle followed by the individual for each of her/his schooling years, i.e., the sum for all her/his schooling years of the dated ratios $R_{k,t} = D_{k,t} / N_{k,t}$ where $D_{k,t}$ and $N_{k,t}$ are respectively the real public expenditure and the number of students in cycle *k* at year *t*, provided that the individual followed cycle *k* at year *t*.

The definition of variable g_i generates two problems.

[13] The average father's age of an individual surveyed in 1993 is 66.8 y.o., and thus 50.9 y.o. in 1977; and the average father's age of an individual surveyed in 2003 is 69.4 y.o., which corresponds to 51.5 y.o. in 1985.

First, data on public expenditure for each education cycle are not available before 1974. Consequently, we approximate $D_{t,k}$ by the number of teachers (or professors) within each cycle for each year provided by the INSEE[14]. Thus, the retained measure to approximate ratio $R_{k,t}$ is the number of teachers (professors) per pupil (student): $\tilde{R}_{t,k} = Teach_{k,t} / N_{k,t}$. This also allows the measurement of real public spending. Given that these data are not available before 1948, the estimations are implemented for individuals between 20 and 50 years of age. Consequently, the estimation of the education function is carried out from a sample of 6261 individuals in 1993, and 7303 in 2003.

Second, according to equation (9), we should calculate the *sum* of the teachers per student corresponding to each cycle the individual followed and each year s/he spent in this cycle, i.e., $\tilde{G}_i = \sum_{k=1}^{k_i} \sum_{t_{ik}} Teach_{k,t_{ik}} / N_{k,t_{ik}}$.[15] However, such a calculation would result in small changes over time in the *g* corresponding to each education level. This is because *g* would be to a large extent determined by the number of schooling years, this number being given for each education level. The very little changes over time in *g* for a given educational level *k* would then result in the variable g_i capturing most of the explanation in the determination of h_i in the estimated education function. To avoid this difficulty without erasing the changes over time in public expenditure and in its distribution across education cycles, we divide the sum $\tilde{G}_i$ by the individual's total number of schooling years. The corresponding indicator is:

$$G_i = \tilde{G}_i / \sum_{k=1}^{k_i} n_k$$

with n_k the number of years spent in cycle *k*.

Human capital

The human capital values $\hat{h}_i$ and $\hat{h}_{i,-1}$ are respectively obtained by multiplying the vector $\hat{a}'$ estimated at stage 1 by the vectors e_i and $e_{i,-1}$, i.e., the course of studies completed by the individual and her/his father ($\hat{h}_i = \hat{a}' \times e_i ; \hat{h}_{i,-1} = \hat{a}' \times e_{i,-1}$). This requires the choice of the appropriate vector(s) $\hat{a}'$.

[14] From the *Annuaire rétrospectif* (INSEE) for the years 1948-1988, and the *Annuaires* for the years 1989-1993.

[15] t_{ik} are the years in which individual *i* pursued cycle *k*.

To validly assess intergenerational mobility, both values $\hat{h}_i$ and $\hat{h}_{i,-1}$ must be stated in the same unit of measurement. This means that the vector $\hat{a}'$ utilised to compute the human capital of both fathers and children must be the same, which requires the choice of this vector provided that $\hat{a}'$ changes according to gender and year.

We must firstly select between the year corresponding to the surveyed individual (1993 and 2003) and the year corresponding to her/his father's occupation (1977 and 1985). We shall apply to the individuals surveyed and to her/his father the vector $\hat{a}'$ corresponding to the father's income calculation, i.e., $\hat{a}'_{1977}$ for the individual surveyed in 1993 and for her/his father in 1977 and $\hat{a}'_{1985}$ for the individual surveyed in 2003 and her/his father in 1985. The reason for this is twofold:

1. We assume that, at the moment when the individual (and presumably her/his family) decides for her/his education, s/he bases her/his judgement on the wage value of each study at the time of her/his decision because s/he does not know the future values corresponding to her/his lifetime. These values can be approximated by considering the vector $\hat{a}'$ corresponding to the time when her/his father works, i.e., $\hat{a}'_{1977}$ for individuals surveyed in 1993 and $\hat{a}'_{1985}$ for those surveyed in 2003. Consequently, we do not assume rational expectations with perfect information.

2. To disentangle human capital from the other determinants of the father's wage, we divide the father's wage by his human capital value, which makes the coefficient α_H related to $h_{i,-1}$ in the education function to encompass both the intra-family transfers and the income-related impact of the father's human capital. This requires that $h_{i,-1}$ corresponds to the year selected for the father's income, i.e., 1977 for the individuals surveyed in 1993 and 1985 for those surveyed in 2003.

We must secondly decide on the gender to which vector $\hat{a}'$ is related. The calculations carried out in stage 1 define three vectors $\hat{a}'$ for three samples, namely, one for the overall sample and one for each gender. Logically, we shall select the overall vector when assessing the overall intergenerational education mobility, and the vectors for male when assessing mobility for men. However, the choice is not straightforward when considering female and when trying to compare the results for male and female.

For women, we shall select the vector $\hat{a}'$ found for the female sample. However, we are aware that this induces a bias because, when dividing the father's wage by his human capital calculated from the female values $\hat{a}'$, this results in multiplying the father's wage determinants excluding human capital by the male/female difference (ratio) in the human capital *H* corresponding to the father's human capital[16].

Finally, calculating the education function coefficients from the male-related $\hat{a}'$ for men and from the female-related $\hat{a}'$ for women makes the human capital measures to be different when considering men and women. This renders difficult comparing men and women results for the education function. In consequence, we shall make an additional estimation of the education functions by applying the overall vector $\hat{a}'$ to both men and women and utilise the related outcomes to compare the results for each gender.

The estimated education function

We estimate the education function:

$$h_i = \alpha + \alpha_H h_{i,-1} + \alpha_\Omega \left(w_{i,-1} - h_{i,-1} \right) + \alpha_G g_i + \nu_i \tag{10}$$

with h_i the logarithm of the individual's human capital, $h_{i,-1}$ the logarithm of her/his father's human capital, $w_{i,-1}$ the logarithm of the father's wage, g_i the logarithm of the public expenditure for the individual i's education, and ν_i the error term.

Coefficient α_H measures the total impact of the parent's human capital upon the child's skill. This impact may be divided between two effects: the intra-family human capital transfers $\alpha_{IF} = \alpha_H - \alpha_\Omega$ and the parent's income effect α_Ω. Finally, α_G is the elasticity of individual *i*'s skill in relation to the public education expenditure specific to *i*.

5.3 Robustness

Selection bias

The wages and individual characteristics are only selected for full time working wage earners. In this case, the OLS method provides biased estimations. This selection bias can be treated through the Heckman selection model. This model is estimated in one step by using maximum likelihood methods to estimate simultaneously both equations (see subsection 5.1). Estimating

[16] The estimated father's wage is $\hat{W}_{i,-1} = \hat{W}_{-1} \hat{H}^m_{i,-1} \hat{X}_{i,-1}$ with $\hat{H}^m_{i,-1}$ his human capital calculated with the male-related vector $\hat{a}'$. Let $\hat{H}^f_{i,-1}$ be the human capital calculated with the female-related vector $\hat{a}'$. By dividing the father's wage by $\hat{H}^f_{i,-1}$, we have: $\hat{W}_{i,-1} / \hat{H}^f_{i,-1} = \hat{W}_{-1} \hat{X}_{i,-1} \times (\hat{H}^m_{i,-1} / \hat{H}^f_{i,-1})$.

maximum likelihood[17] has two advantages: it is more efficient and the variances are easier to calculate.

Heteroscedasticity

A problem of heteroscedasticity may arise from the estimation of the education function because we utilise a limited number of education levels and related skill indicator is thus discontinuous. We use a Breusch-Pagan test to verify heteroscedasticity. The results lead to rejecting the null hypothesis of homoscedasticity[18]. Contrary to the OLS estimator, the variance of this estimator is biased. We thus correct the variance-covariance matrix by using White's correction[19]. This correction provides a convergent estimation of the variance-covariance matrix of the estimated coefficients with robust standard errors.

Multicollinearity

The explanatory variables in the education function are the father's education level, the father's income (with the indicator described in sub-section 5.1) and the education public expenditure allocated to the individual. It is here necessary to check that there is no multicolinearity. To do so, we firstly calculate the correlation matrix, and we secondly calculate the VIFs (« Variance Inflation Factors »). In the correlation matrix, all the coefficients are lower than 0.5, which indicates no multicolinearity. This diagnosis is confirmed by the values of the VIFs that are all very small[20].

6 Results and Discussion

6.1. Wage equation and the value of each degree

The results by education level, for experience and obsolescence (experience square) of the estimated wage equations are in Appendix D. All variables display the expected sign and almost all of them are significant. The coefficients related to the education degrees are all significant, most of them at the 1% level.

[17] It corresponds to partial maximum likelihood because the observations of individuals who do not occupy a full time job do not contribute to the likelihood function for observed wages.

[18] The results of the test for the ten estimated education functions (for each of the two years: one for the overall sample and two for each of the female and the male sample, one using the overall wage value and the other the gender-related wage value for each education level) are available upon request.

[19] White's test is available upon request.

[20] The VIF in the different configurations are available upon request.

In this section, we draw attention (i) to the skill premia that are calculated from the coefficients of the wage equations, and (ii) to the gender wage gap by education level.

We call skill premium (henceforth SP) the ratio of the wage value of a certain education level (degree) in relation to another level taken as a benchmark. We consider two skill premia, SP1 and SP2.

For each education level, SP1 is the skill premium of this level in relation to the lowest education, i.e., primary education not completed. In other words, the SP1 of education level *k* is the wage value of *k* divided by the wage value of the lowest education. The SP1 attached to the education level *k* is obtained by the exponential of the sum of the coefficients in the wage equation of all the successive stages of study necessary to attain education *k*.

SP2 provides the skill premium of each education level above the bac in relation to the bac, i.e., the ratio $\mathrm{SP1}_k / \mathrm{SP1}_{bac}$ for all the courses of study *k* higher than the bac.

Table 2: The skill premia

Sample	Overall sample				Male				Female			
Years	1977		2003		1977		2003		1977		2003	
Education level	SP1	SP2	SP1	SP2	SP1	SP2	SP1	SP2	SP1	SP2	SP1	SP2
Primary not completed	1	.	1	.	1	.	1	.	1	.	1	.
Primary completed	1.14	.	1.07	.	1.16	.	1.08	.	1.11	.	1.05	.
Secondary 1st cycle	1.37	.	1.21	.	1.36	.	1.19	.	1.36	.	1.22	.
Secondary 2nd cycle	1.64	.	1.32	.	1.66	.	1.26	.	1.60	.	1.42	.
Baccalauréat	1.83	1	1.43	1	1.85	1	1.36	1	1.75	1	1.50	1
University 1st cycle	1.95	1.06	1.59	1.10	1.88	1.06	1.43	1.04	1.96	1.12	1.88	1.25
Vocational tertiary	2.10	1.14	1.72	1.20	2.14	1.14	1.65	1.20	1.99	1.14	1.80	1.19
Medical & social studies	1.92	1.05	1.72	1.19	2.00	1.05	1.57	1.51	1.87	1.07	1.84	1.22
University 2nd & 3rd cycles	2.58	1.40	2.11	1.47	2.51	1.40	1.99	1.45	2.67	1.52	2.16	1.44
Grandes écoles	3.13	1.70	2.47	1.72	3.13	1.69	2.34	1.71	2.82	1.61	2.20	1.46

Table 2 depicts the skill premia SP1 and SP2 corresponding to each level of education in 1977 and 2003 for the overall sample and both genders. The results for the years 1985 and 1993 are in Appendix E. For the overall sample and both genders, we can observe the same changes in the skill premia:

1) All the skill premia SP1 until the bac have significantly decreased (Figure 2). As a consequence, over the period 1977-2003, the relative wage value of the bac has fallen by 22% for the overall sample, 26.5% for men and 14.3% for women. It can be noted that the reduction is particularly large for men. In line with the common belief, the huge increase in the number of bac graduates has come with a substantial decrease in its wage value.

2) All the skill premia SP2 corresponding to tertiary education degrees in relation to the bac have increased (Figure 3). It can be noted that, after having raised more than other tertiary

degrees from 1977 to 1993, the *Grandes écoles* SP2 has decreased in the last studied decade (1993-2003). This can be explained by the fact that the increase in the number of students recruited by the *Grandes éco*les in the last decades has essentially concerned the least prestigious ones, lowering thereby the *Grandes écoles* average skill premium. This explanation is confirmed by Albouy and Wanecq (2003) who make a division between '*Grandes écoles*' and '*Très Grandes écoles*' (Top GE), the latter being the most prestigious. They show that, for men, the share of a generation entering a *Grande école* (Top GE not included) has increased from 2.3% to 3.2% (i.e., multiplied by 1.4) when comparing the generations born in 1959-1968 to those born in 1929-1938, whereas this share has simultaneously decreased from 0.8 to 0.6% for the entry into the *Top GE*.

3) However, these increases in the SP2s are not sufficient to offset the decrease in the bac skill premium. Consequently, all the skill premia SP1 (in relation to the lowest attainment), including those corresponding to higher education, decreased between 1977 and 2003 (Table 2), which is in line with the changes in inequality observed in France during this period and with the calculations of Lefranc et al. (2008).

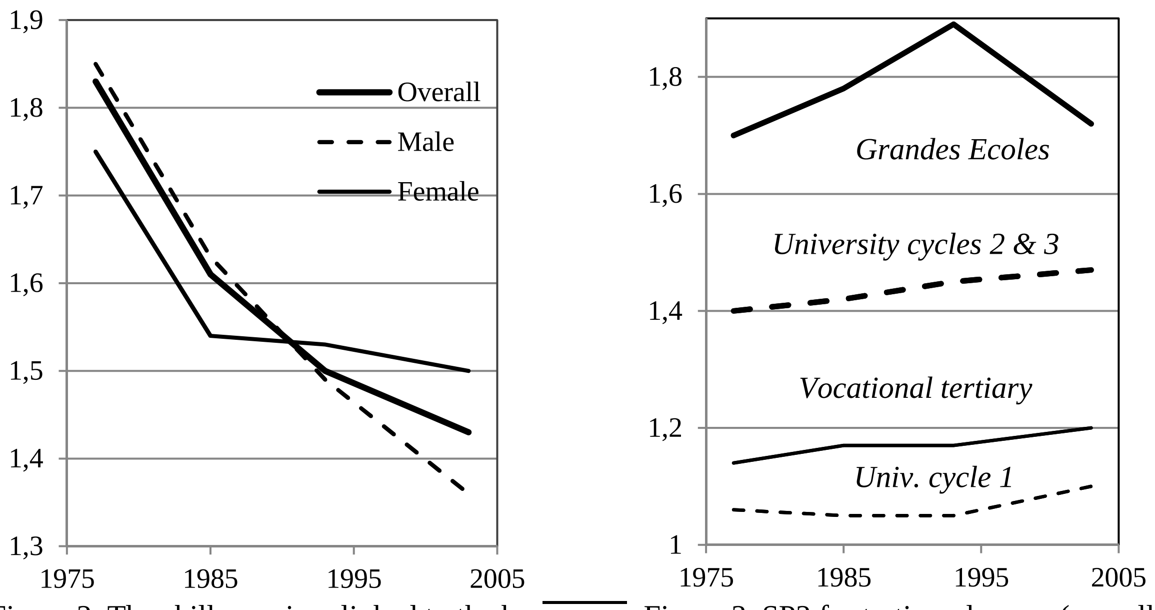

Figure 2. The skill premium linked to the bac. Figure 3. SP2 for tertiary degrees (overall)

Finally, the wage equation allows measuring the changes in the gender wage gap related to each education level, independently from other wage determinants (experience, family characteristics, sector, location, etc.). The gender wage gap attached to the education level j is obtained (i) by multiplying the wage per unit of human capital[21] (i.e., the exponential of the

[21] The unit is the reference education level, i.e., primary education not completed.

constant term) by the skill premium SP1 corresponding to the education *j* for each gender, and (ii) by dividing the obtained wage value for male by that for female.

Figure 4 depicts the gender wage gaps in 1977 and 2003 for the different education levels ranked in increasing order of attainment.[22] This reveals a major change over the analysed period.

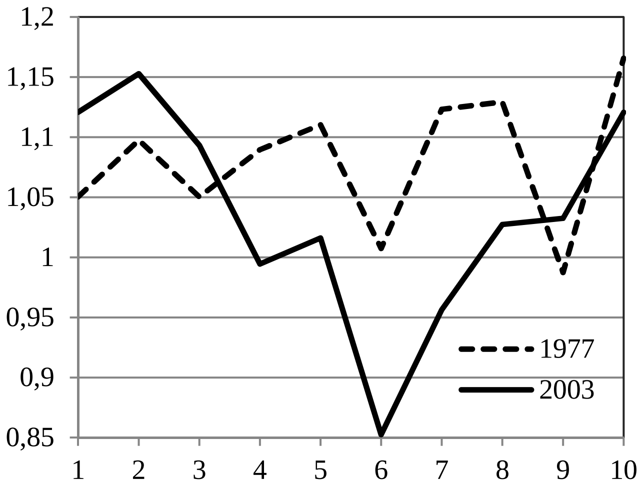

Figure 4. Gender wage gap (male/female) according to the education attainment

In 1977, the 'male wage premium' was somewhat randomly distributed across education levels and men were better paid than women for all levels except the University 2nd and 3rd cycles (level 9) for which both gender received similar pays. In contrast, the gender wage gap curve displays a clear V-shape in 2003. Men are substantially better paid than women for the extremities of the education spectrum (primary education on one side and *Grandes écoles* on the other), but they are equally or less paid than women for the medium level (from secondary 2nd cycle up to university 2nd and 3rd cycle).[23] Provided that women are also relatively less numerous in both extremities of the education hierarchy (see Table 1), the relation between the female education profiles and the V-shaped gender wage gap curve can be seen as self-reinforcing. On the one hand, women tend to have wages similar to those of men in the positions corresponding to education levels in which they are as numerous as or more numerous than men. On the other hand, the V-shaped gender wage gap incite women to go further in education because they receive wages significantly lower than those of men for the lowest skills, but they are also less incited than men to reach the highest level because the marginal gain linked to the *Grandes écoles* relative to the University 2nd and 3rd cycles is

[22] 1 = Primary not completed; 2 = Primary completed; 3 = Secondary 1st cycle; 4 = Secondary 2nd cycle; 5 = Baccalauréat; 6 = University 1st cycle; 7 = Medical & social studies (below doctor level); 8 = Vocational tertiary; 9 = University 2nd & 3rd cycles; 10 = *Grandes écoles*.

[23] Remember that we retain the sole full time wage earners. A determinant of the gender wage gap is the fact that women have more often part-time jobs than men.

substantially lower for them (e.g., in 2003, this marginal gain is of 0.04 points for women against 0.35 points for men).

6.2. Education function and Intergenerational education mobility

Tables 3-5 depict the results of the education function estimations for the individuals surveyed in 1993 and 2003, as well as the decomposition of the family impact between the intra-family human capital transfers and the father's income. Table 3 firstly exhibits these results for the overall sample, i.e., without distinguishing between genders. Table 4 reports the results for men with two measures of human capital, the first (case 1) utilising the values $\hat{a}' = \{\hat{a}_1, \hat{a}_2, ..., \hat{a}_{10}\}$ corresponding to the overall sample and the second (case 2) to the male-related vector $\hat{a}'$. Finally, Table 5 reports the results for women in the two similar cases, i.e., with vector $\hat{a}'$ corresponding to the overall sample (case 1) and to the female sample (case 2). All the variables display the right sign and are significant at the 1% level.

The following results are common to all estimations:

1) The total impact of the father's education (sum of the direct impact *via* human capital transfers and the indirect impact *via* the father's income) has significantly increased during the period in all cases. The related coefficient α_H moves from 0.38 up to 0.48 for the overall sample (using the overall vector $\hat{a}$), from 0.42 up to 0.54 for the men sample (using the male-related $\hat{a}$) and from 0.35 to 0.39 for women (using the female-related $\hat{a}$).

2) The intra-family human capital transfer coefficient, α_{IF}, accounts for between 73 and 85 per cent of the total father's impact coefficient, α_H, according to the year, the gender and the estimation. This however shows that the impact of the family income is far from negligible, especially as this impact increases with time.

3) Both the intra-family human capital transfer (α_{IF}) and the father's income effect (α_Ω) contribute to the increase in α_H. However, the weight of the father's income (α_Ω) within the total effect (α_H) has risen in all cases (from 19 to 24 per cent for the overall sample, from 21.5 to 27 per cent for male, and from 14 to 17 per cent for female), which indicates that the increase in the impact of the family income is the main driver of the increase in the influence of family backgrounds.

Table 3: Education functions, overall sample (OLS with White's correction)

Variables	Skill of the individual 1993 Coefficient	1993 Stand. err	2003 Coefficient	2003 Stand. err
Father's Education	0.383***	(0.012)	0.479***	(0.016)
Father's income	0.073***	(0.009)	0.116***	(0.008)
Public education expenditure	0.732***	(0.014)	0.758***	(0.012)
constant	0.864***	(0.010)	0.832***	(0.007)
R^2	0.35		0.34	
Number of observations	6973		7683	

Family impact Decomposition	1993	2003
Direct impact of father's education (intra-family transfer)	0.310	0.363
Impact of father's income	0.073	0.116
Total father's influence	0.383	0.479

Table 4: Education functions, Male sample (OLS with White's correction)

Explained variable	Individual's education			
	Case 1 (overall $\hat{a}'$)		Case 2 (male-related $\hat{a}'$)	
Variables	1993	2003	1993	2003
Father's Education $h_{i,t-1}$	0.419***	0.530***	0.424***	0.544***
	(0.017)	(0.023)	(0.017)	(0.023)
Father's income	0.087***	0.142***	0.091***	0.147***
	(0.013)	(0.012)	(0.013)	(0.012)
Public education expenditure	0.683***	0.749***	0.680***	0.749***
	(0.018)	(0.016)	(0.018)	(0.017)
constant	0.813***	0.827***	0.805***	0.823***
	(0.012)	(0.009)	(0.012)	(0.009)
R^2	0.34	0.33	0.34	0.34
Number of observations	4205	4579	4205	4579
Family impact decomposition				
Intra-family education transfers	0.332	0.388	0.333	0.397
Impact of father's income	0.087	0.142	0.091	0.147
Total father's influence	0.419	0.530	0.424	0.544

Table 5: Education functions, Female sample (OLS with White's correction)

Explained variable	Individual's education			
	Case 1 (overall $\hat{a}'$)		Case 2 (female-related $\hat{a}'$)	
Variables	1993	2003	1993	2003
Father's Education $h_{i,t-1}$	0.332***	0.406***	0.350***	0.394***
	(0.018)	(0.021)	(0.019)	(0.021)
Father's income	0.056***	0.078***	0.049***	0.068***
	(0.013)	(0.012)	(0.013)	(0.011)
Public education expenditure	0.790***	0.761***	0.761***	0.706***
	(0.022)	(0.016)	(0.021)	(0.018)
constant	0.887***	0.841***	0.879***	0.819***
	(0.013)	(0.011)	(0.012)	(0.012)
R^2	0.37	0.35	0.36	0.34
Number of observations	2768	3104	2768	3104
Family impact decomposition				
Intra-family education transfers	0.276	0.328	0.301	0.326
Impact of father's income	0.056	0.078	0.049	0.068
Total father's influence	0.332	0.406	0.350	0.394

The growing impact of family income upon children educational attainment can be linked to the huge increase in both the weight of private schools and the weight of costly private support in children education in France in the last decades.

The estimations also show a major difference when comparing both genders.[24] The influence of the father's human capital upon her/his children's human capital is significantly higher for male than for female. This diagnosis holds for the total impact as well as for its two components, the intra-family human capital transfer α_{IF} and the father's income effect α_{Ω}.

With our human capital measurement, the highest impact of intergenerational transfers for male compared to female is logical because, given the differences in the valuations of the different education degrees between men and women (Table 2), daughters are less influenced and impacted than sons by their father's skills when taking their education decision.

In addition, and contrary to what is suggested by Lefranc (2011), we find no indication of a decrease in the advantage of sons compared to daughters in the family's expense for children education. The persistent highest impact of parents' funding on male education could derive from two features. First, male have weaker education results than female on average, which could boost parents' expenses for the former. Second, the proportion of men in the *Grandes écoles* is substantially higher than that of women, while the *Grandes écoles* are far more costly that other studies.

7 Conclusion

We have estimated a two-stage model (i) to measure the wage value of each education degree in France, and (ii) to evaluate the influence of parents' human capital upon the human capital of their children. As regards this second point, we distinguish the two main channels through which the parents influence their children's education, i.e., their income and the intra-family human capital transfers. We measure human capital by its value on the labour market resulting from the estimation of the wage equation implemented at Stage 1.

We show that between 1977 and 2003, France underwent a general decrease in its skill premia due to the critical decline in the relative value of the bac. In addition, the skill premium of all tertiary education levels rose in relation to the level of the bac, but this increase was not sufficient to offset the decline in all skill premia relative to the lowest education level.

[24] The comparison between male and female is based on the calculations using the overall vector $\hat{a}'$.

As regards intergenerational mobility, we find a significant increase in the influence of the family backgrounds, particularly through the impact of family income. Intergenerational mobility has decreased and the impact of parents income on children's education has significantly increased

As regards differences between men and women, our calculations firstly reveal the emergence of a V-shaped gender wage gap according to the education attainment. Men benefit from a substantial premium for the very low and very high degrees, but not in-between. Secondly, the impact of the father's education is significantly higher for sons than for daughters, which is not surprising given the uneven valuations of the different education degrees between men (fathers) and women (daughters).

In conclusion, our main findings can be compared with the variations in inequality observed in France in the last thirty years. The changes in the skill premia linked to the different education degrees confirm the decrease in inequality observed in France since the seventies. However, this decrease in intra-generation inequality has come with a rise in inter-generational inequality persistence, i.e., a decrease in social mobility. This confirms the diagnosis of Lefranc (2011). Finally, gender inequality is still there and it essentially concerns the extremities of the skill spectrum. In France, women are particularly under-paid when they exhibit very low and very high education attainment.

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Appendix A. Educational choice with multi-level education stratification

We develop a theoretical framework in which (i) the two channels through which parents influence their children’s education are the intra-family human capital transfers and income, and (ii) the different stages of the course of study provide different returns in terms of wage.

Human capital and income

Individuals are paid in proportion to their human capital. Denoting *W* the wage per unit of human capital and H_i the amount of human capital possessed by individual *i*, her/his wage W_i is:

$$W_i = W \times H_i \qquad \text{(A1)}$$

The individual’s human capital is fully determined by her/his course of study, which consists of an ordered succession of education cycles such that an individual who wants to enter cycle *k* must have successfully completed all the preceding cycles.

Each cycle provides a specific contribution to the accumulation of human capital. By assuming a continuum of cycles over the interval $\left[0, \bar{k}\right]$, individual *i*’ s human capital is:

$$h_i = \int_0^{k_i} a(k)dk \qquad \text{(A2)}$$

where h_i is the logarithm of individual *i*’ s human capital H_i, and k_i the highest education cycle completed by this individual.

Coefficient $a(k)$ measures the contribution of the k-th cycle to the human capital accumulated by the individual. We assume $a(0)=0$, which indicates that an individual cannot have a human capital lower than 1.

By combining equations (1) and (2) we obtain:

$$W_i = W \times \exp\left[\int_0^{k_i} a(k)dk\right] \tag{A3}$$

Education

There is a continuum of possible skills over the interval $\left[1, \bar{H}\right]$ with $\bar{H} = \exp\left[\int_0^{\bar{k}} a(k)dk\right]$.

The human capital that individual i can acquire depends (i) on her/his effort E_i in studying, (ii) on her/his parents' income $R_{i,-1}$ which measures the family's financial contribution to her/his education (subscript -1 denotes the preceding generation), (iii) on her/his parents human capital $H_{i,-1}$ through intra-family human capital transfers, and (iv) on the public expenditure for education from which s/he benefits. The amount of public educational services G_i received by individual i depends on her/his course of study, i.e., on the efficiency of the public expenditure allowed for each of the successive cycles completed by the individual, and thus on the level of human capital H_i s/he acquires at the end of her/his schooling time. Hence: $G_i = G(H_i)$. The education function, assumed to be log-linear, can thus be written:

$$H_i = AE_i^{\gamma_0} H_{i,-1}^{\gamma_1} R_{i,-1}^{\gamma_2} \left(G(H_i)\right)^{\gamma_3} \tag{A4}$$

The expression $A\left(G(H_i)\right)^{\gamma_3}$ depicts the efficiency of public education in all the cycles followed by the individual during her/his course of study. Relation (A4) can be expressed as:

$$E_i = A^{-1/\gamma_0} H_{i,-1}^{-\gamma_1/\gamma_0} R_{i,-1}^{-\gamma_2/\gamma_0} \left(G(H_i)\right)^{-\gamma_3/\gamma_0} H_i^{1/\gamma_0} \tag{A5}$$

Educational choice

The individual's utility depends positively on her/his future income that is directly linked to her/his human capital H_i, and negatively on her/his education effort E_i.

We assume the following simple utility function:

$$u_i = \left(WH_i\right)^{\alpha} - \delta E_i^{\beta}, \qquad 0 < \alpha \leq 1, \;\; \beta \geq 1 \tag{A6}$$

The utility function (A6) is rather general. It stipulates that utility depends (i) positively on income WH_i with the marginal utility of income decreasing or constant, and (ii) negatively on the studying effort E_i with the marginal disutility of effort increasing or constant. Coefficient δ depicts the effort aversion that is assumed identical across individuals.

The individual maximises her/his utility subject to the inverted education function (A5).

Proposition: *The optimal human capital of the individual is:*

$$H_i = CW^{\frac{\alpha\gamma_0}{\beta-\alpha\gamma_0}} H_{i,-1}^{\frac{\beta\gamma_1}{\beta-\alpha\gamma_0}} R_{i,-1}^{\frac{\beta\gamma_2}{\beta-\alpha\gamma_0}} G_i^{\frac{\beta\gamma_3}{\beta-\alpha\gamma_0}} \tag{A7}$$

where $G_i = G(H_i)$, $C = \left(\dfrac{\alpha\gamma_0 A^{\beta/\gamma_0}}{\beta\delta\left(1+\gamma_3\varepsilon_{G/H}\right)}\right)^{\frac{\gamma_0}{\beta-\alpha\gamma_0}}$, and $\varepsilon_{G/H} = \dfrac{\partial G / G}{\partial H_i / H_i}$ is the elasticity of $G(H_i)$ in relation to the human capital level. We assume that this elasticity is constant and lower than 1.

Proof: $u_i = \left(WH_i\right)^{\alpha} - \delta E_i^{\beta} = \left(WH_i\right)^{\alpha} - \delta A^{-\beta/\gamma_0}\left(G(H_i)\right)^{-\beta\gamma_3/\gamma_0} H_{i,-1}^{-\beta\gamma_1/\gamma_0} R_{i,-1}^{-\beta\gamma_2/\gamma_0} H_i^{\beta/\gamma_0}$.

$$\frac{\partial u_i}{\partial H_i} = \alpha W^{\alpha} H_i^{\alpha-1} - \delta\frac{\beta}{\gamma_0} A^{-\beta/\gamma_0} H_{i,-1}^{-\beta\frac{\gamma_1}{\gamma_0}} R_{i,-1}^{-\beta\frac{\gamma_2}{\gamma_0}} G_i^{-\beta\frac{\gamma_3}{\gamma_0}} H_i^{\frac{\beta}{\gamma_0}-1} + \delta\frac{\beta\gamma_3}{\gamma_0} A^{-\beta/\gamma_0} H_{i,-1}^{-\beta\frac{\gamma_1}{\gamma_0}} R_{i,-1}^{-\frac{\gamma_2}{\gamma_0}} G_i^{-\frac{\beta\gamma_3}{\gamma_0}-1} G'_{H_i} H_i^{\frac{\beta}{\gamma_0}} = 0$$

Multiplying this expression by $\dfrac{\gamma_0}{\beta\delta} A^{\beta/\gamma_0} H_i H_{i,-1}^{\beta\gamma_1/\gamma_0} R_{i,-1}^{\beta\gamma_2/\gamma_0}$ yields:

$$\frac{\alpha\gamma_0}{\beta\delta} A^{\beta/\gamma_0} W^{\alpha} H_i^{\alpha} H_{i,-1}^{\beta\frac{\gamma_1}{\gamma_0}} R_{i,-1}^{\beta\frac{\gamma_2}{\gamma_0}} - G_i^{-\beta\frac{\gamma_3}{\gamma_0}} H_i^{\frac{\beta}{\gamma_0}}\left(1+\gamma_3\varepsilon_{G/H}\right) = 0, \text{ with } \varepsilon_{G/H} = \frac{\partial G / G}{\partial H / H}$$

And finally: $H_i = CW^{\frac{\alpha\gamma_0}{\beta-\alpha\gamma_0}} H_{i,-1}^{\frac{\beta\gamma_1}{\beta-\alpha\gamma_0}} R_{i,-1}^{\frac{\beta\gamma_2}{\beta-\alpha\gamma_0}} G_i^{\frac{\beta\gamma_3}{\beta-\alpha\gamma_0}}$, with $C = \left(\dfrac{\alpha\gamma_0 A^{\beta/\gamma_0}}{\beta\delta\left(1+\gamma_3\varepsilon_{G/H}\right)}\right)^{\frac{\gamma_0}{\beta-\alpha\gamma_0}}$.

From the theoretical mode constructed above, the impact of the parents' skill upon the children's skill can be estimated in two stages:

1) Estimating Relation (A3) makes it possible to determine the wage value of the human capital of each educational cycle and thus of each individual.

2) Once calculated this human capital value, estimating (A7) provides (i) the impact of the parents' human capital upon the children's human capital and (ii) the division of this impact between two components, one linked to the parents' income and the other to intra-family externalities.

Appendix B. *Table A1*: Descriptive statistics (1985 and 1993)

	1985			1993		
	Overall	*Men*	*Women*	*Overall*	*Men*	*Women*
The education levels (%)						
1.Primary education not completed	17,77	20,08	13,52	18,96	21,5	14,98
2.Primary education completed	17,81	17,78	17,88	12,15	11,6	13,01
3.Secondary education 1st cycle	35,24	36,07	33,72	38,08	40,21	34,73
4.Secondary education cycle 2	3,63	3,74	3,43	2,28	2,63	1,73
5.Baccalaureate	9,35	7,93	11,96	11,94	9,51	15,75
6.University 1st cycle (2 years)	2,75	2,05	4,04	2,40	1,69	3,52
7.Vocational tertiary (BTS, DUT)	3,28	3,39	3,08	4,66	4,49	4,92
8. Medical & social lower than doctor	1,34	0,14	3,54	1,59	0,23	3,73
9.University cycles 2 or 3	5,96	4,92	7,86	5,56	4,79	6,76
10.*Grandes écoles*	2,87	3,9	0,96	2,38	3,35	0,87
Others variables						
Age (years)	37,39	37,88	36,49	39	39,39	38,39
Monthly wage (current Francs)	7011	7573	5968	8999	9788	7763
Experience (years at work)	18,82	19,72	17,17	19,79	20,49	18,69
Number of observations	**21091**	**13660**	**7431**	**8604**	**5252**	**3352**

Appendix C. *Table A2*: Average wage (current Franc) for each professional occupation

Professional occupations (6 categories)	**Average monthly wage** 1977	1985
1. Farmers	1906	6158
2. Artisans	4071	11587
3. Executives	5977	12794
4. Intermediate occupations	3476	7644
5. Employees	2320	5274
6. Workers	2206	5027

Appendix D. *Table A3*: Estimation of the Wage Equation (3 samples)

Overall Sample	1977		1985		1993		2003	
OUTCOME EQ.: LOG OF MONTHLY WAGE	*Coef*	*Std.Err*	*Coef*	*Std.Err*	*Coef*	*Std.Err*	*Coef*	*Std.Err*
Gender								
Female	Ref		Ref		Ref		Ref	
Male	0.240***	(0.006)	0.159***	(0.006)	0.230***	(0.011)	0.113***	(0.015)
Experience								
Number of years at work	0.038***	(0.000)	0.035***	(0.000)	0.032***	(0.001)	0.026***	(0.002)
Obsolescence								
(Number of years)^2	-0.0005***	(0.000)	-0.0004***	(0.00001)	-0.0004***	(0.00003)	-0.0003***	(0.00005)
Skill level								
Primary educ. not completed (lowest skill)	Ref		Ref		Ref		Ref	
Primary education completed	**0.139*****	(0.006)	**0.103*****	(0.007)	**0.043*****	(0.014)	**0.072****	(0.028)
Secondary education 1st cycle	**0.177*****	(0.006)	**0.150*****	(0.007)	**0.161*****	(0.013)	**0.120*****	(0.027)
Secondary education cycle 2	**0.184*****	(0.013)	**0.153*****	(0.015)	**0.086****	(0.035)	**0.088****	(0.035)
Baccalaureate	**0.108*****	(0.015)	**0.073*****	(0.016)	**0.119*****	(0.039)	**0.082****	(0.037)
University 1st cycle (2 years)	**0.062*****	(0.013)	**0.048*****	(0.013)	**0.057****	(0.024)	**0.103****	(0.044)
Vocational tertiary (BTS, DUT)	**0.137*****	(0.019)	**0.156*****	(0.015)	**0.162*****	(0.022)	**0.185*****	(0.025)
Medical and social degree below doctor	**0.049****	(0.019)	**0.104*****	(0.021)	**0.172*****	(0.024)	**0.180*****	(0.035)
University cycles 2 or 3	**0.280*****	(0.017)	**0.307*****	(0.015)	**0.319*****	(0.027)	**0.282*****	(0.044)
Grandes écoles	**0.534*****	(0.017)	**0.578*****	(0.016)	**0.640*****	(0.028)	**0.543*****	(0.064)
Constant	6.866***	(0.016)	7.842***	(0.015)	8.077***	(0.031)	6.798***	(0.044)
Number of observations	23369		21091		8604		10660	

Men Sample	**1977**		**1985**		**1993**		**2003**	
OUTCOME EQ.: LOG OF MONTHLY WAGE	*Coef*	*Std.Err*	*Coef*	*Std.Err*	*Coef*	*Std.Err*	*Coef*	*Std.Err*
Experience								
Number of years at work	0.040***	(0.001)	0.035***	(0.001)	0.036***	(0.002)	0.023***	(0.003)
Obsolescence								
(Number of years)^2	-0.0006***	(0.00002)	-0.0004***	(0.00002)	-0.0005***	(0.00004)	-0.0003***	(0.00006)
Skill level								
Primary educ. not completed (lowest skill)	Ref		Ref		Ref		Ref	
Primary education completed	**0.154*** **	(0.008)	**0.113*** **	(0.009)	**0.035** **	(0.017)	**0.080** **	(0.036)
Secondary education 1st cycle	**0.160*** **	(0.008)	**0.131*** **	(0.009)	**0.146*** **	(0.016)	**0.097*** **	(0.035)
Secondary education cycle 2	**0.193*** **	(0.015)	**0.166*** **	(0.019)	**0.050** **	(0.023)	**0.063** **	(0.029)
Baccalaureate	**0.110*** **	(0.019)	**0.078*** **	(0.022)	**0.172*** **	(0.031)	**0.074** **	(0.036)
University 1st cycle (2 years)	**0.015** **	(0.007)	**0.009* **	(0.005)	**0.041*** **	(0.008)	**0.044*** **	(0.011)
Vocational tertiary (BTS, DUT)	**0.146*** **	(0.024)	**0.166*** **	(0.020)	**0.161*** **	(0.032)	**0.189*** **	(0.032)
Medical and social degree below doctor	**0.079** **	(0.011)	**0.018* **	(0.010)	**0.011* **	(0.006)	**0.141*** **	(0.013)
University cycles 2 or 3	**0.289*** **	(0.023)	**0.342*** **	(0.023)	**0.313*** **	(0.039)	**0.332*** **	(0.061)
Grandes écoles	**0.525*** **	(0.020)	**0.563*** **	(0.020)	**0.626*** **	(0.034)	**0.538*** **	(0.065)
Constant	7.035***	(0.018)	7.964***	(0.019)	8.234***	(0.038)	6.800***	(0.054)
Number of observations	15387		13660		5252		6268	

Women Sample	**1977**		**1985**		**1993**		**2003**	
OUTCOME EQ.: LOG OF MONTHLY WAGE	*Coef*	*Std.Err*	*Coef*	*Std.Err*	*Coef*	*Std.Err*	*Coef*	*Std.Err*
Experience								
Number of years at work	0.035***	(0.001)	0.035***	(0.001)	0.027***	(0.002)	0.027***	(0.003)
Obsolescence								
(Number of years)^2	-0.0005***	(0.00003)	-0.0005***	(0.00003)	-0.0004***	(0.00005)	-0.0004***	(0.00008)
Skill level								
Primary educ. not completed (lowest skill)	Ref		Ref		Ref		Ref	
Primary education completed	**0.106*** **	(0.012)	**0.073*** **	(0.014)	**0.058** **	(0.024)	**0.053**	(0.048)
Secondary education 1st cycle	**0.201*** **	(0.011)	**0.172*** **	(0.012)	**0.171*** **	(0.023)	**0.151*** **	(0.043)
Secondary education cycle 2	**0.166*** **	(0.026)	**0.116*** **	(0.021)	**0.184*** **	(0.058)	**0.148*** **	(0.046)
Baccalaureate	**0.087*** **	(0.028)	**0.071*** **	(0.023)	**0.013* **	(0.008)	**0.056*** **	(0.019)
University 1st cycle (2 years)	**0.114*** **	(0.017)	**0.084*** **	(0.016)	**0.069** **	(0.034)	**0.224*** **	(0.061)
Vocational tertiary (BTS, DUT)	**0.132*** **	(0.029)	**0.149*** **	(0.021)	**0.149*** **	(0.028)	**0.182*** **	(0.038)
Medical and social degree below doctor	**0.071*** **	(0.022)	**0.109*** **	(0.023)	**0.193*** **	(0.025)	**0.202*** **	(0.047)
University cycles 2 or 3	**0.310*** **	(0.025)	**0.276*** **	(0.019)	**0.328*** **	(0.038)	**0.141** **	(0.064)
Grandes écoles	**0.478*** **	(0.055)	**0.574*** **	(0.037)	**0.642*** **	(0.059)	**0.384*** **	(0.101)
Constant	6.986***	(0.034)	7.925***	(0.025)	8.336***	(0.044)	6.686***	(0.071)
Number of observations	7982		7431		3352		4392	

Appendix E. *Table A4*: Skill Premia (SP1 and SP2) in 1985 and 1993

Sample	Overall				Male				Female			
Year	1985		1993		1985		1993		1985		1993	
Skill level	SP1	SP2	SP1	SP2	SP1	SP2	SP1	SP2	SP1	SP2	SP1	SP2
Primary not completed	1	.	1	.	1	.	1	.	1	.	1	.
Primary completed	1.10		1.04	.	1.12		1.03	.	1.07		1.05	.
Secondary 1st cycle	1.28	.	1.22	.	1.27	.	1.19	.	1.27	.	1.25	.
Secondary 2nd cycle	1.50	.	1.33	.	1.50	.	1.26	.	1.43	.	1.51	.
Baccalaureate	1.61	1	1.50	1	1.63	1	1.49	1	1.54	1	1.53	1
University 1st cycle	1.69	1.05	1.59	1.05	1.64	1.00	1.55	1.04	1.67	1.08	1.64	1.07
Vocational tertiary	1.90	1.17	1.77	1.17	1.92	1.18	1.75	1.17	1.78	1.16	1.77	1.16
Medical & social studies	1.79	1.11	1.78	1.18	1.65	1.01	1.51	1.01	1.71	1.11	1.85	1.21
University 2nd & 3rd cycles	2.30	1.42	2.19	1.45	2.31	1.01	2.13	1.42	2.20	1.43	2.27	1.48
Grandes écoles	2.87	1.78	2.85	1.89	2.86	1.75	2.79	1.87	2.73	1.77	2.90	1.90