Returns to Human Capital: A Review of the French Empirical Literature

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1. Introduction

Since Becker (1964), economists agree upon the idea that the more individuals invest in human capital, the more they acquire skills and the higher their earnings are. This quantitative aspect is, however, not sufficient to understand the relationship between human capital and earnings. Human capital has components that differ in nature. Not only should one distinguish the skills that are of value for any employer from those that are of value for a single employer, but also those acquired before entering the labour market from those that are naturally enhanced through experience.

Individuals who decide to attend extra years in school beyond compulsory schooling must find it preferable to delay their entry to the labour market and to acquire general human capital by raising their education level. Theoretically, an individual who seeks to maximise lifetime net income, will undertake the investment if it leads to a positive net present value and/or if the internal rate of return is greater than the market real interest rate (see Filer, Hammermesh and Rees, 1996).

From an empirical point of view, it is also reasonable to argue that for the criteria of net present value or internal rate of return to be satisfied, it is necessary that the age-earnings profiles are higher for workers with more education throughout their working lives.

A very popular way to compare age-earnings profiles for individuals with different education levels consists in estimating Mincer-type equations (Mincer, 1974). The popularity of such an approach resides in its simplicity and in the existence of compatible data. Moreover, it is very flexible as it enables one to directly estimate the average wage differentials between individuals with different education levels or simply the returns to an extra-year of schooling.

To estimate the returns to human capital, economists very often use cross-section data, that is, a synthetic cohort composed of workers of different ages observed in the same year. It might however be misleading to compare the earnings of people with possibly very different attitudes in the labour market. Of course, it is always possible to restrict the analysis to samples where individuals can be considered as reasonably homogeneous.[1] This, however, is not sufficient since comparing the earnings of people born before world war II to those of people who entered the labour market in the nineties might also be misleading. This makes the use of panel data preferable as it allows a longitudinal approach to the relationship between human capital and earnings.

There remain nonetheless a number of reasons why the returns to human capital estimated via the use of a Mincer-type equation might be biased. Indeed, very often this approach neglects non-wage returns, such as the better working conditions under which highly educated workers generally do their jobs (Lucas, 1977). It also neglects the loss in workers' welfare, due to the higher price of leisure induced by the positive relationship between investment in human capital and wages (Lindsay, 1971).

A possibly more serious source of bias emerges from the lack of a precise measure of individuals' ability. Ability biases have given rise to a number of studies addressing the question of whether the factors that make individuals more likely to reach high education levels would yield higher earnings even if they had stopped their education at earlier stages. If such a hypothesis holds, then the estimates of the returns to education would be biased upward as long as they ignore the reason why some individuals reach high education levels while others do not (Card, 1998).

Intrinsic individual ability is not the only determinant of individuals' education level, however. Social status and family background are also possible and perhaps more easily measurable candidates. This means that education can no longer be treated as a simple exogenous variable if endogeneity biases are to be avoided.

It is worth noticing that most of the recent empirical literature reports attempts to overcome these various sources of bias in estimating the returns to human capital. One of the reasons why it is important to precisely measure the private returns to education is that they can be compared to the social returns that include both private and public costs and benefits of education. Indeed, the more the higher earnings of more educated people result from education increasing their productivity, the more the society or the government representing it will be induced to devote more resources to education,

[1] This is the reason why so many analyses focus only on year-round, full-time male workers.

ceteris paribus. If on the contrary the estimated private returns do not reflect an increase in productivity, then it is likely that the social returns are less than the private ones (Polachek and Siebert, 1993). Thus, once the private returns are estimated, there remains the problem of the accuracy of their interpretation in terms of productivity.

Indeed, alternative explanations exist. The old-school-tie hypothesis argues that successful applicants are selected by previous graduates of similar schools on the basis of loyalty and friendship rather than on performance. A perhaps more relevant explanation is that underlying the so-called screening hypothesis. The idea here is that diplomas may be a way of demonstrating to employers that the graduates have attractive characteristics and ability to perform well on the job. In a variant of the screening hypothesis, it is argued that if the decision of investing in education is affected by employers' willingness to offer higher wages to highly educated individuals, then education functions as a signal to employers of the applicants' ability (see Spence, 1974).

If the returns to education reflect productivity, then there must be no significant bonus returns for being successful in obtaining a diploma as it is difficult to argue that such a bonus reflects higher accumulation of human capital. Evidence reports, however, that such bonuses do exist. Called sheepskin effects, they probably reflect personal attributes valued by employers, such as the determination needed to finish tasks, rather than the greater human capital of the graduates compared with the one of the dropouts (Kane and Rouse, 1995). To analyse sheepskin effects, it is necessary that individuals are distinguished not only according to the number of years of schooling, but also with respect to the diplomas they hold. Another reason why the distinction between diplomas is important is that the number of years of schooling is a rather crude measure of human capital in countries like France and Germany where there are multiple education streams (e.g. vocational s. general education) leading to different returns to education.

Summing up, returns to human capital are neither easy to estimate nor clearly interpretable. This explains the effort made by researchers in order to shed light on the various topics discussed above. Our purpose here, is to report the answers that are suggested by analyses of the French labour market.

The paper is organised as follows: Section 2 gives a brief description of the data sets on which the empirical analyses are based. Section 3 reports the attempts that have been made to evaluate the importance of the various sources of bias and/or to interpret the estimated returns. Section 4 summarises analyses comparing the earnings of individuals with different endowments or characteristics. Section 5 discusses research focusing on either international comparisons or the evolution over time of the returns to human capital. Finally, some concluding remarks are made in section 6.

2. Data

As emphasised by Mincer (1958), theoretical concepts such as learning and earnings imply a longitudinal approach to individuals' income. Nevertheless, analyses of French earnings equations are often driven on the basis of cross-section data, a fact mainly explainable by the scarcity of panel data sets. However, such an approach assumes strong stationarity hypotheses. For this reason, although different cross-sectional data sets are available, most authors interested in the effect of education on earnings have

chosen the surveys called *Formation et Qualifications Professionnelles* (FQP)[2] conducted by INSEE, the French National Statistics Institute, among a sample of households drawn from each population census.[3]

Indeed, these surveys present very interesting characteristics. First, not only are they the richer ones in terms of initial as well as post-schooling education and their professional outcomes, but they also contain very detailed information about individuals[4] and their household characteristics and cover the public as well as the private sectors. Secondly, they contain very interesting biographical variables such as the individual's characteristics as well as his job description five years earlier. Finally, though not concerned with the same individuals, the 5 FQP data sets that are available (1963, 1970, 1977, 1985, 1993) imply that the same information about the French labour market can be observed for many points in time. Though it is not possible to track individuals, some authors use successive waves of the FQP survey in order to highlight the evolution of the observed patterns. Other build pseudo-panel data sets in order to capture cohort effects.

In contrast to the FQP, the other cross-section data sets used in the literature are not directly concerned with education. The *Enquête sur le Coût de la Main-d'Oeuvre et la Structure des Salaires* (ECMOSS)[5] has been conducted by INSEE for the years 1972, 1978, 1986 and 1992. Questionnaires were sent to a sample of establishments in the private non-agricultural sector. Within these establishments random samples of individuals were drawn and their wages and characteristics were described by the employer.[6] Thus, each of the resulting surveys contains two sets of variables. The first is concerned with the production unit (industry and activity, size, region, etc.) while the second describes individual characteristics (nationality, gender, age, occupation and tenure) as well as some labour contract features.[7]

While the 1986 survey covers about 16,200 establishments and some 680,000 employees, that of 1992 concerns around 14,700 production units and 150,000 individuals. The reason why there are fewer individuals is that the 1992 survey focused with fine detail on employer characteristics (manning, turnover, unions activity, labour organisation, product market, etc.). Note, however, that for 1986 there is no information about education while for 1992 detailed description of diplomas is available.

Another interesting data set is that from the fairly recent *Enquête Européenne sur la Structure des Salaires* (EESS)[8] that was conducted in France by INSEE in 1994 and in Germany by the *Statistiches Bundesamt* in 1995. The EESS data cover 9,669,400 West-german workers and 6,648,500 French workers in establishments with more than nine employees from the sectors of industry, commerce, construction and financial services.

The *Enquête Carrière et Mobilité* (ECM)[9], conducted by INSEE for the years 1974, 1981 and 1989, is another data source used in the literature. In the 1989 survey,

[2] Training and Professional Qualifications.
[3] The periodicity of the population census in France is eight years.
[4] Whether they participate or not in the labour force, are employees or self-employed.
[5] Labour Costs and Wages Structure Survey.
[6] The sector of services has been included only after 1972.
[7] Only the 1986 and 1992 ECMOSS surveys are used in the papers discussed in this review.
[8] European Wages Structure Survey.
[9] Careers and Mobility Survey.

individuals born between 1930 and 1959 had to fill in a questionnaire about the characteristics of their first job and of their jobs in March 1960, 1967, 1974, 1981 and 1989.[10]

Compared to the numerous cross-section data sets available in France, panels are rather scarce. In fact, the only panel data sets conducted by INSEE and used in the literature are the so-called *Enquête Emploi* (Emploi)[11], where only a third of the sample is renewed each year, and the *Déclarations Annuelles des Salaires* (DAS)[12], which has been conducted annually since 1967 and covers workers born in October each even year. These workers enter the sample as soon as they get their first job in firms in the private or semi-public sectors so that the sampling rate is about 1/25. It should be noted, however, that while the DAS survey contains a rather rich information on remunerations, it provides no direct measure of human capital.

3. Estimates of returns to education

The results from French labour market data are consistent with the predictions of human capital theory. However, as shown in Table A1 in the appendix, there are significant discrepancies in the estimated coefficients associated with human capital components, especially with respect to the number of years of schooling, the returns to which vary from 4.2 to 19.2% with an approximate average of 8%.[13] Potential explanations of the observed differences reside in the period under consideration, the data the analyses are based on, the adopted methodologies and the individual and/or employer characteristics controlled for. Another explanation is that the various potential sources of bias are not always controlled for. It is therefore important to start our presentation by identifying the studies where effort has been expended to evaluate the importance of such biases.

The first extensive analysis of Mincerian equations in France is provided by Riboud (1978). The author is interested in the interpretation of earnings equations and the empirical problems their estimation leads to. She analyses the role of experience, initial as well as post-school education and household characteristics as wage determinants. However, the perhaps most remarkable feature of Riboud's work is her intuition about the endogeneity of education. She uses the 1963 FQP survey and focuses on French men aged between 13 and 65. Mincer-type earnings equations are first fit by OLS (quadratic function of education and experience), the results of which lead to a discussion of possible explanations of the residuals. Alternative specifications are then estimated including a distinction between secondary education and university and introducing post-school education. When considering family background effects, the author argues that education is endogenous and regresses the number of years of schooling on the education of the individual's father, thus showing that these variables are positively correlated. As a second step, however, she merely includes in the earnings function the father's education and obtains lower returns to education.

[10] Only the 1989 ECM survey is used in the literature discussed below.
[11] Employment Survey.
[12] Annual Declarations of Wages.
[13] Except where the schooling variable is standardised as is the case in Goux & Maurin's (1994) study which we will discuss later.

A satisfactory approach to the endogeneity problem using French data was given only fifteen years later by Boumahdi & Plassard (1992). Their analysis is based on the 1985 FQP survey from which a sample of male employees aged between 16 and 65 was drawn. A Hausman test is performed to examine the relevance of the exogeneity hypothesis. In fact, the test consists in comparing the results from an earnings equation fit by OLS to those obtained when running the same equation using two-stage least squares techniques , the instruments being the parents' education. Compared to the 8.7% OLS estimate, instrumental variables result in a return to education of 11.3%.

Guillotin & Sevestre (1994) also use Instrumental Variables methods (IV), but contrary to Boumahdi & Plassard (1992), their analysis is based on panel data. They use, however, the DAS surveys where no human capital variables are available. To remedy this lack of information, they focus only on individuals entering the survey. They define the entrant year *t* according to whether the individual was absent from the data before *t*, but present in years *t*, *t*+1, *t*+2 and was aged less than 30 in year *t*. As individuals enter the survey the same year as they get their first job, the authors calculate education as the difference between the age of entry into the sample and 14 years.[14] Experience, on the other hand, is calculated as the difference between the current date and the date of entry into the sample. The result is an unbalanced panel data set covering the period 1968-1987.

An interesting feature of Guillotin & Sevestre's (1994) approach is their willingness to report estimates of returns to education, which would have been impossible had they chosen Within estimates.[15] Thus, the authors compare results from OLS, Feasible Generalised Least Squares (FGLS) as well as IV methods to overcome the problem of education endogeneity.[16] The authors also claim that the use of a balanced data set might lead to a loss of sample representativity and thus compare estimates based on balanced and unbalanced data sets.[17] Note also that the authors attempt to correct for selectivity bias due to possible non-representativity of the whole sample.[18]

The results obtained by Guillotin & Sevestre (1994) show that the returns to education are underestimated when using OLS or FGLS; between 3.8 and 4.2% with a balanced data set and around 5% with an unbalanced one. Correcting for education endogeneity results in estimates between 7.5 and 14%. The returns are even higher when controlling for selectivity bias (between 7.3 and 16.3%).

[14] The age of compulsory schooling until 1959. Astonishingly, the authors consider this value though their sample includes individuals for whom the age of compulsory schooling was 16.

[15] Within estimates eliminate variables that are constant over time (e.g. education).

[16] The IV methods proposed by Hausman & Taylor (1981) or Breusch, Mizon & Schmidt (1989) are then more appropriate.

[17] Tests for the presence of a balance bias is performed using the Nijman & Verbeek (1992) method, which is an extension of the Hausman test.

[18] Arguing that the 2-step Heckman's procedure (inverse of Mills' ratio) is too heavy to implement when using panel data, the authors use instead the Nijman & Verbeek (1992) method which consists in adding dummy variables describing the status of individuals in the sample. These variables take the value of 1 if the individual is present during the whole period covered by the sample and/or 1 at time *t* if the individual was present at time *t*-1. An alternative method consists in using the number of times the individual is present in the sample as an additional variable.

It is worth noting that there is no agreement in the studies discussed so far about a unique measure of returns to education. However, they all come to the conclusion that assuming education as exogenous results in returns to education that are biased downward.

Though not directly interested in earnings, other French studies analyse the effect of family characteristics on individuals' professional career. As an example, Goux & Maurin (1997a,b) investigate the propensity of individuals to reproduce their parents' social status. Such an effect is then compared to that of education as a determinant of individuals' own social status. On the basis of a sample of males aged between 25 and 64 from the 1977, 1985 and 1993 FQP surveys, Goux & Maurin (1997a) show that for a given education level, individuals have a tendency to reproduce their parents' social status. Moreover, along their professional career the effect of education levels on their own social status decreases while the effect of their family social status becomes more and more dominant. In another study, Goux & Maurin (1997b) exhibit that though diplomas become more necessary for individuals to get employed, they are less sufficient to access the same social status as older generations, while the link between individuals' diplomas and those of their parents' becomes stronger than in the past.

Another interesting feature of Guillotin & Sevestre's (1994) study is that they conclude to the existence of individual fixed effects and to the rejection of the independence hypothesis between these and observables. Obviously, their approach is interesting as it underlines the importance of individual heterogeneity even though its potential sources cannot be identified since unobservables may include intrinsic ability as well as social origin or any unmeasured characteristic.

The same conclusion is shared by Goux & Maurin (1994). In order to analyse the experience-wage relationship they use a sub-sample of male full-time workers drawn from the Emploi surveys for the years 1990 to 1994. Like Guillotin & Sevestre (1994), they show that not only individual fixed effects have an impact on wages, but they condition the influence of observables on wages. However, as Goux & Maurin (1994) report Within estimates[19], fixed effects include the role of education. Hence, part of the correlation between fixed effects and observables might be due to a correlation between education and observables such as experience.

To our knowledge, no further efforts have been made in the French empirical literature to overcome the problem of individuals' heterogeneity and the various biases it might lead to. Instead, some of the researches address the question of how to interpret the resulting estimates of the returns to education.

Jarousse & Mingat (1986) address the question of whether the returns to education reflect performance or only a filter useful to employers. In order to compare the explanatory power of these two hypotheses, the authors estimate an earnings equation where the education variable is standardised in such a way that it reflects the number of years which would have been necessary to an individual from a given generation to obtain his degree. Their idea is that the latter measure eliminates the number of repeats

[19] The authors also address the question of how the estimated returns to education would vary if the rise in unemployment during the period under consideration was taken into account. This is made through the correction for selectivity bias using the inverse of Mills' ratio. Thus, the endogenous variable in the probit equation says whether the individual is employed or unemployed.

as well as the number of years spent at school without leading to a higher degree. Indeed, the number of repeats may be considered, at least on average, as an ability measure and thus might lead to a negative effect on wages. Non-graduating years, on the other hand, enhance the individual's knowledge but might be less remunerated if sheepskin effects do exist.

Jarousse & Mingat's (1986) analysis is based on samples of French men, drawn from the 1970 and 1977 FQP surveys. Their empirical analysis starts with an OLS estimation of a quadratic function of the number of years of schooling and experience separately for the years 1970 and 1977. Jarousse & Mingat (1986) suggest that simply considering the number of years of schooling results in an overestimation of the returns to education of 2 percentage points.

With more or less the same idea in mind, Goux & Maurin (1994) use a sample of male full-time employees aged between 20 and 64 from the 1993 FQP survey. They consider the average number of years necessary to obtain a diploma, but the OLS coefficient associated with this variable seems to be higher than that associated with the number of years of schooling. Note, however, that the "normal" schooling variable they consider is different from the standardised version of Jarousse & Mingat (1986). Moreover, the two studies do not consider the same period nor do they estimate the same specification. Furthermore, in a different specification, the authors also include the number of repeats as well as the number of non-graduating years as explanatory variables. This allows them to show that non-graduating years result in a rate of return of 3.2% per year while graduating years are about three times more remunerated, thus suggesting the existence of sheepskin effects.

4. Differences across worker groups

All discussion so far has concerned analyses of more or less homogeneous groups of individuals. We should now address the question of how the returns to human capital vary if we consider different groups of workers. This section focuses on three important dimensions: occupational levels, gender and employer characteristics.

Age-earnings profiles of individuals with the same occupational level (labourers, clerks, foremen, white collars) are examined by Lhéritier (1992) on the basis of a cross-section and by Lollivier & Payen (1990) who use panel data. Note, however, that no education variable is available in these two studies.

Actually, the first attempt to estimate earnings equations using longitudinal data for France was made by Lollivier & Payen (1990) who used a sub-sample of males aged between 20 and 65 drawn from the DAS surveys for 1967-1982. However, insofar as no human capital variable is available, the data did not enable the authors to measure the effects of initial education or even experience and tenure on wages. This is the reason why the only explanatory variables considered are age and occupations. Hence, the analysis focuses on comparing estimated age-earnings profiles for different occupations and for different generations of workers. The results are obtained from the estimation and identification of two equations. In the first one, variables are means, by generation. In the second one, individual variables are expressed in terms of their deviation from their generation average values.

The analysis by Lhéritier (1992) is based on the 1986 ECMOSS survey. The author uses OLS to estimate a series of earnings equations including various sets of individual and employer characteristics and compares the results from different sub-samples.

Both studies confirm the prediction of human capital theory; that is, an increasing and concave age-earnings profile. They also both confirm the stylised fact of a differently shaped age-earnings profile from one professional category to another: it is steeper for white-collar than for blue-collar workers or even intermediate categories.

Another result reported by Lhéritier (1992) is a measure of the gender wage gap per industry and occupation levels. Indeed, he shows that in 1986, there existed a wage differential between men and women[20] comparable from the point of view of their age, tenure, citizenship and employer size. This differential ranged from 4.4% for service employees with low qualifications, working in the sector of services to 39.9% for top managers in the same sector. These figures confirm those obtained in other studies such as Guillotin & Sevestre (1994) (between 6 and 18%) and Plassard & Tahar (1990) (25% for the year 1977).

Still another gender gap analysis is provided by Sofer (1990) who examines the extent to which the male-female differential is related to the depreciation of women's human capital, due to their longer interruptions of activity. For this purpose, she uses the 1977 FQP survey. However, she includes only men and women whose first job started between 1972 and 1977 and those who remained employed in the same firm before 1972. Such a restriction enables the author to reconstitute the entire wage career of all sample individuals or, more precisely, to establish the total length and characteristics of the periods of inactivity and unemployment.

The analysis by Sofer (1990) of gender wage differentials is initially based on the Oaxaca-Blinder decomposition and thus on the comparison of two gender-specific wage equations estimated using OLS. In a second step, she estimates other equations in order to precisely examine the role of experience and time spent unemployed as possible explanations of the observed gender gap. Moreover, different sub-samples are considered, in particular according to the femininisation rate of the individual's occupation. The Oaxaca-Blinder decomposition gives a discrimination effect varying between 0.7 and 9.3% according to whether the rate of femininisation is taken into account or not. These results induce the author to conclude that the observed gender gap is not due to a depreciation of women's human capital, but rather to discrimination. Furthermore, a comparison of the earnings equation estimates highlights the existence of a small but systematic difference in the returns to education.

Another gender based comparison is that provided by Simonnet (1996) who analyses the impact of intra- and inter-firm mobility of men and women on their wage profiles. In particular, she examines the link between the gender gap in wages and in the returns to education. Simonnet (1996) uses the 1989 ECM survey, but focuses on a sub-sample of 30 to 35 years old full-time workers and considers only those whose first job was prior to March 1981 and whose first job or occupation change occurred after March 1974. The OLS estimation results she obtains suggest very appealing conclusions. In particular, she shows that the wage differential between men and women with comparable education levels and experience cannot be explained by gender differentials

[20] Full-time workers aged between 18 and 59 and having worked the whole year.

in the returns to education, by industry or geographical effects. It is, instead, the result of different professional careers and discrimination.

Indeed, it seems that intra-firm mobility of male workers is assimilated to an accumulation of specific human capital and thus results in higher wages than for women. In contrast, inter-firm mobility seems to be favourable to women, not to men. The net effect is, however, favourable to men.

In order to compare the explanatory power of mobility to that of different returns to education as possible determinants of the gender wage differential, Simonnet (1996) considers as additional regressors the number of years of schooling per type of diploma. Her approach is obviously interesting because it also highlights differences in the returns to a supplementary year of schooling depending on the chosen type of education. Moreover, it enables the author to show that the returns to education are not systematically in favour of men; they are higher for women who are technical *Bacheliers* or undergraduates.

Another result obtained by Simonnet (1996) shows that the tenure-wage profiles remain unchanged in nature when including training and/or continuing education indicators. These seem, however, to have a positive effect on wages that is stronger for men than for women except when workers' mobility between the private and the public sector is taken into account.[21]

Simonnet's results may be linked to those obtained by Goux & Maurin (1997c) who try to identify the determinants of continuing education effort and to measure its effect on workers' wages and mobility. The data set used is a sub-sample of the 1993 FQP survey, covering workers aged between 20 and 64 who worked for the same employer between 1988 and 1993. Comparison of OLS and FGLS estimates suggests that continuing education has a positive but small effect on wages.[22]

Moreover, estimation of a probit model allows them to show that continuing education has a negative effect on the probability of workers employed both in 1988 and 1993 to quit their current employer. This effect is even more important for men than for women and for high education levels than for low ones.

The conclusion the authors draw from their work is that continuing education has a stronger effect on job stability than on wages. However, workers do not have equal access to continuing education. It even seems that workers with fragile stability in the labour market are those who have less access to continuing education.

Another result highlighted by Goux & Maurin (1997c) is that continuing education effort increases with employer size. This finding is also to be connected to that obtained by Araï, Ballot & Skalli (1996b), who analyse the effect of employer size on seniority-wage profiles. Using the 1992 ECMOSS survey, they show that for blue-collar workers, the larger the establishment size is, the higher are the returns to seniority in the beginning of the workers' careers and the more rapid is the decrease of these returns to

[21] A positive effect of post-school education emerges also from the results by Riboud (1978) and Plassard & Tahar (1990). These authors make, however, no gender-related comparisons of such an effect.

[22] FGLS estimates are obtained from regressions with employer fixed effect and correction for selection in training programmes.

seniority. For the other categories of employees, they observe the opposite. They then examine the relevance of several hypotheses as explanations of the observed differences in wage profiles. In particular, they consider the hypothesis of specific human capital by evaluating the effect of the firm's expenses in formal vocational training programmes on the size-specific returns to seniority. However, the data seem to suggest that size-related differences in these expenses do not explain the differences observed in seniority-wage profiles.

These considerations suggest that employer characteristics may have non-negligible effects on wages and possibly on the returns to human capital. For instance, Araï, Ballot and Skalli (1996a) and Plassard & Tahar (1990) report evidence on the existence of inter-industry wage differentials.

The analysis by Araï, Ballot & Skalli (1996a) involves the estimation of several earnings functions using OLS including various sets of employer characteristics. As a further step, the authors try to measure the explanatory power of different employer characteristics as possible sources of the observed inter-industry wage differentials.

Also Plassard & Tahar (1990) are mainly interested in inter-industry wage differentials and their possible explanation in terms of efficiency wages. It is, however, to be noted that their analysis is based on the 1977 FQP survey which contains detailed information on schooling and experience, while in Araï, Ballot & Skalli's (1996a) study, only education levels and age are available. Nevertheless, both studies provide evidence pointing to a non-negligible sensitivity of the returns to human capital according to whether industries, occupations and employer characteristics are controlled for or not. For example, the returns to education seem to be very sensitive to the presence of industry dummies as they drop from 9 to 6% in Plassard & Tahar (1990).

5. International comparisons and trends over time.

So far we have neglected, for the sake of simplicity, two important dimensions: national specificities and trends over time. The literature provides some evidence regarding these two aspects.

Kaukewitsch & Rouault (1998) propose a comparison of wage hierarchies in France and Germany while Bell, Elliott and Skalli (1996) compare the returns to age and education in France and the UK. Finally, Araï & Skalli (1996) provide a French-Swedish comparison of the distributions across industries of the returns to several characteristics, including gender, education, age and employer size.

The analysis by Kaukewitsch & Rouault (1998) is based on the *Enquête Européenne sur la Structure des Salaires* (EESS). Though the number of years of schooling is not available, interestingly, these data enabled the authors to construct for each country five dummy variables describing qualification bands, hence overcoming the problem of non-comparability of the French and German education systems.[23]

Another interesting feature in Kaukewitsch & Rouault's (1998) study is the use of the so-called Oaxaca-Blinder decomposition as a means of comparing the country-

[23] Note that education levels were available only for a small sub-sample of workers. Thus the analysis is mainly based on earnings equations including occupation levels rather than education dummies.

specific wage distributions, the ingredients of such a decomposition being earnings equations including individual and employer characteristics estimated using OLS.

Kaukewitsch & Rouault (1998) report that gross average hourly wages are 1.25 times higher in West-Germany than in France. The variance of wages is, however, larger in France. In particular, while French young workers earn less than young West-German workers, the opposite is observed for older workers.[24] Such a difference in age-earnings profiles is also confirmed by higher returns to age in France.

Regarding occupation levels, it seems that, compared to their French colleagues, German labourers enjoy higher wages while white-collar workers earn less. Moreover, though the gender gap is higher in West Germany, partly because the proportion of part-time female workers is larger, West-German women have more access to intermediate occupation levels.

An appealing feature of Kaukewitsch & Rouault's (1998) analysis is the reported difference in the role of education as a wage determinant. Indeed, they show that the number of workers with extremely low and extremely high education levels is higher in France than in West Germany. Moreover, it seems that compared to the French *Baccalauréat*, the German Arbitur is less necessary for accessing intermediate occupation levels. However, at the same time, returns to education levels are on average higher in France.

One characteristic of the Oaxaca-Blinder decomposition is that it completely neglects the role of the residuals from the estimated earnings functions. Thus, individual and/or country-specific unobservable characteristics are not taken into account. This is the idea underlying the UK-France comparison by Bell, Elliott & Skalli (1996) where the Juhn, Murphy and Pierce decomposition is preferred. Assuming that part of the residuals reflects institutional aspects of labour market, the question addressed is respective how the distribution of wages would have looked like if French workers had the individual endowments of the British and if the French labour market institutions were similar to those of Great Britain. To perform such an analysis, the authors use the 1986 and 1992 New Earnings Survey for the UK and the French ECMOSS survey for the same years. Moreover, the estimated earnings equations are fit by OLS and include only age and 5 qualification bands, constructed in such a way that education levels are comparable in terms of the number of years of schooling.[25]

The age-earnings profiles are strikingly different between France and Britain. In France, the earnings of men and women rise steadily with age, until retirement, while in Britain, the profile assumes a distinct hump shape: they peak in the early thirties for women and in the early forties for men.[26] Moreover, the returns to age seem to be lower in France, perhaps because of the higher age of entry to the labour market. Another possible explanation is the existence of the minimum wage (SMIC) since the omitted

[24] This specific pattern of age-earnings profiles in France is also highlighted by Baudelot & Gollac (1997) and Bell, Elliott & Skalli (1996).
[25] Other variables included are comparable industry dummies and a capital city dummy.
[26] These results suggest that quite different models are appropriate to describe the labour markets in Britain and France. While in the former, age-earnings profiles are compatible with human capital theory, in the latter, it might be the case that long-term contractual arrangements, perhaps as proposed in the theory of agency, are at work.

groups are at the lower range of the age spectrum. Of course, this means that while employers in France may hire fewer younger workers than in Britain they will be of higher average quality in France. After this adjustment to the SMIC has been achieved, one would expect to observe smaller wage differentials between younger and older workers in France.

Regarding education, it seems that in both countries, returns to jobs with different levels of required qualifications raise steadily for both males and females in 1986 as well as in 1992. However, the rise in the premia, in the earnings of those in qualified jobs relative to the earnings of those in unskilled jobs, is less steep in Britain than in France. More generally, returns to education are higher, particularly for well-educated women.

Synthetic earnings distributions for British male workers are also constructed by applying both observed returns and unobserved characteristics of the French labour market. The results indicate that the application of both influences tends to reduce earnings dispersion in Britain.

The wage structure in France is compared to the Swedish one in Araï & Skalli (1996). Here, however, differences in earnings are not decomposed in terms of differences in returns or in endowments. Rather, owing to a unique industry classification, inter-industry differentials in the returns to different characteristics are evaluated and then compared across the two countries. Indeed, the results from earnings equations fit by OLS and where gender, seniority, schooling and employer size are alternatively crossed with industry dummies. It should, however, be noted that while the 1991 LNU survey[27] used for Sweden provides information about the number of years of schooling, the 1992 ECMOSS survey on which the French estimates are based does not. Instead, for the sake of comparability, education grades have been used to evaluate the theoretical number of years of schooling necessary to reach those grades.

The results obtained by Araï & Skalli (1996) indicate that high wage sectors pay higher returns to schooling and seniority and that the employer-size wage effect is correlated to industry affiliation both in France and Sweden. Regarding the returns to schooling, it appears that they are higher in France than in Sweden (6% and 4.5%, respectively) and that the rankings of the estimated industry-specific rates are highly correlated between the two countries. This induces the authors to conclude that, though there are a number of institutional dissimilarities between Sweden and France with respect to private costs of education, and the education in Sweden can be assumed to be less heterogeneous than in France, the variation in returns to schooling has a striking similarity. Not only is the coefficient of correlation between the inter-industry differentials in the returns to education in the two countries 0.50, but the extreme returns to schooling are found in the same industries in both countries.

The authors also report results suggesting that the gender gap vary highly across industries. However, it turns out that these differentials are not systematically correlated across the two countries. Obviously, in order to understand the nature of the gender

[27] The Swedish Level of Living Survey (LNU) is conducted by the Swedish Institute for Social Research (SOFI). It covers a random sample of the Swedish population aged between 18 and 64 and contains around 6,000 individuals. For comparison considerations, only a sub-sample of 1,496 individuals working in the private non-agricultural sector is used in the analysis.

wage gap, it is necessary to examine the importance of cross-industry occupational distributions and the role of occupational segregation, an analysis the authors do not make.

Finally, it seems that the returns to seniority are 9 times higher in France than in Sweden. Moreover, despite differences in levels, not only are the industry-seniority effects positively correlated across countries, but they are also highly positively correlated with the schooling effects. Thus, high wage industries pay higher returns to both schooling and seniority and the pattern of this variation is similar in France and Sweden.

A common feature of the three international comparisons discussed above is that each one focuses exclusively on the results from a single pair of cross-sections. Thus, nothing can be said about the way the observed similarities or differences evolve through time. Therefore, we should at least examine the stability of the observed patterns in France.

Analyses of the evolution of the returns to human capital necessitate either availability of comparable sets of information observed at different points in time or, perhaps preferably, panel data sets. For this reason, papers reporting trends over time use either pseudo-panel data on the basis of the FQP surveys or panel data such as those drawn from the Emploi or the DAS surveys.

To our knowledge, the first extensive analysis of the evolution of age-earnings profiles through time is that by Baudelot & Glaude (1989) who perform a pseudo-panel analysis based on samples of male full-time employees from the 1970, 1977 and 1985 surveys. Generations of workers are distinguished according to the year of their entry into the labour market, their wages being corrected to reflect constant Francs. Different specifications are then estimated using OLS in order to capture conjuncture and cohort effects. Note also that one version of the estimated model includes a standardised schooling variable while in another one, education is expressed in terms of diplomas.

Baudelot & Glaude (1989) show that during the period 1970-85, the role of schooling became more and more determinant in earnings setting. Because of the increasing number of individuals with longer schooling durations, the relative position of low-level diplomas is more and more depreciated. Even university degrees begin to be depreciated, at least among high wage-earners. Marginal returns to education have also decreased regularly. This decreasing trend is more clearly observable for general than for vocational education. However, those decreasing returns seem to be partly due to economic circumstances. The increase of low wages, particularly the minimum wage (SMIC), has led to less wage dispersion and thus has contributed to the depreciation of the returns to the high level diplomas. Actually, when these economic circumstances are taken into account, marginal returns to education decrease slowly; they even seem stable when reasoning in terms of cohorts of workers.

In a sense, the pseudo-panel analysis performed by Goux & Maurin (1994) could be seen as an update of Baudelot & Glaude's (1989) one since they include the 1993 FQP survey as well. Their results show that the rates of return to schooling tend to decrease by 1 percentage point each tenth generation. Moreover, they estimate earnings functions where the number of years of schooling is replaced by the relative position of

individuals in their generation, which corresponds to a standardisation of the schooling variable by generation. They then come to the result that the influence of the individual's rank in his generation diminishes faster for the younger generations than it did for those born around world-war II.

The authors suggest different explanations of the observed decreasing patterns. It might be the case that firms, becoming more and more flexible, give more and more importance to individuals' ability in terms of autonomy and cooperation, than to standard criteria such as education. An alternative hypothesis is relative to unemployment. To be more specific, the increase in unemployment has led to a number of low-educated people being unemployed. The question is thus that of examining if the wages of the employed reflect their actual human capital or just the destiny of those who could avoid unemployment. Taking into account this selectivity process allows Goux & Maurin (1994) to confirm the hypothesis of decreasing returns to education.

Another interesting interpretation is that suggested by Jarousse (1988). This author shows that the shifts in new enrolments in various disciplines since the beginning of the decreasing trend of returns confirm the low influx of *Bacheliers* into the programmes with the highest values and the persistence of enrolments in declining fields, offering the lowest returns. His explanation focuses on the distinctiveness of the French academic system, which is extremely segmented. Thus, Jarousse (1988) proposes a model taking into account the endogeneity of educational costs. He then comes to the result that the increase in the number of options explains the seemingly paradoxical nature of Bacheliers' choices for degrees that have low job market value but also require a minimal effort to obtain. He shows that, in fact, the decrease in the returns to education is accompanied by a decrease in the amount of time devoted to study.

It is to be noted that evidence about differences in the job market value of different education streams is reported by Baudelot & Glaude (1989) and Goux & Maurin (1994). In both studies, a distinction is made between individuals according to the type of education they have chosen. The results highlight a stable hierarchy in the returns to education levels and significant differences in the returns to degrees necessitating the same number of years of schooling but different in type. For example, graduate students holding a *Grande Ecole* degree earn systematically more than graduate university students. Another example is the differential between those having chosen a general education stream and those who have pursued a specialised one.

Combined to each other, these results suggest that the returns to education are declining in absolute rather than in relative value since the hierarchy of education levels is stable. Further evidence about this stability is reported by Ponthieux (1997). The question she addresses is why the average young worker earns less in 1995 than in 1991, while he is more highly educated.

Ponthieux (1997) uses the 1991 and 1995 Emploi surveys from which she draws a sub-sample of workers aged between 16 and 29 who were in school the preceding year. She then estimates an earnings equation in which education level dummies are constructed according to whether individuals were employed in 1991 or 1995. These equations are estimated using OLS, but with a correction for selectivity bias as the

sample contains only employed beginners.[28] Though the estimated coefficients are systematically lower for 1995 than for 1991, the author explains that a Fisher test resulted in the acceptance of the null hypothesis. Hence, she concludes that the reason why beginners earned less in 1995 than in 1991 does not reside in lower returns to education, but rather in worse insertion conditions in the labour market. In particular, she highlights the increasing role of short term contracts and the decreasing trend of working time due to the development of part-time jobs.

One should not conclude that Ponthieux (1997) is in contradiction with Baudelot & Glaude (1989) or Goux & Maurin (1994). While she examines changes that have occurred during the 4 years she considers, they analyse differences between generations of workers by observing a time-interval of more than 20 years.

Baudelot and Gollac (1997) are also interested in long-run transformations of the age-earnings profiles. Though they do not focus explicitly on education, their results suggest that the returns to human capital are significantly changing. Their analysis is mainly based on the 1970 and 1993 FQP surveys with no sample restriction.[29] Separate OLS estimates are, however, presented for men and women for 1970 as well as for 1993. Interestingly, the results highlight decreasing returns to education for both sexes, but also huge increases in the returns to age. This result reflects radically changing age-earnings profiles. Indeed, the authors show that since 1975, age earnings differentials started to change significantly in such a way that the earnings of young workers were declining while those of the oldest were increasing. Moreover, though the age-earnings profiles are still concave, individuals reach their maximal earnings later and later. Such patterns are observed by the authors for men and women, white and blue collars in the private as well as in the public sector.

6. Concluding remarks

Most of the important questions addressed in the literature analysing the causal effects of human capital on wages have been examined empirically using French data. In the studies we have summarised, topics like endogeneity bias, sheepskin effects and individuals' heterogeneity have been the subject of investigation. However, there remain some topics the evidence on which is not strongly convincing. Examples are the screening and ability bias hypotheses. Other topics have not been examined at all. For example, to what extent can measurement errors in human capital variables be considered as negligible? Does the legal length of compulsory schooling influence individuals' decisions to invest in education or the returns to education?

Unfortunately, researchers might find it difficult to explore new dimensions, simply because the available data are not necessarily appropriate. Among the surveyed studies, the two most sophisticated ones are Goux & Maurin (1994) and Guillotin & Sevestre (1994). The results they report suffer, however, from the fragility of the data used. While Goux & Maurin (1994) have rather limited information on education in their

[28] Age is not included in this regression as it is highly correlated with the education variables. Such a correlation is, of course, due to the sample including only beginners in the labour market.
[29] The 1962-1991 DAS surveys are also used by the authors in order to compare wages of those aged between 26 and 30 and those aged between 51 and 60.

longitudinal analysis, Guillotin & Sevestre (1994) are obliged to approximate the number of years of schooling.

Thus, the question is how high would the returns to investment be if detailed data sets and sophisticated methods were used. Card (1998) concludes his survey of the literature, including recent studies of the earnings and schooling of twins and siblings, by arguing that the average return to education is not much different from the estimate that emerges from a standard human capital earnings function fit by OLS. This means that under the assumption that the various sources of bias have comparable effects from one country to another, international comparisons could reasonably be based on similar specifications of the earnings functions estimated using OLS.

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Appendix :

Tables A1, A2 and A3 report the results from selected earnings functions estimated in the reviewed studies. The idea underlying our choice of the reported results is to enable the reader to examine the sensitivity of the estimated coefficients with respect to methods, samples and/or specifications. As an example, the reported results from Guillotin & Sevestre's (1994) study show differences in the returns to human capital according to whether endogeneity bias is taken into account or not, to the sample used (balanced versus unbalanced panel) and to the estimation method. Baudelot & Glaude's (1989) results, on the other hand, highlight the role of conjuncture as compared to that of generation effects.

Not least because of their size, the reading of these tables remains unobvious. To make them more accessible, the following hints may be useful.

Firstly, employees in France receive (generally each month) gross wages excluding social security expenses and declare annually their total household revenue to the fiscal administration. The calculation of the taxes they have to pay is based on the household declaration. The calculated taxes are then paid during the year after the revenues have been received. As a result, analyses of earnings in France are always based on gross wages. Thus, net wages in the tables below refer to gross wages excluding social security expenses while gross wages refer to gross wages including social security expenses.

Secondly, empty cells either mean that the information is not provided in the study under consideration or that the coefficients have not been estimated. Returns to human capital have neither been reported when the measure used was non-continuous. Indeed, in such cases, the classifications (Education levels, Socio-economic categories, Age bands, etc.) differ from one study to another and sometimes also within the same study in such a way that reporting all the associated coefficients would have made the tables unreadable.

Thirdly, in none of the reviewed studies a distinction is made between private and public sector samples. However, analyses based on the ECMOSS survey cover the non-agricultural private sector only. In all other cases, the column "other exogenous variables" contains the code PP each time a private/public sector dummy has been included in the regression under consideration.

Finally, the following codes identify the rest of the variables controlled for and the coefficients of which have not been reported.

Table A0 : Notations

Codes	Variables
ABS	Number of days of absence
BD	Date of entry into the labour market
CC	Capital City dummy
CE	Continuing Education dummy
DCE	Duration of Continuing Education
DPS	Duration of Post-Schooling education
EBA	Existence of an industry (*Branche*) level collective Agreement
E88	Individual's Experience in the year 1988
FE	Father's Education
FLS	Firm's Law Status
FR	Femininisation Rate (proportion of women in the job)
FS	Firm Size
FS88	Firm Size in 1988
FVTP	Has been involved in Formal Vocational Training Program between 88 and 93
GD	Gender Dummy
HR	Working Hours Regime (3x8, night work, etc.)
IM	Intra-firm mobility indicators
IND	INdustry Dummies
LC	Labor Contract dummies
MS	Marital Status dummies
NAT	Citizenship dummies
NUP	Number of Periods of Unemployment
NYS	Number of Years of Schooling
OCC	Occupation dummies
OLM	Duration of inactivity and unemployment periods
PIE	Post-Initial Education dummy
PR	Pay Regime (piece rate, time rate, etc)
PP	Private/Public sector dummy
PS	Establishment Size
PT	Part-Time dummy
PTR	Part-Time Rate
REG	Regional dummies
SEC	Socio-Economic Category dummies
SM	Private/public Sector Mobility indicators
SNYS	Standardised Number of Years of Schooling
T88	Individual's job Tenure in the year 1988
UU	Size of the Urban Area
XM	Inter-firm mobility indicators
YE	Year of first job