THE EFFECTS OF HUMAN CAPITAL DEPRECIATION ON EXPERIENCE-EARNINGS PROFILES: EVIDENCE FROM SALARIED SPANISH MEN*

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ABSTRACT

This article formulates a model for salary determination, which permits the identification of the depreciation rate of the stock of professional qualifications using the 1994 Spanish PHOGUE data referring to salaried males. The depreciation rate of the stock of qualifications is estimated at a narrow interval centred at 1%. Empirical evidence also suggests that although the depreciation rate does not vary according to the level of education, it does so depending on the sector (public-private) in which the professional activity is carried out and on unemployment spells endured by the worker in recent years.

JEL classification: J24; J31.

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1. INTRODUCTION

The Human Capital Theory developed by Becker (1964) and Ben Porath (1967) is one of the most important contributions of the last 35 years in the field of labour economics. Its basic merit lies in the fact that it permits an analytical management of the heterogeneity of the labour factor and the investment process throughout time that generates this heterogeneity. The human capital production model transforms the different knowledges and skills that individuals have in homogeneous units.

Starting from this theory, an extensive empirical literature has evolved on the returns from investments in human capital or on age-earnings profiles throughout the working life of individuals. However, the professional qualifications acquired by the individual depreciate, and, thus, his human capital depletes. This depreciation can be broken down into various types of factors, some directly attributable to the worker's physical deterioration (health, intelligence, skills, etc.) and others caused by obsolescence, i.e. by the loss of market value of the worker's qualifications due to changes in the economic environment. For instance, technological progress makes labour methods, and therefore workers, to be constantly adapting to new technologies. Thus, it is important for individuals to acquire new skills in order to maintain their productivity, that is, their market value.

However, the effect of technological changes is not always a gradual one. It often causes disappearance of certain productive activities and emergence of new ones, with the resulting re-assignation of the labour factor among the different economic sectors. In the extent that the qualifications of workers belonging to the disappearing sectors are specific for those professional activities, their knowledge becomes obsolete.

Surprisingly, despite the undoubted relevance of human capital depreciation, very few studies have dealt with it. This void is probably due to the fact that the reference model in most empirical works is the one proposed by Mincer (1974), where the depreciation rate cannot be identified. Even so, there are some studies based on Mincer's model, which have attempted to estimate the depreciation rate, under certain identification assumptions. An example of this approach are the works focussing on the process of human capital accumulation and age-earnings profiles of females, and the depreciation effect associated with exits from the labour market of this social group. (See, e.g. Mincer and Polacheck (1974) and Mincer and Ofek (1982)). Carliner (1982), looked at the human capital depreciation process when studying the evolution of the salaries of U.S. males close to retirement. Also, based on Mincer's model, Neuman and Weiss (1995) analyse the differences between obsolescence and physical depreciation of human capital for the Israeli case, showing their relevance in studying age-earnings profiles but quantifying indirectly the human capital depreciation rate.

In the context described above, this paper proposes a different analytical framework to that of Mincer's, that permits a simultaneous study of the experience-earnings profiles of individuals and of the depreciation rate of qualifications accumulated over time, either through formal education or from on-the-job experience. Under this setting, depreciation is understood to be the loss of homogeneous units of human capital and, therefore, of the capacity to produce income. The second section presents the model. The third section discusses the main empirical results paying special attention to the effects of unemployment spells on the human capital depletion phenomenon. Conclusions and final remarks are placed in section four.

2. A MODEL FOR THE ANALYSIS OF HUMAN CAPITAL DEPRECIATION

Let us assume that individuals make two types of investments in order to increase their human capital: those that are effected during their infancy and youth (Schooling), and those made once they have entered the job market (post-school investment). The difference between these two components is not only linked with the moment of the life cycle in which they occur, but also with the fact that while the former is basically identified with the individuals' formal education, the latter is related to the increase in skills caused by the use of that formal education in their jobs, i.e. professional experience.

Consider an individual who has finished his formal education and has joined the labour market. Let I_{it}^{*} be the gross post-school investment made by an individual *i* with *t* years of experience. Then, the stock of professional qualifications, K_{it}, accumulated by individual *i* after *t* years of experience is given by I_{it}^{*} plus the stock he possessed in the previous period K_{it-1} , minus what this may have depreciated δK_{it-1} . δ being the depreciation rate. Formally,

$$K_{it} = I_{it}^{*} + (1-\delta) \cdot K_{i\,t-1} \tag{1}$$

that is, due to depreciation, investments made in the past are equal to a lesser amount of investment today. Therefore, depreciation implies a loss of equivalent units of capital and, as a consequence, a loss in the capacity to generate income. By substituting this recursively, the stock of qualifications of an individual can be expressed as the sum of all past post-school investments and an initial stock acquired during the formal education stage:

$$K_{it} = \sum_{j=0}^{t-1} (1-\delta)^{j} \cdot I_{i\,t-j}^{*} + (1-\delta)^{t} \cdot K_{i0} \tag{2}$$

Once K_{it} is defined, the human capital stock of individual *i* with *t* years of experience, H_{it}, will be determined by all those personal characteristics which permit him to obtain a wage. Thus, H_{it} depends on the stock of professional qualifications accumulated by the worker, K_{it}, and on some other specific factors of the individual, v_{it}.

$$H_{it} = A \cdot e^{\beta_K \cdot K_{it} + v_{it}} \tag{3}$$

where β_K is the rate of return on the Stock of qualifications and *A* a constant of proportionality. Assuming that the earnings of individual *i* with *t* years of experience are given by:

$$Y_{it} = W \cdot H_{it} \cdot e^{\beta_Z \cdot Z_{it} + u_{it}} \tag{4}$$

where Z_{it} are a group of observable variables, which have an influence on job earnings. In general, Z_{it} are socio-economic features such as working sector, region of residence, etc. *W* is the wage or rental price per equivalent unit of human capital, which is assumed to be constant over time, and u_{it} represents other random influences in wages. Substituting (3) into (4) we obtain:

$$Y_{it} = A \cdot W \cdot e^{\beta_k K_{it} + \beta_z Z_{it} + u_{it} + \nu_{it}} \quad (5)$$

that is, earnings , Y_{it}, are a function of the individual's human capital stock, of other characteristics influencing salaries, and of a set of random components. Substituting (2) into (5), we obtain:

$$Y_{it} = A \cdot W \cdot e^{\beta_k \left[\sum_{j=0}^{t-1} (1-\delta)^j \cdot I^*_{i\,t-j} + (1-\delta)^t \cdot K_{i0} \right] + \beta_Z \cdot Z_{it} + \nu_{it} + u_{it}} \quad (6)$$

and by taking logarithms in (6) we have:

$$\ln Y_{it} = \ln \omega + \beta_k \cdot \left[\sum_{j=0}^{t-1} (1-\delta)^j \cdot I^*_{i\,t-j} + (1-\delta)^t \cdot K_{i0} \right] + \beta_Z \cdot Z_{it} + \nu_{it} + u_{it} \quad (7)$$

It is worth noting that neither I_{it}^* nor K_{i0} are observable, so that if (7) is to be estimated, some identification restrictions must be introduced. In this respect, it would seem appropriate to consider that the initial stock of professional qualifications is a function of the years of formal education, S_i, which will be approximated by a polynomial, $K_{i0} = g_0 + g_1 \cdot S_i + g_2 \cdot S_i^2 + \ldots$. In addition, once the individual starts working, his investment in qualifications, I_{it}^* will be a polynomial function of experience t_i. That is, $I_{it}^* = a_0 + a_1 \cdot t_i + a_2 \cdot t_i^2 + \ldots$.

Alternative expressions for the empirical equation (7) can be obtained depending on the order of the polynomials in t_i and S_i. Thus, assuming that K_{i0} is a quadratic function on S_i, leaving open the possibility that each year of formal education contributes differently to that stock, that I_{it}^* decreases linearly with experience, until it becomes zero at retirement, and some standard identification assumptions, K_{i0} and I_{it}^* can be formally expressed as

$$K_{i0} = S_i + \gamma \cdot S_i^2$$

$$I_{it}^* = \alpha - \frac{\alpha}{J - S_{i0}} \cdot t_i$$

where J is retirement age (generally 65) and S_{i0} is the age at which the individual begins working after completing his studies. Thus, from (7) we have:

$$\ln Y_{it} = \ln \omega + \beta_k \cdot \left\{ (1-\delta)^t \cdot (S_i + \gamma \cdot S_i^2) + \left[\frac{1-(1-\delta) \cdot t_i}{\delta} \right] \cdot \left[\alpha + \frac{\alpha}{J - S_{i0}} \cdot \left(\frac{1-\delta}{\delta} \right) - \frac{\alpha \cdot t_i}{(J - S_{i0}) \cdot \delta} \right] \right\} + \beta_Z \cdot Z_{it} + \nu_{it} + u_{it} \quad (8)$$

By making the usual assumptions on the model disturbances, this equation, unlike (7), can be estimated by non-linear techniques and constitutes the basis of the estimations presented in the third section. It should be noted that, unlike what happens with the traditional Mincerian wage equation, the depreciation rate parameter is identified. In addition, in our model not all the years of education increase the stock of qualifications in the same proportion, so that the rate of return of an additional year of formal education may vary.

3. ESTIMATION AND RESULTS

The data used in the estimation of the reference model, summarised in equation (8), are drawn from the Household Panel of the European Union (PHOGUE), carried out for Spain by the National Institute of Statistics (INE). This survey contains information on the labour status and income resources for 17908 individuals during the period 1993-1994. In the estimation of the model a sub-sample was selected, which was made up of the main core of the Spanish labour market, i.e. males of working age (over 16) receiving wages. Although the total number of individuals with these characteristics was 3304, complete precise information was only available to perform estimations for 1867 of them.

According with the theoretical model, the main variables used in estimation are the following: the gross wage/hour expressed in 1994 pesetas; the education level reached by the individual measured in the number of years involved in the corresponding cycle -4 for individuals with primary studies, 8 for those with basic studies, 12 for those with medium grade studies, and 16 for those with university degrees-; and his experience measured in years. Other characteristics of the individual were represented by a set of dummy variables, including marital status, whether the individual had suffered unemployment spells in recent years, profession, region, type of firm (public-private) and its size and field of activity. Appendix 1 explains how these variables were constructed.

Table 1. Estimation results of the proposed model in equation (8)

	I	II	III
Constant	5,706 (0,077)	5,561 (0,105)	5,573 (0,073)
Rate of return (b_K)	0,059 (0,013)	0,074 (0,022)	0,069 (0,013)
Depreciation rate (d)	0,009 (0,003)	0,016 (0,002)	0,017 (0,002)
Depreciation rate *x* Primary studies	--	0,001(*) (0,002)	--
Depreciation rate *x* Basic studies	--	0,002(*) (0,002)	--
Depreciation rate *x* Medium grade studies	--	0,0002(*) (0,002)	--
Depreciation rate *x* Public Sector	--	-0,013 (0.002)	-0,014 (0,002)
Depreciation rate *x* Unemployed at least once in previous 5 years	--	0,009 (0,002)	0,009 (0,002)
Depreciation rate *x* Long-term unemployment	--	0,012 (0,004)	0,012 (0,002)

Depreciation rate *x* Unemployed at least once in previous 5 years *x* training courses received	--	--	--
Depreciation rate *x* Long-term unemployment *x* training courses received	--	--	--
Square of years of formal education (g)	-0,026 (0,005)	-0,027 (0,007)	-0,024 (0,005)
Investment function (a)	0,499 (0,111)	0,607 (0,176)	0,645 (0,128)
Public Sector	0,309 (0,022)	--	--
Unemployed at least once in previous 5 years	-0,101 (0,022)	--	--
Long-term unemployment	-0,116 (0,031)	--	--
Large size Firm	0,276 (0,030)	0,262 (0,029)	0,236 (0,030)
Medium size Firm	0,210 (0,023)	0,197 (0,023)	0,181 (0,023)
Agriculture + Fishery	-0,237 (0,050)	-0,263 (0,038)	-0,261 (0,051)
Finance + Energy	0,243 (0,038)	0,247 (0,038)	0,248 (0,038)
Household	-0,156 (0,072)	-0,198 (0,079)	-0,195 (0,079)
Northeast + Madrid	0,193 (0,020)	0,193 (0,020)	0,193 (0,020)
East	0,133 (0,023)	0,136 (0,024)	0,136 (0,024)
South	0,092 (0,025)	0,093 (0,025)	0,092 (0,025)
Managerial and Professional staff	0,571 (0,035)	0,569 (0,037)	0,572 (0,037)
Technicians	0,250 (0,032)		0,246 (0,033)
Administrative staff	0,102 (0,037)	0,091 (0,039)	0,091 (0,039)
Qualified workers	0,066 (0,020)	0,053 (0,020)	0,053 (0,021)
Married	0,060 (0,024)	0,078 (0,024)	0,078 (0,025)

Log likelihood	-644,82	-673,01	-673,01
Standard deviation of residuals	0,344	0,349	0,349

1. Description of model specification for depreciation:
   - *I*: constant depreciation rate regardless of personal peculiarities.
   - *II*: depreciation rate depending on level of education, on nature of economic activity (private-public) and on unemployment status.
   - *III*: depreciation rate depending on nature of economic activity (private-public) and on unemployment status.

(*) Non significant at a 90% confidence level.

Note: Number in parentheses indicates standard deviation robust to heterocedasticity as proposed by White.

Table 1 presents the estimation results of the model summarised in (8)[1]. The estimation was carried out assuming that individuals retire at 65, ($J=65$) and that they do not begin working until they finish the maximum study level they declare to own. Moreover, in view of the legal restrictions in force concerning child labour, it is considered that none of the individuals started working before the age of 16. Estimation was carried out by Non-Linear Least Squares (NLLS) and standard errors robust to heterocedasticity were used for inference purposes. As can be seen in column I, the depreciation rate of human capital estimated for working Spanish men is statistically different from zero at a 95% confidence level, and it reaches approximately 0.9% annually. This result is consistent with those obtained for the USA. For instance, Johnson and Hebein (1974) finds depreciation rates between 1 and 3.5%, Heckman (1976) obtains depreciation rates between 0.7 and 4.7% and in Haley (1976) they were between 0.5 and 4%. For European economies, the only estimates available are those for Great Britain (11%) and the Netherlands (17%) reported by Groot (1998). However, as can be observed, his results are far removed from both, those obtained in the articles mentioned above for the U.S. and those reported for Spain in this paper.

The estimated rate of return per one additional unit of human capital is 5.9%. Nevertheless, the negative sign in the parameter associated with S squared implies that the production function of the stock of qualifications exhibits decreasing returns to scale. Namely, every additional year of studies contributes less to human capital production than the previous year[2].

In addition to the educational level and experience, there is a wide set of variables such as: productive sector, previous spells of unemployment, size of the firm, region of residence, type of occupation and marital status, which are significant in the determination of

1 Although the initial stock of professional qualifications in the model was approximated by a 2nd order polynomial, it was tested against the alternative of a 3rd order polynomial, but the parameter associated with the 3rd order term was not significantly different from zero at a 90% confidence level. Also, to relax the assumption that, once the individual starts working, the investment process is linear in experience, linearity was tested against the alternative of an investment process quadratic in experience, but the linearity of the investment process was not rejected.

2 Theoretically, at a certain study level, it would be feasible for the rates of return to re-increase. However, this would imply a cubic formulation for the initial qualifications stock, a fact that, as has been commented on previously, was rejected by our database.

wages[3]. The results obtained for the variables reflecting past unemployment status are worth mentioning. Individuals who have been out of work at sometime in the previous five years earn, on average, less than those who have been employed in the same period of time. Furthermore, if these unemployment spells have been long (more than twelve months), earnings are even lower. One potential explanation for this outcome is that human capital is eroded away by both unemployment spells and by their length. In other words, work inactivity accelerates the rate at which human capital decays. Notwithstanding, to verify this hypothesis it would be necessary to allow for the possibility that the depreciation rate hinges, among other things, on the unemployment status of the individual. This will be considered in the next section.

On the basis of the estimation results shown above (Table I column I), the experience-earnings profiles per level of education attained by the average individual were obtained[4]. These experience-earnings profiles, taking into account the depreciation rate of human capital, are depicted in figure 1.

Experience-Earnings profiles

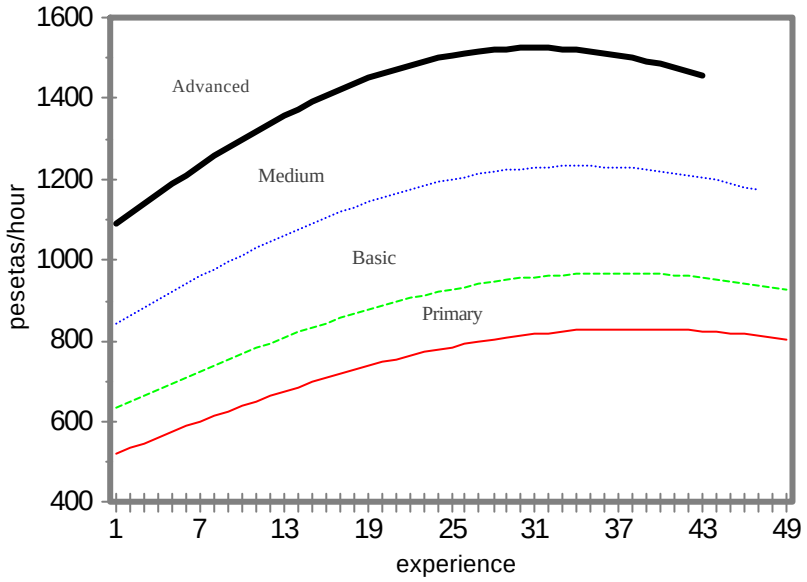

Figure 1

As can be observed, these experience-earnings profiles show that the higher the level of education, the higher the wage for any level of experience. However, these experience-earnings profiles are not parallel: they separate at the beginning of the working life getting closer later on, as the individual reaches retirement age. Moreover, as suggested by Neuman and Weiss (1995), the years of experience at which the highest wage is reached vary with the worker's level of education. Thus, for those individuals with advanced studies, the highest wage is reached after 31 years of experience, for those with medium grade studies (secon-

3 As there were no significant differences between the parameters of some of these variables, it was proceeded to regroup them in a smaller number of variables (see Appendix for more information).

4 The average individual for each level of education has been obtained from the sample by evaluating for each level of education, the dummy variables at their mean.

dary school) this wage level is attained with 34 years of experience, for basic studies with 37 years and, finally, for elementary studies with 38 years. The higher absolute depreciation rate at which human capital decays for high levels of education explains this result. This means that even though the depreciation rate is the same regardless of the level of education, however, the higher the level of education, the higher the number of units of human capital eroded away per period as a result of depletion.

Likewise, departing from the estimation of our model, the stock of qualifications-experience profiles by level of education can also be derived. These profiles are depicted in figure 2. As this figure shows, the stock of qualifications-experience profiles define a different evolution from the one corresponding to experience-earnings shapes. This is due to the existence of other factors, apart from the stock of qualifications, affecting wage formation. For example, as figures 1 and 2 set out, a clear difference can be observed if we compare the wages and the stock of qualifications for individuals with medium and high studies. The existence of this gap indicates that a major part of wage differentials between these two groups is due to other factors apart from the stock of qualifications. This fact is mainly evident in the years before retirement where the stocks of qualifications nearly coincide whereas the wage profiles do not.

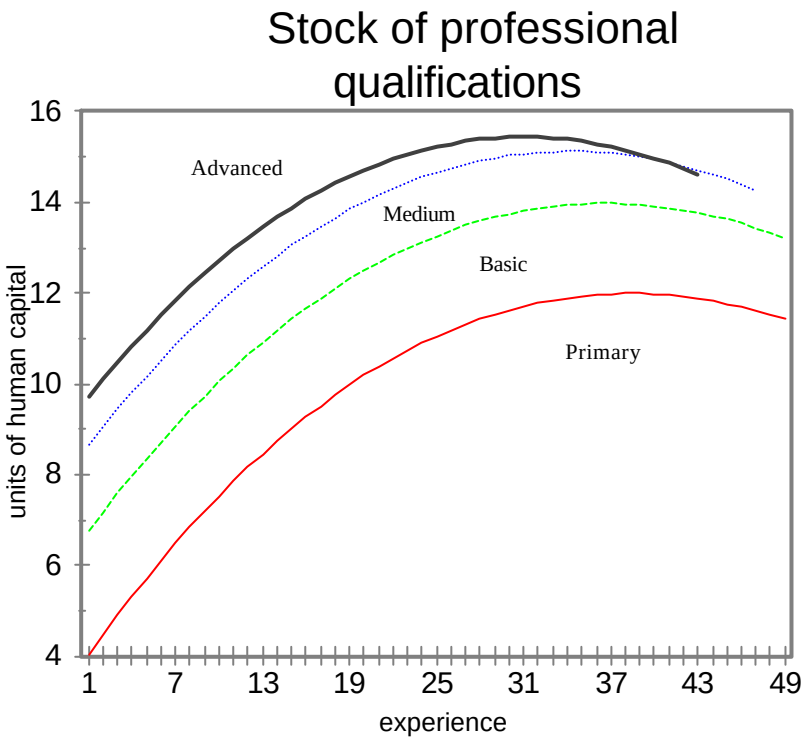

Figure 2

Differences in the rate of depreciation

Once we have verified the existence of a statistically significant depreciation rate for the stock of qualifications, it is interesting to check whether this rate is the same for all individuals or, on the contrary, it changes according to the characteristics of the worker. Authors such as Johnson (1970), Neuman and Weiss (1995) and Groot (1998) point out that the depreciation rate of human capital may vary with the level of education. Nevertheless, there is a lack of consensus in the literature about the sign and the magnitude of this relationship between depreciation and personal educational attributes. Neuman and Weiss (1995) su-

ggest that the more sophisticated the knowledge is, the faster it deteriorates and therefore, the rate of depletion of human capital should increase as the level of education expands.

Although it could be thought that human capital accumulated by individuals with higher education depletes at a higher rate than that accumulated by workers with lower levels of education; this may not be the case, provided that the proportion of the total human capital accrued by highly educated workers, corresponding to lower levels of education, decays at a lower rate. This line of reasoning implies that it is not evident that we have to observe in practice depreciation rates varying with education, as suggested by the authors mentioned above. Below, we test, for the Spanish case, whether the level of education is relevant or not in determining the rates of depreciation of human capital.

Authors such as Mincer and Polacheck (1974) and Mincer and Ofek (1982) have highlighted the implications that the interruptions in labour force participation might have on the magnitude of the rate of depletion of human capital. They find that the more continuous the participation, the lower the rate at which capital depreciates. Taking into account this conclusion together with our finding that unemployment spells affect negatively the average wages received by workers, in what follows we will also check the influence of the unemployment status of the individual on the depreciation rate of human capital. In addition, given that there are significant differences in the process of wage formation between the Spanish public and private economic sectors, it is also probable that the transmission mechanism of the depreciation of human capital to wages will be also divergent between these two sectors. Therefore, the peculiarities of the Spanish Public Sector call for caution in evaluating the depreciation rates of the individuals working in that specific sector and demand an explicit consideration in our model.

To verify the potential variation of the depreciation rate of human capital with the level of education attained by the worker, with the variable public sector and with the unemployment status of the individual, we re-estimated the model making the depreciation rate to depend on these characteristics. Columns II and III in table 1 present the results obtained from this re-estimation. The parameter associated with depreciation shows that there is no evidence that the depreciation rate of human capital differs by levels of education. To be precise, the hypothesis of equality of depreciation rates for all the levels of education considered cannot be rejected at a 90% confidence level. This result, which is consistent with Carliner (1982), is also sensible if we take into consideration that the specific human capital accrued by individuals with higher education might reduce the depreciation rate of non-specific human capital accumulated at lower levels of schooling (basic knowledge and skills). If this is the case, then the observed depreciation rate of a highly educated individual might not be different from that of a person with a lower level of formal education. Moreover, this result is coherent with both Human Capital Theory and with our model in which it is assumed that the units of human capital are homogeneous, regardless of the education level in which they were accrued.

Column III (table 1) shows the results once the restriction of equality in depreciation rates for all education levels has been imposed. We find significant differences between the depreciation rates of individuals working in the private sector and civil servants. Whereas the formers human capital depreciates at a rate of 1.7%, the latter have a depletion rate, which is not different from zero. As mentioned above, this outcome must be analysed with caution since rather than indicating that the stock of qualifications does no deplete in the public sector, it implies that in the public sector the depreciation process is not reflected in the formation of wages. However, as expected, unemployment spells enlarge the depreciation

rate of human capital. The depreciation rate for those individuals who have been unemployed at some time in the last five years reaches 2.6%, which is remarkably higher than that for those who have been employed during the whole period (1.7%). In addition, if the unemployment spell has been long-term the depreciation rate is even higher (3.8%). Therefore, it seems that not only the existence of unemployment spells, but also the length of time of these periods of work inactivity accelerate the erosion of human capital. These results coincide with those obtained by Mincer and Polacheck (1974) and Mincer and Ofek (1982), who find that interruptions in labour force participation induce losses in human capital and wages beyond the losses just caused by the non-accumulation of years of experience[5].

4. SUMMARY OF THE MAIN CONCLUSIONS

In order to overcome some of the limitations of the traditional Mincerian wage equation, this paper proposes a model that allows the estimation of the depreciation rate of human capital. In this way, a mode of approach to the study of depreciation, novel in the literature, is presented. The empirical part of the study is a first approximation to an analysis of the depreciation rate in Spain, and although being aware of its limitations, we consider that the results obtained are of enormous interest. The proposed model was estimated using 1994 data for Spain from PHOGUE referring to salaried males, and the human capital depreciation rate obtained was around 1% annually. It is therefore clear that any analysis of human capital or of the salary evolution of individuals throughout their working life should take into account human capital depreciation.

Furthermore, and unlike what other authors have suggested, it is found that the depreciation rate is the same for all education levels considered. In addition, the depreciation rate is higher for individuals enduring periods of unemployment, and higher still if that unemployment is long-term.

Finally, it was not rejected that the depreciation rate estimated for the public sector could be zero, which rather than indicate that the human capital of public sector workers does not depreciate, is a consequence of the salary-fixing system in that sector, being far removed from market rules.

5 In order to analyse this fact, an estimation was carried out including interaction variables for the unemployment status of the individual and its time-length with a variable indicating if the individual had received any additional training in recent years. The results obtained did not permit rejecting at a 90% confidence level that individuals who had been unemployed at least once in the past five years but who had received additional training had the same depreciation rate as the rest of the individuals. However, we think that caution is necessary when interpreting these results since this inference was made on the basis of a reduced number of observations –i.e. only 20% of the individuals who had been unemployed had received additional training-. Moreover, it was not possible to identify which individuals had changed their jobs or productive sector as a consequence of unemployment spells and this information would be fundamental for analysing this phenomenon.

Appendix 1: Description of variables.

Taking as a starting point the information in PHOGUE, the variables used in the analysis are the following:

1) **Gross hourly-wage expressed in 1994 pesetas**. This variable is not available as such in PHOGUE, so that it was necessary to structure it from gross monthly salaries and hours worked which the cited survey does supply. In fact, the gross monthly salary found in PHOGUE was divided into the number of hours worked monthly, obtained by multiplying the weekly hours appearing in PHOGUE by 4,3452 (the approximate number of weeks in a month). It should also be pointed out that all the possible jobs held by each individual were taken into account.

2) **Level of study completed by individuals**. PHOGUE supplies information about the maximum level of studies completed by individuals. With this information, we have set up a variable that aimed to include the number of years of study: four for individuals with primary studies, eight for individuals with basic studies, twelve for those with medium grade studies, and sixteen for those with advanced studies.

3) **Experience**. This variable was set up by computing the difference between the individuals' age and the age at which they started working.

4) **Other characteristics of the individual**. PHOGUE supplies information on numerous characteristics of individuals. The following variables were considered:

   — *Public or private nature of the firm they work in*. A variable is included which takes on a value of 1 for those individuals who work in the public sector and 0 if they do so in the private sector.

   — *Size of the firm if it is a private one*. Three possible sizes were considered: Small (under 50 employees), Medium (between 50 and 500 employees) and Large (over 500 employees).

   — *Unemployment situation in the past five years*. This variable takes on a value of 1 for those individuals who have endured a period of unemployment in the past five years, and 0 if they have not.

   — *Long-term unemployment*. This variable takes on a value of 1 for those individuals who have endured a period of unemployment in the past five years and which was long-term (over 1 year), and 0 otherwise.

   — *Productive Sector in which the individual works*. At first, the following sectors were considered: Services, Household, Agriculture and Fishery, Building, Transport, Financial, Information Technology, Energy, Commerce and Industry. As there were no significant differences between the parameters associated with some of these variables, it was proceeded to reorganise the sectors so that in the final model they were grouped as: Household, Agriculture and Fishery, Finances and Energy, and the remainder.

   — *Region of residence*. At first, the seven regions included in the database were considered: the Canary Isles, Central Spain (Castile and Leon, Castile La Mancha and Extremadura), the North West (Galicia, Asturias and Cantabria), the North East (the Basque Country, Navarra, Rioja and Aragon), Madrid, the East (Catalonia, Valencia and the

Balearic Isles) and the South (Andalusia and Murcia). As there were no significant differences between the average wage of some of these regions, they were regrouped in: Northwest and Madrid, the East, the South, and the remainder.

— *Professional status of the individual*. The nine large professional groups in PHOGUE were considered: Managers, Scientists and intellectuals, Technicians, Administrative staff, Sales people, Farmers, Qualified Workers, Qualified Machine operators, Unqualified workers. These categories were finally regrouped as: Managerial and Professional staff, Technicians, Administrative staff, Qualified workers, and the remainder.

— *Marital status*: A variable was set up with a value of 1 for those individuals who were married and 0 for those who were not.

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