RETURNS TO OVEREDUCATION AND UNDEREDUCATION: EVIDENCE FOR THE HOSPITALITY SECTOR IN ANDALUCIA

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Abstract:

The objetive of this work is to estimate the returns to overeducation and infraeducation for wage-earners in the hospitality sector in Andalusia. Using a cross-section of workers from a representative survey carried out with the financial support of ERDF (project IFD97-0858), we compare educational attainment of workers and job-required education (reported by workers and managers) in order to obtain a general especification of the earnings function from the allocation model of the labor market. This model contains the human capital specification and the job competition specification as special cases. The results show as an earnings especification that includes the possibility of mismatch between educational attainment and requirement is superior to one that only incorporates one or other of the two sides of the matching process. When we use the opinions of workers (managers) about educational requirements, the rate of return to years of adecuate education is 2.89% (3.32%). The penalty in the rate of return to education of every year of overeducated workers is estimated at –1.45 (-1.21) percentage points compared to workers with the same schooling years and matching the level required by the job. The penalty on the rate of return to education of every year of infraeducation is estimated at –1.66 (-1.92) percentage points.

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1. Introduction

The analysis of the relationship between the educational system and the labor market has led to different research areas, among which two stand out (Sicherman, 1991). Some studies have focused on how the capacity of the educational system and employees to adapt to business requirements in the labor market is reflected in educational returns; others have analyzed the determinants of the match between the educational levels achieved by employees and those required by the job they hold.

In this context, the current study falls into the first category and its aim is to estimate the rate of return of the years of study undertaken by those employees whose level of education is equal to that required by their job. Similarly, we calculate the rate of return of the years of under- or overeducation of those employees whose educational level does not correspond to that required by their job. In order to obtain the required education in the job, we use the opinions given by workers and managers.

With this objective in mind, this study is organized into the following sections. First, we review the theoretical framework for the analysis of educational mismatch. Then, we present the different versions of the wage equation which leads to the specification required to estimate the rates of return to schooling when the qualifications held match those required for the job, and when this is not the case. In the next section we describe the database and variables used in the empirical analysis. Finally, we present some points arising from the study and offer some conclusions.

2. Theories of educational mismatch

When we review the theoretical literature analyzing the mismatches between employees' schooling levels and the level required by their jobs, we can identify three analytical perspectives (García Serrano and Malo, 1996): the theory of human capital, the job screening model, and the job competition theory. A fourth analytical perspective, which includes the models mentioned above and which derives from the assignment theory, is developed in the works of Tinbergen (1956), Sattinger (1980), and Hartog (1981).

The human capital theory (Becker, 1964; Mincer, 1974) assumes that the educational mismatch is a transitory and short-term phenomenon. The origin of this imbalance is due to the uncoordinated functioning of the mechanisms which shape the characteristics of labor supply and demand. Thus, for example, if we assume that productive activities in the economy are carried out by using a flexible technology which employs three productive factors (capital, skilled labor, and unskilled labor), an increase in the supply of skilled labor where the demand for it remains constant will result in its price falling and, therefore, in a change in the relative prices of the productive factors. The model predicts the resulting effects on labor supply and demand. On the demand side, business will adapt to the new situation by substituting – so far as the technology permits – capital and unskilled labor for skilled labor, the latter element becoming relatively cheaper[i]. On the supply side, this change implies a fall in the profitability of the additional schooling years required to convert an unskilled worker into a skilled one.

The neoclassical model of the functioning of the labor market, on which the theory of human capital is based, assumes that the information available to economic agents is perfect. This means that firms know the marginal productivity of each worker and that the competitive process results in wages being dependent on this productivity level. Specifically, this model recognizes the existence of a direct relationship between the workers' educational level and their productivity and, therefore, their wage level. However, in general, the assumption of perfect information in the marketplace does not hold. For instance, the information available to employers about their workers' characteristics does not enable them to establish their productivity. In this context, the job screening model (Spence, 1973; Arrow, 1973) suggests that workers' educational level acts as an indicator enabling employers to identify the most capable and, possibly, the most productive workers. This is recognised by the workers themselves and therefore acts on those workers who wish to stand out against their competitors in the job market as an incentive to invest in their own education.

The third theoretical perspective for analyzing educational mismatch is known as the job competition theory (Thurow, 1975). Like the job screening model, Thurow's approach suggests that the existence of educational mismatches in the marketplace is a permanent phenomenon. This can be explained theoretically by assuming that workers

compete for vacant jobs in the market according to their productive characteristics, which are related to their educational level and work experience, among other factors. In addition, both the educational level and experience are inversely related to the costs incurred by firms of training employees to be able to perform their jobs.

Finally, the assignment theory – developed by Sattinger (1980) and Hartog (1981) on the basis of the initial contribution by Tinbergen (1956) – considers that the labor market is a market of individual productive characteristics, on the basis of which we can define the individual supply of labor and demand by firms. In line with these productive characteristics, this model assumes the existence of heterogeneous workers and heterogeneous jobs. Wages, therefore, are the instruments which facilitate the assignment of workers to the available jobs, rather than simply rewards attributable to their different productivity levels. As a result, the market finds it difficult to engineer a complete match between workers' productive characteristics and employers' job requirements. Educational mismatches, therefore, can present a permanent problem in the labor market. This model represents, in this sense, a theoretical framework which includes the human capital and job competition models.

3. The wage equation

Following the theoretical framework outlined, the human capital theory model suggests wages depend on those aspects related to labor supply -- that is, on the salary workers' specific characteristics -- and does not take into account requirements associated with the job they perform. Following Mincer (1974), the wage equation for this theoretical context can be specified as follows:

$$LNG(W) = \alpha_0 + \alpha_1 X + \alpha_2 X^2 + \alpha_3 \mathbf{E} + \alpha_4 Z + \varepsilon' \quad (1)$$

where (W) denotes the wages of the worker, (E) schooling years, (X) work experience, (Z) can denote, in a wider specification, another set of variables related to the specific characteristics of the worker, and (ε') is the error term. Under certain conditions, the coefficient value of the variable schooling years[ii], α_3, is interpreted as the rate of return for an additional year of education (Mincer, 1974).

On the other hand, regarding the job competition theory, wages do not depend on the characteristics of the workers, but on the characteristics of the job itself. A simple specification of the equation for this model is as follows (Thurow and Lucas, 1972):

$$LNG(W) = \beta_0 + \beta_1 \mathbf{E^r} + \varepsilon'' \quad (2)$$

where (E^r) is the number of schooling years required to perform the job.

Finally, according to the comprehensive framework of the assignment theory, the wage equation includes supply and demand factors and can be specified as follows [Duncan and Hoffman (1981), Hartog and Oosterbeek (1988), and Sicherman (1991)]:

$$LNG(W) = \gamma_0 + \gamma_1 \mathbf{E^r} + \gamma_2 \mathbf{E^o} + \gamma_3 \mathbf{E^u} + \varepsilon''' \quad (3)$$

where the number of schooling years of the worker (E) has been split into the years required by the job (E^r), and the years of overeducation (E^o) and undereducation (E^u). In this way we have:

$$\mathbf{E} = \mathbf{E^r} + \mathbf{E^o} - \mathbf{E^u} \quad (4)$$

where:

$$\mathbf{E^o} = \mathbf{E} - \mathbf{E^r} \text{ if } \mathbf{E} > \mathbf{E^r}$$

$$\mathbf{E^o} = \mathbf{0} \text{ otherwise}$$

$$\mathbf{E^u} = \mathbf{E^r} - \mathbf{E} \text{ if } \mathbf{E^r} > \mathbf{E}$$

$$\mathbf{E^u} = \mathbf{0} \text{ otherwise}$$

The interpretation of the coefficients of the wage equation (3) is as follows (Sicherman, 1991):

γ_1 = The returns to years of adequate education.

γ_2 = The returns to years of education that exceed those required, relative to adequately educated workers with the same required education.

γ_3 = The loss of earnings due to one year of undereducation relative to adequately educated workers with the same required education.

The expected signs for these coefficients are the following: $\gamma_1 > 0$, $\gamma_2 > 0$, $\gamma_3 < 0$. In addition, in the context of labor mobility, the rate of return for the years of

overeducation is expected to be lower than the rate for the required schooling years $\gamma_2 < \gamma_1$. This prediction is based on the assumption that at the beginning of their working life, workers seek learning opportunities in the jobs they take, and so they are willing to obtain lower returns for their educational level providing they gain experience which will allow them to have access to better jobs in the future.

In addition, the estimation of the wage equation parameters (3) will also enable us to empirically compare two stylized facts (Hartog, 1997, Sloane et al 1999). Assuming that there are two types of job, a goob job requiring a formal education of S_1 and a poorer job requiring S_2, where $S_1 > S_2$, the stylized facts are as follows:

1) The earnings of overeducated workers (E_{oes1}) are less than the earnings of those with the same level of education as themselves, but who are in jobs with the required level of education (E_{aes1}), but more than the earnings of workers who have the required but lower level of education (E_{aes2}):

$$E_{aes1} > E_{oes1} > E_{aes2}$$

2) The earnings of undereducated workers (E_{ues2}) are more than the earnings of those with the same level of education who work in jobs which require that level of education (E_{aes2}), but less than the earnings of workers who have the required and higher level of education (E_{aes1}):

$$E_{aes1} > E_{ues1} > E_{aes2}$$

Finally, once the specification of the wage equation is estimated (3), both hypotheses can be compared. First, we can contrast whether $\gamma_1 = \gamma_2 = -\gamma_3$ and thus, not reject equation (1) proposed by the human capital theory. Second, we can find out whether $\gamma_2 = \gamma_3 = 0$ and test empirically whether the wages only depend on factors exclusively related to supply, as expressed in equation (2) based on the job competition model.

4. Data and variables used

The data available for this study came from a database created in 2000 as a part of the research project "Déficit de cualificaciones, productividad y salarios en el sector turístico andaluz" (Skill shortages, productivity, and wage in the Andalusian Hospitality Sector, Project code 1FD97-0858 financed by ERDF and CICYT). In order to measure the educational mismatch of salary workers, we used the responses given by employees (What kind of education does a person need in order to perform your job?) and employers ((What kind of education does a person need in order to perform the job in each of these occupations?). The comparison between required and attained education leads to three possible definitions:

a) "Adequately educated" are those workers whose required education coincides with the formal education possessed by them.
b) "Overeducated" are those workers whose education is greater than that required to perform the job.
c) "Undereducated" are those workers whose level of education is less than that required for the job.

Bearing in mind the theoretical framework chosen and the data available, the empirical variables used in the estimations are the following. The dependent variable in the wage equation is the logarithm of the monthly net wages earned. Besides the logarithm of the number of working hours per month, we include as explanatory variables some continuous variables related to the worker's human capital characteristics: years of schooling required for the job, theoretical experience in the market, and seniority in the current firm. Second, we include a set of demographic variables such as the gender and marital status of the employee. Third, we incorporate variables related to the labor status of the employee and the characteristics of the job such as the type of business (hotel or restaurant), the size of the firm, and the type of contract. Although the database also offered information regarding the workers' occupations[iii], the correlation noted by some authors between this variable and the educational level can downbias the true value of the effect of education over the dependent variable wages[iv]. Thus, it was decided not to include this variable in the equation. Finally, the empirical variables used to control the educational mismatch of workers are specified in two different ways. First, by defining as continuous variables the individual's years of overeducation (E^o) and undereducation (E^u), using the

responses given by workers and employers and taking equation (4) as the starting point. Second, by classifying the variables schooling years and schooling years required for the job (based on employers' and employees' responses) according to dummy variables that correspond to seven educational levels: No schooling, Compulsory Schooling; Vocational Education I, Upper Secondary School, Vocational Education II, Lower University Degree, and Higher University Degree.

Table 1 shows the percentage of workers not presenting educational mismatch -- i.e. workers matching the educational level required for the job (Match) -- overeducated (Over) and undereducated (Under), classified according to the responses given by workers and employers regarding the educational requirements of the job[v].

Table 1 Educational mismatch according to the responses of workers and employers regarding educational requirements of the job (by percentage based on educational level).

SCHOOLING YEARS COMPLETED (s)	SCHOOLING YEARS REQUIRED (r)							
	Workers				Employers			
	r < s Over-	r = s Match	r > s Under	Nº Obs.	r < s Over-	r = s Match	r > s Under	Nº Obs.
No schooling	(*)	44.1	55.9	111	(*)	0.9	99.1	113
Compulsory Schooling	4.2	55.9	39.8	1230	1.6	29.3	69.1	1254
Vocational Education I	18.0	44.7	37.2	266	34.1	21.5	44.4	270
Upper Secondary School	18.1	46.7	35.3	465	33.9	15.0	51.1	472
Vocational Education II	29.6	62.2	8.3	230	45.3	36.2	18.5	232
Lower University Degree	28.4	64.2	7.3	313	39.9	55.9	4.2	313
Higher University Degree	61.6	38.4	(*)	73	72.0	28.0	(*)	75
TOTAL SAMPLE	**14.4**	**53.8**	**31.9**	**2688**	**20.4**	**28.5**	**51.2**	**2729**

(*) These cases cannot occur due to the way the variable is constructed.

According to employees' responses, 53.8% of the total sample consider that their education matches the requirements of their job, while according to the employers this is the case for only 28.5%. These figures reflect the expected results, since workers will tend to assert their suitability in order to avoid recognizing situations of undereducation[vi]. This can be seen when comparing the number of individuals that are under- or overeducated according to both the employers' and employees' points of view. Employers assert that there are more cases of undereducation (51.2% of the total sample) than employees (31.9%). For overeducated individuals, workers consider that

only 14.4% of the total sample falls into this category, while employers think 20.4% do so. Similarly, the greatest number of individuals whose education matches the job requirements are found in Vocational Education II and Lower University Degrees.

5. Results

We now present the results for the estimation of the wage equations proposed according to the two alternative specifications of the variable schooling years: as a continuous variable and as a categorical variable. Table 2 shows the results obtained after estimating wage equations (1), (2), and (3) according to the responses of employees and employers.

According to equation (1), the rate of return to education (E) is 2.4%. This low rate of return can be explained due to the low educational attainment of salary workers in the hospitality sector in Andalusia (only a 4.1% of workers has university degree). When using equation (2), the rate of return for the required schooling years (E^r) obtained according to workers' responses (1.98%) and employers (1.92%) are statistically the same but lower than the rate of return obtained with equation (1).

In equation (3), and according to workers' responses, the coefficients for the required years of schooling, overeducation, and undereducation are significant and have the expected sign. The rate of return for each year of education of employees having the required educational level for the job is 2.89%. However, the return to an additional year of education that exceeds the job requirement (overeducation) is estimated at 1.44%. In this way, and according to Sicherman (1991), penalties in the rate of return to an additional year of schooling that exceeds the jod requirement, relative to workers with the same level of schooling who have the required schooling on the job, is estimated at –1.45 porcentage points (= 1.44 – 2.89). On the other hand, the penalty on the rate of return to education of every year of difference between the level of study required for the job and the level of education the undereducated worker has is estimated at –1.66 porcentage points. Similarly, the wage differences between workers who work in jobs that required an additional year of schooling (a year more than they have) and workers who have the same level of schooling, but work in jobs that require that level of schooling, is 1.23 porcentage points (= 2.89 – 1.66).

Table 2: Results from the estimations of wage equations (1), (2), and (3) according to the responses of workers and employers for the variables under study.

Variable	Coefficient	t-statistic
Equation (1)		
Schooling years of the individual (E)	0.0240	16.42
R^2 adjusted	0.6352	
Based on workers' responses:		
Equation (2)		
Schooling years required for the job (E^r)	0.0198	16.30
R^2 adjusted	0.6334	
Equation (3)		
Schooling years required for the job (E^r)	0.0289	18.59
Years of overeducation (E^o)	0.0144	5.39
Years of undereducation (E^u)	-0.0166	-8.15
R^2 adjusted	0.6446	
Sample	2.688	
Based on employers' responses:		
Equation (2)		
Schooling years required for the job (E^r)	0.0192	13.35
R^2 adjusted	0.6237	
Equation (3)		
Schooling years required for the job (E^r)	0.0332	18.64
Years of overeducation (E^o)	0.0211	7.60
Years of undereducation (E^u)	-0.0192	-10.70
R^2 adjusted	0.6457	
Sample	2.729	

Notes. The logarithm of monthly net wages is the dependent variable. All equations include the following variables: monthly working hours (as logarithms), gender, work experience, seniority in the current firm, marital status, type of firm (hotel or restaurant), type of contract, and size of the firm. The estimated coefficient for the logarithm of monthly working hours is not different from unity in the estimations presented. For the variables measuring work experience and seniority in the firm the results obtained are those expected. Married men get higher wages, but no differences were found in the type of firm the individual worked for (hotel or restaurant). Earnings also varied depending on the type of contract; the workers with a full-time (reference category) and permanent contract had higher wages. Regarding the size of the firm, the only significant differences with a positive sign are found in companies with more than 100 employees compared to the reference category (less than 9 workers). In order to test the result obtained for the coefficient of the variable "schooling years of the individual" we estimated the wage equation (1) using the database from the European Community Household Panel (Panel de Hogares de la Unión Europea PHOGUE) for 1996. The results obtained show a return to education for those people working in the hospitality sector of 2.3%, i.e., a decimal lower than our estimation for wage equation (1).

When dealing with employers' responses, the rate of return for the required education is 3.32%. This rate of return is higher and statistically different from the return obtained with employees' responses (2.89%) -- the value of the t-statistic for coefficient equality was 2.43--. On the other hand, the rate of return to education for each year of overeducation was estimated at 2.11%, which is also higher and statistically different -- the value of the statistic for coefficient equality was 2.44 -- to the one obtained with the employees' responses (1.44%). On the other hand, the penalty

for undereducated individuals on the rate of return for each year of undereducation was estimated at –1.92 porcentage points, a figure which is not statistically different to the one obtained with employees' responses (1.66%) -- the value of the t-statistic for coefficients equality was –1.46--. It is important to note that rates of return to education for Andalusian workers in the hospitality sector are significantly lower than those obtained in similar studies for the Spanish economy as a whole. For example, in a study for the whole of Spain, Alba (1993) reported rates of return of 5.8% for the required educational level; 4.7% for years of undereducation and 2.7% for years of overeducation.

Finally, table 3 shows the results obtained while testing alternative hypotheses. The results show a rejection of the null hypothesis according to the value obtained by the F-statistic. Thus, evidence shows that a wage equation specification such as (3) -- where both supply and demand factors are included -- would be superior to one that only incorporates one or other of the two sides of the matching process.

Table 3: Comparing human capital and job competition theories based on responses from workers and employers regarding the educational requirement of jobs.

	F Statistic
According to Workers:	
Human Capital Theory: $\gamma_1 = \gamma_2 = -\gamma_3$	44.79 (*)
Job Competition Theory: $\gamma_2 = \gamma_3 = 0$	43.17 (*)
According to Employers:	
Human Capital Theory: $\gamma_1 = \gamma_2 = -\gamma_3$	41.02 (*)
Job Competition Theory: $\gamma_2 = \gamma_3 = 0$	85.21 (*)

(*) Statistically Significant at 1%.

Following the methodology proposed by Hartog (1986), the analysis carried out so far by the estimation of wage equation (3) can be substantially enhanced by creating dummy variables for each combination of the individual's educational level and the educational level required for the job. In this way, if the schooling years have been classified into seven levels, we can define a 7x7 matrix, where each of the 49 dummy variables will take value 1 if the individual belongs to a given cell, and zero otherwise. The final equation to be estimated is the following :

$$LNG(W) = \delta_0 + \delta_{ij} \mathbf{Q_{ij}} + \delta_z Z + \mu \qquad (5)$$

where i is the current educational level of the individual (i = 1,…,7), j is the required level for the job (j = 1,…,7), and Z a vector of control variables.

Tables 4 and 5 show the results obtained from estimating equation (5) according to workers' and employers' responses, respectively. We only show the coefficients of the 49 dummy variables created to model the different situation of educational match and mismatch. The reference category used in both tables is a worker who has no schooling and whose level matches the educational requirements of his/her job. Equation (5) has also been estimated by imposing a set of linear constraints on the equality between coefficients, both on rows and columns. The coefficients estimated under the equality constraint within a row or column appear in Tables 4 and 5 labeled as "constrained". These Tables show an applied F-test to compare whether the null hypothesis holds and the label "F-test" is included.

Each cell of the 7x7 matrix in Tables 4 and 5 show the value of the estimated coefficient and the t-statistic (in parenthesis). The main diagonal of the matrix represents those individuals whose education matches the requirements of the job they do. If this diagonal is taken as reference, the cells below represent overeducation. On the other hand, cells above the main diagonal represents situation of undereducation. With a sample of 2,688 cases (Table 4) and 2,729 (Table 5) and 49 cells (7x7), the mean number of cases per cell is 54.9 and 55.7, respectively. However, most cases are concentrated in the main diagonal or near it (below or above)[vii].

Table 4 Results from estimating the wage equation according to the schooling years of the individual and the schooling years required for the job (based on responses given by EMPLOYEES).

EDUCATIONAL LEVEL COMPLETED BY THE INDIVIDUAL	EDUCATIONAL LEVEL REQUIRED FOR THE JOB								
	No Schooling	**Compulsory Schooling completed**	**Vocational Education I**	**Upper Secondary School**	**Vocational Education II**	**Lower University Degree**	**Higher University Degree**	**Constrained**	**F-test**
No Schooling		0.035 (0.76)	0.239* (2.52)	0.282* (2.74)	0.175* (2.38)	0.274 (1.24)		0.104* (2.46)	2.77* F(4. 2627)
Compulsory schooling	0.119* (2.63)	0.142* (4.14)	0.131* (3.33)	0.199* (5.21)	0.195* (5.33)	0.218* (4.20)	0.393* (5.99)	0.163* (4.79)	6.01* F(6. 2627)
Vocational Education I	0.042 (0.54)	0.145* (2.92)	0.217* (5.44)	0.113 (1.61)	0.241* (5.74)	0.137 (1.32)		0.201* (5.46)	2.67* F(5. 2627)
Upper Secondary School	0.113 (0.98)	0.209* (4.77)	0.152* (2.24)	0.238* (6.39)	0.271* (6.30)	0.314* (7.49)	0.445* (5.51)	0.257* (7.06)	3.62* F(6. 2627)
Vocational Education II	0.148 (1.54)	0.214* (3.72)	0.233* (4.03)	0.203* (3.13)	0.298* (7.57)	0.351* (5.43)	0.274* (2.08)	0.276* (7.33)	1.61 F(6. 2627)
Lower University Degree	0.267 (1.21)	0.171* (2.28)	0.147 (1.63)	0.306* (6.55)	0.330* (5.50)	0.429* (11.23)	0.654* (11.37)	0.404* (10.79)	11.03* F(6. 2627)
Higher University Degree	0.212 (0.95)	0.266 (1.67)		0.360* (5.00)	0.371* (4.34)	0.524* (8.98)	0.629* (11.56)	0.508* (11.67)	4.25* F(6. 2627)
Constrained	0.114* (2.70)	0.132* (3.91)	0.176* (4.87)	0.230* (6.54)	0.235* (6.70)	0.368* (10.10)	0.551* (12.94)		
F-test	0.39 F(5. 2627)	2.72* F(6. 2627)	2.16 F(5. 2627)	2.73* F(6. 2627)	3..95* F(6. 2627)	7.68* F(6. 2627)	5.72* F(4. 2627)		

(*) = Statistically significant at 5%.

Note: Each cell shows the estimated coefficient and the t statistic (in parenthesis).

Table 5: Results from the estimation of the wage equation according to schooling years of the individual and schooling years required for the job (based on responses given by EMPLOYERS).

EDUCATIONAL LEVEL COMPLETED BY THE INDIVIDUAL	EDUCATIONAL LEVEL REQUIRED FOR THE JOB								
	No schooling	**Compulsory Schooling completed**	**Vocational Education I**	**Upper Secondary School**	**Vocational Education II**	**Lower University Degree**	**Higher University Degree**	**Constrained**	**F-test**
No Schooling		0.294 (1.33)	0.277 (1.24)	0.301 (1.35)	0.398 (1.80)	0.313 (1.28)	0.377 (1.22)	0.324 (1.48)	1.15 F(5. 2667)
Compulsory Schooling completed	0,306 (1,37)	0.377 (1.72)	0.404 (1.84)	0.454* (2.07)	0.454* (2.08)	0.456* (2.07)	0.605* (2.47)	0.438* (2.00)	5.95* F(6. 2667)
Vocational Education I	0,416 (1,73)	0.436* (1.98)	0.483* (2.19)	0.463* (2.06)	0.496* (2.25)	0.390 (1.75)	0.343 (1.28)	0.461* (2.10)	1.16 F(6. 2667)
Upper Secondary School	0,417 (1,65)	0.472* (2.14)	0.453* (2.06)	0.505* (2.29)	0.529* (2.41)	0.554* (2.52)	1.121* (4.58)	0.514* (2.33)	7.44* F(6. 2667)
Vocational Education II	0,721* (2,94)	0.453* (2.04)	0.503* (2.26)	0.573* (2.56)	0.515* (2.34)	0.589* (2.65)	0.814* (3.39)	0.532* (2.42)	3.47* F(6. 2667)
Lower University degree		0.501* (2.22)	0.638* (2.85)	0.636* (2.86)	0.568* (2.57)	0.691* (3.14)	1.058* (4.66)	0.663* (2.99)	12.84* F(5. 2667)
Higher University degree		0.498* (2.11)	0.720* (3.10)	0.683* (2.70)	0.712* (3.12)	0.786* (3.52)	0.869* (3.87)	0.761* (3.44)	3.06* F(5. 2667)
Constrained	0,385 (1,73)	0.383 (1.74)	0.416 (1.88)	0.467* (2.12)	0.465* (2.11)	0.561* (2.51)	0.872* (3.92)		
F-test	4,07* F(3, 2667)	4.21* F(6. 2667)	8.19* F(6. 2667)	6.15* F(6. 2667)	5.88* F(6. 2667)	17.68* F(6. 2667)	6.27* F(6. 2667)		

(*) = significant at 5%.

Note: Each cell shows the estimated coefficient and the t-statistic (in parenthesis).

Again from the coefficients estimated for the cases of over- and undereducation it is possible to test the stylized facts. In order to compare and obtain a better understanding of these four relationships, we can take as reference, for example, the submatrix (3x3) obtained by considering three higher educational levels (i.e., upper secondary school, and lower- and higher university degrees). In Table 4 this submatrix is marked by a thicker border. Expression (6) for the first stylized fact corresponds to:

$$a_{77} > a_{76} > a_{66} \qquad (6)$$
$$0.629 > 0.524 > 0.429$$

In other words, a worker with a higher university degree in a job requiring this educational level earns more than someone with the same degree working in a job requiring a lower university degree (i.e., the person presents overeducation). However, the latter would earn more than another worker with a lower university degree having a job matching his/her qualifications. On the other hand, expression (7) corresponding to second fact, would translate as follows:

$$a_{66} > a_{56} > a_{55} \qquad (/)$$
$$0.429 > 0.351 > 0.298$$

Now a worker with a lower university degree in a job requiring such an educational level would earn more than someone working in the same job but having only completed higher secondary school (i.e., the person is undereducated). However, the latter would earn more than another worker with higher secondary school education having a job matching his/her qualifications. If this same analysis in done to the rest of the matrix cells, we can assert that the relationships used in expressions (6) and (7) are verified in most cells with significant coefficients.

In order to analyze the level of statistical significance of the constraints, it is necessary to calculate the value of the F-statistic, which allows us to compare the coefficients estimated in the constrained and non-constrained model from a joint perspective. The results obtained and labeled as “F-test” show how in 11 of the 14 constrained models estimated the null hypothesis is rejected.

We now look into the results based on the employers' responses regarding the educational requirements of jobs (Table 5). In this case, all the coefficients in the main diagonal are significant, except the cell corresponding to compulsory schooling completed (a_{22}). As in Table 4, all coefficients increase as we move towards higher educational levels. There are 16 statistically significant coefficients located below the main diagonal (i.e., overeducated), while there are 12 below the matrix's diagonal (i.e., undereducated). The two relationships detected in Table 4 (expressions 6 and 7) are also clearly verified in Table 5. If we now focus on the submatrix (3x3) obtained by only taking into consideration the three higher educational levels, then:

$$a_{77} > a_{76} > a_{66} \qquad a_{66} > a_{56} > a_{55}$$

$$0.869 > 0.786 > 0.691 \qquad 0.691 > 0.589 > 0.515$$

The hypothesis of equality of the sum of square residuals in the models with and without constraints is rejected when the F-statistic is applied in all cases except in row 1 and 3 (no schooling and vocational education I) in the constrained model. The results, shown in Table 4 and 5, are coherent with reports from other authors such as Hartog (1986), Hartog and Oosterbeek (1988), and Sloane et al. (1999).

Using these results it is possible to calculate the annual differential return for the different levels of education[viii]. Table 6 only shows estimations of returns to education for workers matching the educational requirements of the job according to the responses of workers and employers. First of all, and focussing on the employees responses, the results show that those workers who have completed compulsory schooling have a differential return for each schooling year of 2.38% in relation to workers who have no schooling. The highest annual differential returns are found in the higher educational levels, i.e., lower university degree (9.45%) and higher university degree (16.99%). Besides this, it is important to point out that the coefficients estimated for vocational education I and upper secondary school are not statistically different. This result means that for workers whose education matches the job requirements there is no increase in differential returns to each schooling year if a worker decides to increase his/her educational level from vocational education i to upper secondary school.

Table 6 Calculation of annual differential returns to different educational levels for workers whose education matches job requirements.

	Mean schooling years	Estimated Coefficient	Annual differential returns
According to workers' responses:			
No Schooling	0		
Compulsory schooling	6.4	0.142	**2.38%**
Vocational Education I	10	0.217*	**2.49%**
Upper Secondary School	12	0.238*	**-**
Vocational Education II	13	0.298	**7.78%**
Lower University Degree	15	0.429	**9.45%**
Higher University Degree	17	0.629	**16.99%**
According to employers' responses:			
No Schooling	0		
Compulsory schooling	6.4	0.377	**7.15%**
Vocational Education I	10	0.483*	**4.53%**
Upper Secondary School	12	0.505*	**-**
Vocational Education II	13	0.515*	**-**
Lower University Degree	15	0.691	**16.13%**
Higher University Degree	17	0.870	**19.52%**

Note: The estimated coefficients are not statistically different at 1%.

Second, by analyzing the annual differential returns to education according to employers' responses we can see greater returns for higher educational levels, i.e., lower university degrees (16.28%) and higher university degrees (19.62%). These results show higher returns when compared with those obtained with workers' responses. Besides this, the coefficients estimated for vocational education i, upper secondary school, and vocational education i are not statistically different. Consequently, whether upgrading from vocational education i to upper secondary school does not bring earnings rewards from the workers' perspective; having upper secondary school or vocational education ii are equivalent to vocational education i from the employers' view. It is worth noting the high annual differential return of workers with compulsory schooling completed in relation to those who have no schooling (7.15%), when compared to the results obtained from workers' responses (2.38%).

The differences found in the calculation of annual rates of return -- carried out according to the educational requirements of a given job and bearing in mind both the workers' and employers' points of views -- could be due to the higher educational requirements presented in employers' replies (i.e., resulting in a greater number of undereducated individuals) and the lack of acknowledgement on the part of workers of undereducation in certain circumstances (i.e., a greater number of individuals matching the

educational requirements of their jobs). These two factors affect the value of estimated coefficients in Tables 5 and 6 and, therefore, in further calculations of annual differential returns.

5. Conclusions

Using the database originally generated in the research project "Déficit de cualificaciones, productividad y salarios en el sector turístico andaluz" (1FD97-0858), and taking the model formulated by Mincer as the starting point, we have estimated different wage equations in order to measure the effects of individuals' educational mismatch on the returns to their investment in education. In this work, our results show that a wage equation speficification where both supply and demand factors are included is the best representation of the generation data process.

According to workers' opinions, the estimated coefficients show a return to education for workers matching their job requirements of 2.89%. However, the educational returns for each additional year for overeducated workers is 1.44%. For undereducated workers, the penalty for each year below the educational level required for the job is equivalent to –1.66 percentage points. Using the employers' opinions, the rate of return to education for the years required becomes 3.32%, while for every additional year of overeducation the return is 2.11%; and for the undereducated workers, the penalty translates into –1.92 porcentage points.

The calculation of the annual differential rate of return to education for workers who do not present an educational mismatch in relation to their jobs is greater for lower- and higher university degrees. The coefficients estimated for vocational education i, upper secondary school, and vocational education I are not statistically different. Consequently, whether upgrading from vocational education i to upper secondary school does not bring earnings rewards from the workers' perspective; having upper secondary school or vocational education ii are equivalent to vocational education I from the employers' view. From the same perspective, the yearly differential return of workers with compulsory schooling completed in relation to those who have no schooling (7.15%) is higher when compared to the results obtained from the workers' responses.

Finally, it is necessary to bear in mind two aspects in the analysis of rates of returns to education. First, it would be necessary to directly include the variable "productivity" in the analysis. Authors such as Tsang (1987) have pointed out the negative effect of overeducation on workers' productivity by using an index of work satisfaction. Second, we have to note that the main limitations of this work are related to the constraints imposed by the data available, the impossibility to control using Heckman´s method by estimating a probit of participation -- since we do not have data on people who do not work-- or the use of instrumental variables to take into account the correlation between the variables "schooling years required for the job" and "undereducation years" with the error term included in the wage equation. Nevertheless, the work of Raymond et al. (2001, p. 260) points out that there are very few differences between the estimations obtained by ordinary least squares and those estimated using the instrumental variables method.

6. References

ALBA-RAMÍREZ, A. (1993): "Mismatch in the Spanish Labor Market. Overeducation?. Journal of Human Resources, vol. 28, nº 2, pp. 259-278.

ARROW, K.J. (1973): "Higher Education as a Filter". Journal of Public Economics, nº 2, pp. 193-216.

BECKER, G. (1964): Human Capital. New York. National Bureau of Economic Research.

DUNCAN, G. y HOFFMAN, S. (1981): "The incidence and wage effects of overeducation". Economics of Education Review. nº 1, pp. 75-86.

GARCÍA SERRANO, C. y MALO, M. (1996): "Desajuste Educativo y Movilidad Laboral en España". Revista de Economía Aplicada, nº 11, pp. 105-131.

HARTOG, J. (1981): Personal income distribution: a multicapability theory. Martinus Nijhoff, Leiden/Boston.

HARTOG, J. (1985): "Earning functions: testing for the demand side". Economic Letters, n° 19, pp. 281-85.

HARTOG, J. (1986): "Allocation and the earnings function". Empirical Economics, vol. 2, nº 2, pp. 97-110.23

HARTOG, J. (1997): On returns to education: wandering along the hills of ORU land. Conferencia de la Asociación de Econometría Aplicada. Maastricht, 15-16 de mayo.

HARTOG, J. y JONKER N.: "A Job to Match your Education: Does it Matter? To appear in:Heijke", in H. y L. Borghans (eds.), *Towards a Transparent Labour Market forEducational Decisions*, Avebury.

HARTOG, J. y OOSTERBEEK, H. (1988): "Education, allocation and earnings in the Netherlands: Overschooling?". Economics of Education Review. nº 8, pp. 185-194.

LASSIBILLE, G. (1993): "El rendimiento de las inversiones educativas en España". Estadística Española, nº 134, pp. 645-663.

LASSIBILLE, G. y NAVARRO, L. (1998): "The evolution of returns to education in Spain". Education Economics, vol.057 6, nº 1, pp. 3-9.

MINCER, J. (1958): "Investment in human capital and personal income distribution". Journal of Political Economy, vol. 66, pp. 281-302.

MINCER, J. (1974): Schooling, Experience, and Earnings. New York. Columbia University Press.

OLIVER, J., RAYMOND, J., ROIG, J. y ROCA, A. (1998): "Función de ingresos y rendimiento de la educación en España 1990". Documento de trabajo, Fundación de Cajas de Ahorro Confederadas, nº. 138.

RAYMOND, J., BERCEINAS, F., OLIVER, A. y ROIG, J. (2001): "Spain" in Harmon, C., Walker, I. and Westergaard-Nielsen, Education and earnings in Europe, Edward Elgar, Cheltenhan, UK.

SÁNCHEZ OLLERO, J. L. (2001): Desajuste educativo: Existencia, medición e implicaciones en la industria hostelera de Andalucía. Tesis doctoral. Universidad de Málaga.

SATTINGER, M. (1980): Capital and the distribution of labor earnings. Amsterdam. North Holland.

SICHERMAN, N. (1991): "Overeducation in the Labour Market". Journal of Labour Economics, vol. 9, nº 2, pp. 101-122.

SLOANE, P., BATTU, H. y BELFIELD, C.R. (1999): "Overeducation Among Graduates: A Cohort View". Education Economics, vol. 7, nº 1, pp. 21-38.

SPENCE, M. (1973): "Job market signaling". Quartely Journal of Economics, nº 87, pp. 355-374.

THUROW, L. (1975): Generating Inequality. New York. Basic Books.

THUROW, L. y LUCAS, R. (1972): The American distribution of income: a structural problem. U.S. Government printing office. Washington.

TINBERGEN, J. (1956): On the theory of income distribution. Weltwirtschaftliches archiv, nº 77, pp. 156-175.

TSANG, M. (1987): "The impact of underutilization of education on productivity: a case study of the U.S. Bell Companies". Economics of Education Review, vol. 6, nº 3, pp. 239-254.

[i] It could be argued that the elasticity of the substitution between skilled and unskilled labor is higher than that between skilled labor and capital (which could reasonably be regarded as complementary factors). In this case, therefore, the shift in demand essentially affects unskilled labor.

[ii] The other terms used in this work for this variable are *years of education* and *educational level.*

[iii] The different occupational categories were obtained from the "The Spanish National Labor Agreement for the Hospitality Sector". The resulting list of occupations can be found in Sánchez Ollero (2001). That work also includes the features of the database used as well as the sampling method employed for its construction.

[iv] See, for example, the work of Oliver et al. (1998) for the Spanish economy.

[v] The level "Compulsory schooling" was assigned with a mean value of 6.4 years. This value results from calculating the weighted mean of schooling years for each group of workers, the weighting structure being the distribution of workers according to the educational level achieved.

[vi] Hartog and Jonker (1997) pointed out that individuals tend to overestimate the educational requirements associated with a given job or simply match these requirements to their own level.

[vii] In Tables 4 and 5 there are 13 cells where the number of cases is greater than zero and lower than 10; most of them are concentrated in columns 1 (no schooling) and 7 (Higher University Degree), and row 7 (Higher University Degree). For example, the coefficient estimated for cell a_{47} in Table 5 (having an educational level equivalent to Upper Secondary School but a job requiring Higher University Degree) is only based on four cases.

[viii] See, for example, Lassibille and Navarro (1998), and Lassibille (1993).