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Effects of educational mismatch on private returns to education: An analysis of the Spanish case (1995–2006)

Inés P. Murillo [a], Marta Rahona-López [b], Maria del Mar Salinas-Jiménez [a,*]

[a] *Universidad de Extremadura, Spain*
[b] *Universidad Complutense de Madrid, Spain*

Abstract

This study examines the effects of educational mismatch on wages in the Spanish labour market since the mid-nineties. First we study the evolution of returns to education and then we estimate returns to education in terms of the match between the worker's schooling and the job requirements. The results indicate that returns to education have declined since the mid-nineties. One also finds that the return associated with the job's required education is greater than that corresponding to the worker's actual schooling, and that the return on an additional year of attained education is positive but less than that of an additional year of required education. From a policy perspective, the existence of educational mismatch points to inefficiencies in the allocation of the educational resources. Investment on education can positively contribute to alleviate the unemployment problem in Spain, but taken into account the existence of educational mismatch it also becomes necessary to introduce structural reforms in order to adapt the job structure to a model of production based on knowledge so that the more highly qualified workers can find a job that corresponds to their educational level.

JEL classification: I20; I29; J30

Keywords: Return to education; Required education; Overeducation; Undereducation

* Corresponding author at: Dpto. de Economía, Facultad de CC.Económicas y Empresariales, Universidad de Extremadura, 06006 Badajoz, Spain.
E-mail address: msalinas@unex.es (M.d.M. Salinas-Jiménez).

1. Introduction

Investment on human capital has attracted increased attention in recent decades as an instrument to promote economic growth and a more equitable distribution of the resources. Besides individuals' private returns to education, social benefits from investment in education, regarding both efficiency and equity aspects, have long been recognized.[1] Consequently, economic policy has enhanced investment in education and schooling rates and participation in higher education have increased in most developed countries (OECD, 2008). Nevertheless, to fully take advantage of investment on education it becomes necessary that resources are allocated efficiently and skills acquired through the education processes match those required by the market. The labour market plays hence an intermediate role in the country's production model so that workers would be able to find a job commensurate with their educational level in order to avoid problems of overeducation (Dolado, Felgueroso, & Jimeno, 2000; García-Montalvo & Peiró, 2009). It would then be necessary to consider the demand and supply sides of the labour market simultaneously, with qualified labour requirements going with greater investment in education (Jorgenson, Goettle, Ho, Slesnick, & Wilcoxen, 2008; Teixeira, 1999).

The Spanish educational system has experienced an intense process of development over recent decades. While in 1970 the number of students in the Spanish educational system was less than 7 million, in 2006 this figure was close to 11 million students (Ministry of Education, 2007). In the case of higher education this momentum is reflected in that 29% of the Spanish population aged between 25 and 64 had a higher education degree in 2006, a percentage that is above the average for OECD countries (27%) and for the EU-19 countries (24%) (OECD, 2008). In this context, a question of particular interest is whether the more qualified workforce is in accordance with the employment needs of the Spanish labour market.

When there exists overeducation in the labour market, this generates negative effects both socially and individually, especially if this type of mismatch becomes a permanent phenomenon (Spence, 1973; Thurow, 1975). Socially, it leads to the inefficient allocation of skilled workers to jobs with lower educational requirements, thus adversely affecting the economy's productivity and competitiveness (Tsang & Levin, 1985). From a worker's standpoint, the result may be frustration with their job prospects (Tsang, Russell, Rumberger, & Levin, 1991), reconsideration of the human capital investment decisions in future generations (García-Serrano & Malo, 1996), and a negative effect on wages. Several authors have studied this last question in an international context (Bauer, 2002; Groot, 1993; Hartog, 2000; Kiker, Santos, & Mendes de Oliviera, 1997), with two main conclusions standing out: on the one hand, the wages earned by an undereducated worker tend to be lower than those earned by co-workers with an educational level in accordance with their job and, on the other, while an overeducated worker indeed gets higher wages, they are below the average expected given their educational level. Alba-Ramírez (1993), and more recently Budría and Moro-Egido (2008) and García-Montalvo and Peiró (2009), obtain similar results for the Spanish case. However, there have been few studies examining the evolution of returns to education in Spain and how overeducation might have affected these values over the last decade.

This paper aims to contribute to this literature by analyzing the degree of match between education and employment and its evolution since the mid-nineties, and by studying the effects

[1] A discussion of education as an instrument of income distribution can be found in Rice (1981) or Adelman and Levy (1984). On the other hand, some works on the effects of human capital investment on economic growth and productivity are those by Rosenzweig (1988), Salinas-Jiménez et al. (2006) or Duval and de la Maisonneuve (2010).

of educational mismatch on individual earnings in the Spanish labour market. To this end, we first consider the evolution of returns to education. According to Rumberger (1981), a decrease in the monetary returns to a given educational level would point to the existence of overeducation. Also according to that author, another meaning of overeducation refers to discrepancies between the individuals educational level and that required by the job they do, an idea based on the assumption that every job requires a certain level of qualification for the efficient performance of the tasks it involves. Following this argument, we focus on studying whether or not there exist such discrepancies between individuals' educational level and that required by the job they are doing, estimating the returns to education by taking into account the match between the workers schooling and the educational requirements of their job.[2]

The remainder of the paper is organized as follows. Section 2 briefly presents the theoretical framework and the principal results in the economics literature on educational mismatch and returns to education for the Spanish case. Section 3 focuses on the empirical analysis. First, we present the data used in the study and then examine the evolution of private returns to education between 1995 and 2006 with the estimation of Mincerian wage equations (Mincer, 1974). Next, we study the returns to education taking into account the degree of match between the educational level reached by a worker and that required to perform her job by estimating ORU (Over-Required-Undereducated) specifications (Duncan & Hoffman, 1981). Finally, Section 4 closes with a summary of the main findings of the study.

2. Literature review

The literature on educational mismatch has largely focused on the relationship between overeducation and wages. Human capital theory assumes that the remuneration of an individual in the labour market depends on her marginal productivity, which is determined by the human capital accumulated through formal education, on-the-job training, and experience (Becker, 1964; Mincer, 1974; Schultz, 1961). According to this approach, overeducation is a temporary mismatch in the labour market and the returns to education are independent of whether or not the individual is overeducated.

There has long been interest in the analysis of the returns to education in Spain. Oliver, Raymond, Roig, and Barceinas (1999) summarize the main studies of the private returns to education in the 1980s and 1990s. Among the conclusions, they note that in Spain there was a high return per year of schooling, with returns varying by educational level, being greater the higher the level attained by the worker. Similar results have been reported in more recent work (Arrazola & de Hevia, 2006; García-Mainar & Montuenga, 2005; Raymond, Roig, & Gómez, 2009).

In contrast, there have been far fewer studies on the evolution of these returns to education. Those that have been published describe an increasing trend in the private returns to short-cycle educational qualifications between the 1980s and the 1990s, but a decreasing trend for long-cycle university studies (Barceinas, Oliver, Raymond, & Roig, 2000; Lassibille & Navarro, 1998; San Segundo, 1997; Vila & Mora, 1998). For the second half of the 1990s onwards, however, the results have been inconclusive. Caparrós et al. (2001) find that returns to education

[2] A third definition of overeducation, according to Rumberger (1981), is based on the lack of fulfilment of individuals' expectations about their careers after they have reached a certain educational level. We do not consider this third sense of overeducation in the present work due to the lack of information on individuals' wage expectations in our database.

decrease in Spain between 1994 and 1996, and Pastor, Raymond, Roig, and Serrano (2009) report a similar result for the period 1995–2002. In contrast, Arrazola and de Hevia (2008) conclude that, between 1994 and 2000, private returns to investment in education tended to remain constant.

Although the evolution of returns to education can give an idea of whether or not there exist educational mismatches in the labour market, another approach to study this question assumes that different jobs require different levels of training to be properly performed, and that mismatches in the labour market may be a persistent phenomenon. Many economists have challenged the idea that a worker productivity depends solely on her personal characteristics (i.e., education or experience), noting that it will also depend on the characteristics of the job. Thus, in accordance with the theories of job-screening (Spence, 1973) and of job-competition (Thurow, 1975), the individual's productivity depends, at least in part, on the characteristics of the job and on the match between the worker's knowledge and the skills that the job demands. In this case, the rate of return to education will also depend on the goodness of fit between the skills acquired by the worker and those necessary to adequately perform her work.

To estimate the returns to education in terms of the match between the worker's educational level and that required in their job, it is necessary to previously estimate the degree of educational match. Different measures of educational mismatch have been used in the literature, being generally grouped into objective, subjective, and statistical measures. Objective measures are based on an analysis of the jobs, taking into account their characteristics, degree of difficulty, and the training and experience needed to perform the tasks they require. These requirements are then compared with the individuals' training to determine whether or not they match.

Subjective measures are based on information provided by the workers themselves about some personal and job-related characteristics. Among these measures, it is common to distinguish between a direct inquiry in which the individuals are asked if they consider themselves to be appropriately educated, undereducated, or overeducated for the job they are doing, and an indirect inquiry in which they are asked about the training needed to perform their jobs, comparing then this response with their actual educational level.

Finally, statistical measures compare the worker's educational level with that of other workers doing the same job, using as referent the statistical mean or the modal value of the distribution. In this sense, Verdugo and Verdugo (1989) categorize as overeducated (undereducated) those individuals whose years of formal education are more than one standard deviation above (below) the average found for that job. Alternatively, Kiker et al. (1997) propose using the modal value as the referent, arguing that this statistic is less sensitive to the existence of outliers in the distribution.

Each of the above measures of educational mismatch has advantages and disadvantages both methodologically and in the conditions needed for their practical implementation.[3] Furthermore, there is no clear preference for the use of one or the other measure in the empirical literature. Instead, the choice of method is usually determined by the available information in the database used. In any case, as emphasized by Hartog (2000), the conclusions obtained in different studies that estimate the returns to education considering the degree of match between the workers' educational level and that required to perform their jobs tend to be consistent, regardless of the type of measure used to estimate the educational mismatch.

[3] A detailed discussion of the advantages and disadvantages of each of these measurement methods can be found in Hartog (2000).

3. Empirical analysis

3.1. Data

The data used in this study come from the Spanish Wage Structure Survey (WSS) in its three available waves (years 1995, 2002, and 2006). These surveys were conducted by the National Institute of Statistics (Instituto Nacional de la Estadística, INE) as part of a European project that seeks to provide harmonized, four-year-period, information about the structure and distribution of wages in each of the States of the EU.

One of the main features of the WSS is the availability of matched employer-worker micro-data, which is particularly useful for the study of wage determination (Abowd & Kramarz, 1999; Hamermesh, 2008). In this sense, the WSS provides comprehensive information on firms with ten or more workers (WSS 2006 also includes firms with fewer than ten workers), classified in one of the following productive sectors: industry, construction, trade, catering, transport and communications, financial intermediation, real estate and leasing, business services, and, with the exception of WSS 1995, education, health, and other social activities. The WSS also provides information on firm size, type of collective labour agreement to which the firm is ascribed, and the region in which it is located. Worker related information includes, in addition to wages, variables such as age, gender, education, time with the firm, occupation, type of contract, and working hours. Beginning with WSS 2002, variables on the worker's nationality and whether he or she has supervisory responsibilities are also available.

Since the WSS has incorporated new features into its successive waves, it is necessary to apply a series of filters to ensure the proper comparison of results for each cross section. For this reason, in the present study we removed from WSS 2006 those firms with fewer than 10 workers. We also excluded the education, health, and other social activities sectors which were not present in the first wave of the WSS. Thus, the sample used consists of wage earners of both genders, aged between 16 and 65 years, working in firms with 10 or more workers, and excluding the areas of education, health, and other social activities.

Wages are expressed in gross terms per hour worked, and are calculated from the base wages for the month of October (considered representative of the whole year), adding prorated wage complements if any. Moreover, since the statistical source used in this study provides no information about the years of schooling of the individuals, they are approximated by the theoretical number of years of schooling required to complete the highest educational level declared by the worker. Finally, and given that the individual's actual experience in the labour market was unknown, the potential experience is used as a proxy. This variable is calculated, as is usually done in the literature, by subtracting six years plus the years of schooling from the individual's age.

Table A.1 in Annex A presents the summary descriptive statistics for the educational level of the individuals in the sample. On average, the time a worker remained in the education system continued to increase from 9 years in 1995 to 9.8 years in 2006. This increase in the years of schooling is in line with the changes in human capital stock that were noticed when analyzing the distribution of the sample by educational level. Thus, while the percentage of workers with just compulsory education or less fell from nearly 65% in 1995 to 56% in 2006, the percentage of individuals with vocational training or college education increased. There also stood out the growing proportion of university graduates, which doubled from 1995 to 2006, in that last year representing over 10% of the total sample.

Table 1
Returns to education: coefficients of the Mincer equation.

	1995	2002	2006
Constant	0.3124 (44.68)	0.7860 (12.78)	1.0955 (164.60)
Schooling	0.0954 (236.15)	0.0852 (215.94)	0.0736 (207.94)
Experience	0.0527 (123.70)	0.0415 (94.88)	0.0363 (87.12)
Experience^2	−0.0005 (−74.59)	−0.0004 (−52.33)	−0.0004 (−50.69)
R^2	0.3450	0.2884	0.2480
Standard deviation	0.4408	0.4541	0.4436
F-Statistic	23 189.56	18 390.79	16 169.18
Observations	132 050	136 113	147 048

Note: t-Statistics in parentheses.

3.2. *Evolution of private returns to education in Spain (1995–2006)*

This section presents empirical evidence on the evolution of returns to education in Spain from the mid-nineties until 2006. We use the theoretical framework proposed by Mincer (1974) and estimate the following wage equation:

$$\ln(w_i) = \alpha + \beta S_i + \gamma_1 E_i + \gamma_2 E_i^2 + u_i \tag{1}$$

In this equation, the wages (w) received by individuals are explained in terms of years of schooling (S), years of experience in the labour market (E) and its square (E^2), and a random perturbation (u) reflecting the unobservable individual characteristics that affect wages.

The results of estimating this equation for the Spanish case in 1995, 2002, and 2006 (Table 1) show the return to education to have declined over that period. In 1995 the return on an additional year of education was 9.5%, in 2002 was 8.5%, and in 2006 was barely 7.4%.[4]

The results in Table 1 were obtained under the assumption that all years of schooling, regardless of educational level, contribute equally to the individual's wage. An alternative way to analyze the influence of human capital on wages is to consider schooling as a discrete variable. In this case, the term reflecting the effect of education on earnings is replaced by a set of dummy variables that represent the highest educational level attained by the worker. The wage equation would then be specified as follows:

$$\ln(w_i) = \alpha + \beta_1 SEC1_i + \beta_2 SEC2_i + \beta_3 MVT_i + \beta_4 UVT_i + \beta_5 DIP_i + \beta_6 B.A._i + \gamma_1 E_i + \gamma_2 E_i^2 + u_i \tag{2}$$

where $SEC1$ is a dummy variable that takes the value unity if the individual has completed first stage secondary education and zero otherwise, and the other dummy variables are defined analogously: second stage secondary education ($SEC2$); middle grade vocational training (MVT); upper grade vocational training (UVT); 'diplomature' – an educational level in Spain roughly corresponding to one year less higher education than a Bachelor's degree (DIP);

[4] In addition to the basic Mincer equation, we estimated extended equations which included other variables potentially related to wages (gender, firm size, region, sector, occupation, etc.). As was to be expected, in the extended equations the return to education decreased, although there were no appreciable changes in its evolution over time. These results are available upon request.

Table 2
Returns associated with the different educational levels.

	1995	2002	2006
University graduate – *B.A.* (vs diplomature)	15.40	11.73	11.17
Diplomature (vs *SEC*2)	9.08	10.23	8.60
*SEC*2 (vs *SEC*1)	10.88	8.21	6.84
UVT (vs *MVT*)	7.94	7.32	6.06
MVT (vs *SEC*1)	13.14	11.89	11.10

and university graduate (*B.A.*); taking primary education (or less than primary) as reference level.

The advantage of this specification is that it does not impose uniform returns to all years of schooling, allowing one to estimate the return associated with different educational levels. This involves comparing the marginal costs associated with an additional level of education with the marginal benefits the individual expects to obtain from this higher level of education (Psacharopoulos, 1980). The idea behind this reasoning is that the individual incurs an opportunity cost – in the form of lost wages – while continuing their education, offset by an expected greater wage when entering the labour market with a higher education level. As noted by Raymond et al. (2009), in practice this method yields results that are very similar to those obtained by calculating the internal rate of return associated with a given educational level relative to the preceding level. According to those authors, the return associated with a certain educational level can be calculated as follows:

$$R_B = \frac{\beta_B - \beta_A}{S_B - S_A} \tag{3}$$

where R_B is the return associated with an educational level B relative to the preceding level A, S_A and S_B are the years of schooling needed to attain educational levels A and B, respectively, and β_A and β_B are the coefficients associated with those levels as obtained from a least squares fit to the discrete wage equation (Eq. (2)).

This estimation (see Table A.2 of Annex A) provides the basis for calculating the returns associated with the different educational levels as presented in Table 2. One observes that returns to education in Spain continue to be high, although the economic return associated with each level decreases progressively over the course of the period considered. This result is in line with most studies that have analyzed the Spanish case from the eighties onwards (Caparrós et al., 2001; Lassibille & Navarro, 1998; San Segundo, 1997; Vila & Mora, 1998). It stands out that one of the greatest declines in the rate of return is associated with the lower educational levels. Barceinas et al. (2000) find a similar result for the period 1990–95, and that the least educated workers have undergone the sharpest decline in their stock of human capital. Also, and consistent with the findings of San Segundo (1997), Vila and Mora (1998), Caparrós et al. (2001), and Budría and Moro-Egido (2008), among others, there is a notable decrease in the rate of return to university degrees. García-Montalvo and Peiró (2009) argue that this behaviour may be explained by the strong growth in the number of graduates in the last few decades which has not been accompanied by any similar increase in the number of skilled jobs.

According to the first definition of overeducation proposed by Rumberger (1981), these results provide evidence for overeducation in the Spanish labour market, with a decline in returns to education over the period 1995–2006. To explore this question in greater depth,

the next section focuses on the analysis of educational mismatch using the definition based on possible discrepancies between the individuals' educational level and that required by their jobs.

3.3. The relationship between educational mismatch and wages: estimating ORU equations

In order to determine whether there exist differences in returns to education according to its match with the job being performed, Duncan and Hoffman (1981) were pioneers in using the so-called ORU specification. This is a variant of the Mincerian wage equation in which the individuals' years of schooling (S) are decomposed into years of schooling required in the job (S_r), years of overeducation (S_o), and years of undereducation (S_u):

$$\ln(w_i) = \alpha + \beta_o S_{oi} + \beta_r S_{ri} + \beta_u S_{ui} + \gamma_1 E_i + \gamma_1 E_i^2 + u_i \tag{4}$$

In the context of this specification, the coefficients of the education variables are interpreted as follows: β_r expresses the return to an additional year of job-required education; and β_o and β_u the returns to an additional year of over- or undereducation, respectively, compared with that obtained by other workers doing a similar job and who achieve a proper match between the required and their actual education.

Within this specification, wages are determined by demand side variables (S_r), but also by parameters that measure deviations between the supply and demand of qualifications (S_o and S_u). This form of the wage equation has the advantage of allowing one to quantify the return to years of overeducation, of job-required education, and of undereducation, rather than having to settle for a single overall return on the worker's schooling.

Given the information available, in this study we used a statistical measure of educational mismatch, with the mode as reference value.[5] To define the variables S_o, S_r, and S_u, we differentiated nine job categories in accordance with the National Occupational Classification 1994. For each of these groups, the modal value of the schooling of workers in that category was determined, together with the possible mismatch between that value and the actual schooling reached by each worker. Thus, the variable S_r shows (for those individuals who are appropriately educated) the modal number of years of schooling in each occupation, and S_o and S_u for the over- and undereducated individuals of the sample, respectively, the difference between their actual years of schooling and the modal value of years of schooling for their occupation.

Table A.3 in Annex A presents the percentage distribution of workers in the sample and their average schooling by educational match. One observes that the percentage of workers whose education and job are appropriately matched shows a declining trend, reaching around 40% in 2006. This increase of educational mismatch is reflected in both senses, with slight increases in the percentages of both overeducated and undereducated workers.[6] Furthermore, the increase in average schooling of the workers in the sample is mainly due to the decisions of overeducated

[5] Other studies using this same measure of educational mismatch are those of Kiker et al. (1997), Cohn and Ng (2000), Mendes de Oliveira, Santos, and Kiker (2000), and Bauer (2002).

[6] There have been only a few studies analyzing the evolution of educational mismatch in Spain, notable being those of García-Montalvo (1995), Oliver et al. (2002), and Aguilar and García-Crespo (2008). There stands out in all their results that the incidence of overeducation has tended to increase over time, although the results relating to undereducation are less conclusive. In this sense, García-Montalvo (1995) estimated that the percentage of undereducated workers in Spain increased in the period 1985–91 and then decreased from 1991 to 1993. Aguilar and García-Crespo (2008) found that the

Table 3
Estimated returns to years of schooling according to the (mis)match between the worker's actual and job-required educational level.

	1995	2002	2006
Constant	0.2445 (35.73)	0.7049 (102.59)	0.9872 (149.98)
Appropriately schooled	0.10419 (48.49)	0.0981 (234.06)	0.0884 (227.00)
Overschooled	0.08532 (20.13)	0.0634 (90.29)	0.0555 (97.17)
Underschooled	−0.0547 (−75.04)	−0.0456 (−51.91)	−0.0401 (−50.20)
Experience	0.0511 (122.91)	0.0389 (91.08)	0.0349 (85.95)
Experience^2	−0.0005 (−76.45)	−0.0004 (−51.14)	−0.0003 (−50.71)
R^2	0.3815	0.3269	0.2901
Standard deviation	0.4284	0.4417	0.4310
F-Statistic	16 291.05	13 224.08	12 018.84
Observations	132 050	136 113	147 048

Note: t-Statistics in parentheses.

workers. Thus, the observed increase in average schooling for the sample as a whole is conditioned by the increase in the years of schooling of overeducated individuals, especially in the early and middle part of the decade 2000–09. The average years of schooling of the appropriately educated and undereducated individuals also increased in the second half of the nineties, but tended to remain stable or declined slightly during the period 2000–09.

To analyze the differences in returns to education in terms of the match between workers' education and employment, Table 3 presents the results of estimating the ORU specification of Eq. (4). In the three years studied (1995, 2002, and 2006), the estimates are consistent with the theoretical prediction and the empirical evidence. Economic returns to an additional year of overeducation are positive but less than the returns to an additional year of required education. The economic return to an additional year of undereducation is negative, as has customarily been found in other studies examining this issue (Alba-Ramírez, 1993; Cohn & Khan, 1995; Daly, Büchel, & Duncan, 2000; García-Montalvo & Peiró, 2009). In the three years considered, the penalty for undereducation is lower than the wage increase from an additional year of overeducation, although the difference declines over time. This result coincides with those obtained in the work of Sicherman (1991) and Cohn and Khan (1995) for the U.S. case and of Hartog and Oosterbeek (1998) for the Dutch case, but is contrary to those reported for Spain by Alba-Ramírez (1993) using data of 1985.

It is also noteworthy that returns to required education decrease over time from 10.4% in 1995 to 9.8% in 2002 and 8.8% in 2006. Nonetheless, comparing these figures with those obtained under the assumption that all years of schooling contributed equally to wages regardless of educational level (Eq. (1)), one observes that the return to job-required education is always greater than the return to the worker's actual education. For example, while in 2006 the return to an additional year of required education was 8.8%, the figure for the attained education was 7.4%. This might indicate that returns to actual schooling could be biased downwards as a result of overeducation: the return to education obtained in estimating the Mincerian wage equations is the return associated with an additional year of schooling independently of whether it is required for the job being considered or is in excess over the qualifications required.

proportion of undereducated workers in Spain fell significantly between 1995 and 1998, but rose slightly between 1998 and 2001.

Table 4
Summary of the coefficients (returns to schooling according to educational mismatch).

	1995	2002	2006
β_r	10.4	9.8	8.8
β_o	8.5	6.3	5.6
β_u	−5.6	−4.6	−4
$\beta_o - \beta_r$	−1.9	−3.5	−3.2
$\beta_u + \beta_r$	4.8	5.2	4.8

Table 4 summarizes the estimated ORU specification coefficients and the differences between the coefficients of over- and undereducation relative to the required education. From this table, one observes how the positive effect on wages of overeducation decreases over time. The negative values of the difference $(\beta_o - \beta_r)$ reflect the loss of income of a worker who has an extra year of overeducation compared with another who, with the same educational level, has achieved a proper match between the actual educational level and that required by the job. In this sense, one observes that the wage penalty for overeducation compared to appropriately allocated workers increased over time from 1.9% in 1995 to more than 3% in the first years of the present century. The sum $(\beta_u + \beta_r)$ indicates the additional wages received by a worker who has an extra year of undereducation compared with another who, with the same years of schooling, performs a job which matches her educational level. In this case, one observes that the return to an additional year of undereducation tends to remain stable at around 5% throughout the period analyzed.

4. Conclusions

The analysis of overeducation and its consequences has aroused notable interest in developed countries. The case of Spain is no exception, with most of the studies having focused on identifying the determinants of educational mismatch and on the labour mobility of those individuals who have not found a proper match between their actual educational level and that required in their job. Few authors, however, have examined the effects of educational mismatch on wages and how the returns to education have evolved over time.

In this context, the present study has sought to contribute to this line of research, studying the evolution of returns to education from the mid-1990s to 2006 and examining the effects of educational mismatch on these returns. To this end, the existence of overeducation in the Spanish labour market was examined from two theoretical perspectives. First, Mincerian wage equations were estimated to study the private returns on investment in education and their evolution over time. Second, we considered the existence of mismatches between workers' educational level and that required by their jobs, and, by estimating ORU equations, the effect of such educational mismatches on wages. The longitudinal nature of the study, with calculations of returns to education at different times, endows this analysis with particular interest given the growth of Spain's educationally qualified workforce. Another contribution of the work has been the conjoint estimation of Mincerian wage equations and ORU equations. This provides a more comprehensive vision of the returns to education and enables one to distinguish between the returns associated with the worker's actual education and the education required by the job.

The results point to the existence of overeducation in the Spanish labour market, with a decline in returns to education in the period 1995–2006 that affected all educational levels. Moreover,

one observes that, during this period, between 55% and 60% of workers experienced educational mismatch in their jobs, some being undereducated and, more frequently, others overeducated. The ORU estimates showed that, for overeducated workers, this educational mismatch implies a wage penalty in excess of 3% in the last years of the study period. Finally, taking into account the degree of match between the education received by the worker and that required in the job, we found that the return to schooling is not uniform but depends on whether the worker has an educational level that is appropriate, higher, or lower than is required in her job, with the return to job-required schooling being greater than that corresponding to the worker's actual schooling.

From a policy perspective, the above results point to inefficiencies in the allocation of the educational resources, with a high percentage of workers experiencing a mismatch between the skills acquired through schooling and those required in their job. Given the intense process of human capital accumulation undergone by the Spanish economy it would be necessary to tackle the structural reforms needed in order to take advantage of this investment. The high unemployment rate of the Spanish economy should also be taken into account. Investment on education can significantly contribute to alleviate the severe unemployment problem in Spain, but to fully take advantage of this investment it would be necessary to introduce structural reforms which allow the more educated individuals to find a job and that the requirements of that job are in accordance to their qualifications. If the Spanish economy intends to transform its model of economic growth to one based on knowledge and innovation, its job structure will have to adapt to fit this new model of production so that the more highly qualified workers can find a job that corresponds to their educational level. This would contribute to achieving a more efficient allocation of productive resources, with the consequent positive impact on the competitiveness of the Spanish economy.

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Annex A.

Table A.1
Descriptive statistics: average schooling and educational levels.

	1995	2002	2006
Sample size	132 050	136 113	147 048
Average schooling (years)	8.99	9.53	9.78
Percentage distribution of the sample by education level			
Less than primary	2.46	0.00	0.09
Primary	30.94	28.23	27.61
*SEC*1	31.32	31.04	28.39
*SEC*2	11.73	10.75	11.17
MVT	4.81	6.48	6.44
UVT	8.08	9.25	9.44
Diplomature	4.91	5.83	6.47
University graduate (*B.A.*)	5.74	8.42	10.39

Table A.2
Wage equation by educational level.

	1995	2002	2006
Constant	0.9052 (154.10)	1.3332 (238.30)	1.5611 (288.58)
*SEC*1	0.1051 (32.26)	0.0813 (24.71)	0.0725 (23.20)
*SEC*2	0.5403 (123.73)	0.4096 (90.48)	0.3462 (82.84)
MVT	0.3678 (60.88)	0.3190 (58.39)	0.2945 (57.37)
UVT	0.5266 (104.68)	0.4653 (96.09)	0.4157 (92.60)
Diplomature	0.8126 (134.25)	0.7165 (123.24)	0.6041 (115.45)
University graduate (*B.A.*)	1.1205 (191.54)	0.9511 (182.99)	0.8275 (182.42)
Experience	0.0553 (129.82)	0.0432 (98.44)	0.0377 (90.32)
Experience^2	−0.0006 (−84.25)	−0.0004 (−56.85)	−0.0004 (−54.21)
R^2	0.3567	0.2946	0.2541
Standard deviation	0.4369	0.4521	0.4418
F-Statistic	1 6291.05	7 105.7	6262.09
Observations	132 050	136 113	147 48

Note: *t*-Statistics in parentheses.

Table A.3
Average years of schooling and percentage distribution of the sample distinguished by degree of educational match.

	1995	2002	2006
Appropriately schooled			
Average schooling (years)	8.79	9.31	9.27
Percentage of the sample	43.94	42.50	39.83
Overschooled			
Average schooling (years)	10.37	11.17	11.52
Percentage of the sample	35.30	31.88	37.21
Underschooled			
Average schooling (years)	7.64	7.83	7.83
Percentage of the sample	20.76	25.62	22.96

References

Abowd, J. M., & Kramarz, F. (1999). The analysis of labour markets using matched date employer–employee data. In O. Ashenfelter, & D. Card (Eds.), *Handbook of labor economics*. North-Holland.

Adelman, I., & Levy, A. (1984). The equalizing role of human resource intensive growth strategies: A theoretical model. *Journal of Policy Modeling*, *6*(2), 271–287.

Aguilar, M. I., & García-Crespo, D. (2008). Desajuste educativo y salarios en España: Nueva evidencia con datos de Panel. *Estadística Española*, *50*(168), 393–426.

Alba-Ramírez, A. (1993). Mismatch in the Spanish labour market: Overeducation? *The Journal of Human Resources*, *28*, 259–278.

Arrazola, M., & de Hevia, J. (2008). Three measures of returns to education: An illustration for the case of Spain. *Economics of Education Review*, *27*, 266–275.

Arrazola, M., & de Hevia, J. (2006). Gender differentials in returns to education in Spain. *Education Economics*, *14*(4), 469–486.

Barceinas, F., Oliver, J., Raymond, J. L., & Roig, J. L. (2000). Los rendimientos de la educación y la inserción laboral en España. *Papeles de Economía Española*, *86*, 128–148.

Bauer, T. K. (2002). Educational mismatch and wages: A panel analysis. *Economics of Education Review*, *21*, 221–229.

Becker, G. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. New York: National Bureau of Economic Research.

Budría, S., & Moro-Egido, A. (2008). Education, educational mismatch and wage inequality: Evidence for Spain. *Economics of Education Review*, *27*(3), 332–341.

Caparrós, A., Gamera, C., Marcenaro, A., & Navarro, L. (2001). *Un análisis comparativo del rendimiento de la educación en España*. Murcia: X Jornadas de la Asociación de la Economía de la Educación. http://www.revecap.com/encuentros/anteriores/viieea/autores/A/149.doc

Cohn, E., & Khan, S. (1995). The wage effects of overschooling revisited. *Labour Economics*, *2*(1), 67–76.

Cohn, E., & Ng, Y. C. (2000). Incidence and wages effects of overschooling and underschooling in Hong Kong. *Economics of Education Review*, *19*(2), 159–168.

Daly, M. C., Büchel, F., & Duncan, G. J. (2000). Premium and penalties for surplus and deficit education: Evidence from United States and Germany. *Economics of Education Review*, *19*(2), 169–178.

Dolado, J. J., Felgueroso, F., & Jimeno, J. F. (2000). Youth labour market in Spain: Education, training and crowding-out. *European Economic Review*, *44*, 943–956.

Duncan, G., & Hoffman, S. D. (1981). The incidence and wage effects of overeducation. *Economics of Education Review*, *1*(1), 75–86.

Duval, R., & de la Maisonneuve, C. (2010). Long-run growth scenarios for the world economy. *Journal of Policy Modeling*, *32*(1), 64–80.

García-Mainar, I., & Montuenga, V. (2005). Education returns of wage earners and self-employed workers: Portugal vs. Spain. *Economics of Education Review*, *24*(2), 161–170.

García-Montalvo, J. (1995). Empleo y sobrecualificación: el caso español. *Documento de trabajo 95-20*. FEDEA.

García-Montalvo, J., & Peiró, J. M. (2009). *Análisis de la sobrecualificación y la flexibilidad laboral*. Fundación Bancaja.

García-Serrano, C., & Malo, M. A. (1996). Desajuste educativo y movilidad laboral en España. *Revista de Economía Aplicada*, *11*(4), 105–131.

Groot, W. (1993). Overeducation and the returns to enterprise-related schooling. *Economics of Education Review*, *12*, 299–309.

Hamermesh, D. (2008). Fun with matched firm-employee data: Progress and road maps. *Labour Economics*, *15*(4), 662–672.

Hartog, J. (2000). Over-education and earnings: Where are we, where should we go? *Economics of Education Review*, *19*, 131–147.

Hartog, J., & Oosterbeek, H. (1998). Health, wealth and happiness: Why pursue a higher education? *Economics of Education Review*, *17*(3), 245–256.

Jorgenson, D. W., Goettle, R. J., Ho, M. S., Slesnick, D. S., & Wilcoxen, P. J. (2008). Growth, productivity, and wages in the U.S. economy U.S. labor supply and demand in the long run. *Journal of Policy Modeling*, *30*(4), 603–618.

Kiker, B. F., Santos, M. C., & Mendes de Oliviera, M. (1997). Overeducation and undereducation: Evidence for Portugal. *Economics of Education Review*, *16*(2), 111–125.

Lassibille, G., & Navarro, L. (1998). The evolution of returns to education in Spain: 1980–1991. *Education Economics*, *6*(1), 3–10.

Mendes de Oliveira, M., Santos, M. C., & Kiker, B. F. (2000). The role of human capital and technological change in overeducation. *Economics of Education Review*, *19*, 199–206.

Mincer, J. (1974). *Schooling, experience and earnings*. New York: Columbia University Press.

Ministerio de Educación. (2007). *Indicadores de la educación y publicaciones de síntesis*. Madrid.

OECD. (2008). *Education at a glance*. Paris: OECD.

Oliver, J., Raymond, J. L., Roig, J. L., & Barceinas, F. (1999). Returns to human capital in Spa. In A. survey of the evidence, R. in: Asplund, & Q. P. Pereira (Eds.), *Returns to human capital in Europe: A literature review, ETLA*. Helsinki: The Research Institute of Finnish Economy.

Pastor, J. M., Raymond, J. L., Roig, J. L., & Serrano, L. (2009). *El rendimiento del capital humano en España*. Fundación Bancaja.

Psacharopoulos, G. (1980). Returns to education: An updated international comparison. In T. King (Ed.), *Education and income* (pp. 73–109). World Bank, Staff Working Paper, no. 402.

Raymond, J. L., Roig, J. L., & Gómez, L. M. (2009). Rendimientos de la educación en España y movilidad intergeneracional. *Papeles de Economía Española*, *119*, 188–205.

Rice, R. (1981). Can educational policy affect the distribution of earnings? A quantitative exploration. *Journal of Policy Modeling*, *3*(3), 317–335.

Rosenzweig, M. R. (1988). Human capital, population growth, and economic development: Beyond correlations. *Journal of Policy Modeling*, *10*(1), 83–111.

Rumberger, R. W. (1981). The rising incidence of overeducation in the US labour market. *Economics of Education Review*, *1*, 293–314.

Salinas-Jiménez, M., Alvarez-Ayuso, I., & Delgado-Rodríguez, M. J. (2006). Capital accumulation and TFP growth in the EU: A production frontier approach. *Journal of Policy Modeling*, *28*(2), 195–205.

San Segundo, M. J. (1997). Educación e ingresos en el mercado de trabajo español. *Cuadernos económicos del I.C.E.*, *63*, 105–125.

Schultz, T. W. (1961). Investment in human capital. *American Economic Review*, *51*(1), 1–17.

Sicherman, N. (1991). Overeducation in the labour market. *Journal of Labor Economics*, *9*(2), 101–122.

Spence, M. (1973). Job market signalling. *Quarterly Journal of Economics*, *87*, 355–374.

Teixeira, P. (1999). Investment in good jobs. *Journal of Policy Modeling*, *21*(6), 769–779.

Thurow, L. C. (1975). *Generating inequity*. New York: Basic Books.

Tsang, M. C., & Levin, H. M. (1985). The economics of overeducation. *Economics of Education Review*, *4*(2), 93–104.

Tsang, L. C., Russell, W., Rumberger, W., & Levin, H. M. (1991). The impact of surplus schooling on worker productivity. *Industrial Relations*, *30*(2), 209–228.

Verdugo, R. R., & Verdugo, N. T. (1989). The impact of surplus schooling on earnings. Some additional findings. *Journal of Human Resources*, *24*(4), 629–643.

Vila, L., & Mora, J. G. (1998). Changing returns to education in Spain during the 1980s. *Economics of Education Review*, *17*(2), 173–178.