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Education, Over-education and Wage Inequality: Evidence for Spain

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RESUMO/ABSTRACT

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In this paper we use the European Community Household Panel to explore the connection between education, over-education, and wage-inequality in Spain for the period 1994-2001. Our central approach is based on quantile regression. We find that higher education is associated with higher wage dispersion. This indicates that an educational expansion towards higher education is expected, criteris paribus, to increase overall wage inequality. We find that over-education contributes to enlarge wage differentials within university graduates, still, over-education itself can not account for the positive association between higher education and wage dispersion. Finally, we show that over the last wage distribution of over-educated workers with university education became more dispersed. This process, together with an increasing proportion of over-educated workers, contributed to raise overall wage inequality through the within dimension.

KEYWORDS: Returns to education, over-education, quantile regression.

JEL Codes: C29, D31, I21.

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Abstract

In this paper we use the European Community Household Panel to explore the connection between education, over-education, and wage inequality in Spain for the period 1994-2001. Our central approach is based on quantile regression. We find that higher education is associated with higher wage dispersion. This indicates that an educational expansion towards higher education is expected, ceteris paribus, to increase overall wage inequality. We find that over-education contributes to enlarge wage differentials within university graduates. Still, over-education itself can not account for the positive association between higher education and wage dispersion. Finally, we show that over the last years the wage distribution of over-educated workers with university education became more dispersed. This process, together with an increasing proportion of over-educated workers, contributed to raise overall wage inequality through the within dimension.

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0. Introduction

In a recent book, Asplund and Barth (2005) summarize recent evidence on the connection between education and wage inequality in Europe. The dominating pattern in a majority of countries is substantial returns to education despite an increasing proportion of high-educated workers, higher wage dispersion within more educated individuals, and a slight increasing trend in wage inequality. Similar evidence is found for the U.S. (Buchinsky, 1994, Autor *et al.* 2004). In this paper, we use recent data to investigate the effects of education and over-education on the Spanish wage structure. We also investigate how these effects have evolved over the last years.

More educated individuals benefit from higher wages, more job quality and higher earnings growth during their working lives. On the basis of this evidence, it is frequently argued that policies aimed to increase average schooling levels are a useful tool to reduce economic inequality. However, recent evidence suggests that education may promote earnings differences. Using international data, Pereira and Martins (2004) have found that in most countries schooling has a positive impact on wage dispersion. As regards the literature for Spain, Barceinas *et al.* (2000), and Cantó *et al.* (2000) show that over the last decades, increases in wage differentials across education groups were partially responsible for the observed increase in wage inequality. Abadie (1997) analyzes changes in the Spanish income structure over the eighties, and finds a positive, though decreasing, association between education levels and within-groups dispersion. In a work related to ours, Febrer and Mora (2005) find that higher education has a positive effect on wage dispersion.

In this paper, we use the Spanish waves (1994-2001) of the European Community Household Panel (ECHP, henceforth) to explicitly explore the interplay between education, over-education, and wage inequality. Our central approach combines OLS with quantile regression. Estimation by OLS assumes that the marginal effect of schooling on wages is constant over the conditional wage distribution. In contrast, the use of quantile regression allows us to model the effects of schooling at different points of the wage distribution. By combining OLS and quantile regression we can decompose the impact of school qualifications on wage inequality into two channels: between-groups inequality and within-groups inequality. OLS returns to education are

a measure of between-groups inequality, for they represent the average difference between education groups. Differences in quantile returns are a measure of within-groups inequality, for they represent the wage differential between individuals in the same group but located at different quantiles.

According to our estimates, the wage premium earned by tertiary and secondary educated workers is about 40% and 16%, respectively, relative to the base case of individuals with less than secondary education. However, returns to education are not constant over the conditional wage distribution. Workers at high-pay jobs earn substantially higher returns from university education than workers at low-pay jobs. This is interpreted as a positive impact of higher education on wage dispersion.

While an increasing body of the literature has analyzed the impact of education on wage inequality, little is still known about the impact of over-education. Most researchers have defined an individual as being over-educated if he has education in excess of that required to do his job. Over-educated workers earn less than workers who have the same education but hold jobs for which they are adequately educated (Alba, 1993, Sloane *et al.* 1999, Sloane, 2002, Dolton and Silles, 2001). However, there is no evidence regarding the effects of over-education at different points of the wage distribution. This is unfortunate, as quantile returns can describe the marginal impact of over-education on within-groups inequality. If the pay penalty of over-education is higher for the earnings-poor, then an expansion in the proportion of over-educated workers is expected to deteriorate the labour market position of already disadvantaged individuals. Such expansion is expected, therefore, to increase wage inequality by enlarging the lower tail of the wage distribution.

Furthermore, over-education might account for the positive association between higher education and within-groups dispersion found in Pereira and Martins (2004) for a majority of industrialized countries. A situation where a proportion of university graduates take jobs with low skill requirement and low pay would be consistent with having increasing returns to higher education over the wage distribution. This hypothesis, which has been frequently suggested in the literature, has not been tested up to date.

With these knowledge gaps in mind, we contribute to the over-education literature by calculating the wage effects of over-education at different points of the wage distribution. This allows us to i) characterize the impact of over-education on within-groups dispersion, and ii) test whether over-education is responsible for the positive association between higher education and wage dispersion. If over-educated workers contribute to enlarge wage differentials among university graduates, then we should expect lower wage inequality among the group of university graduates who are not over-educated. Our results show that, first, over-education is associated with a substantial pay penalty and, thus, it contributes to enlarge wage differentials within education groups. Second, the impact of over-education on wages (and, thus, on within-groups inequality) is not constant over the wage distribution. Third, wage inequality among the high-educated is still large (though slightly lower) after controlling for over-education. This result indicates that over-education itself can not account for the higher wage dispersion found among university graduates.

We also explore the evolution of the returns to education for the period 1994-2001. In recent decades, average schooling levels have increased dramatically in Spain. This process has been intense during the nineties. Among the 25-64 age group, the proportion of individuals with less than upper secondary education fell from 78% in 1991 to 58% in 2001, while the proportion of individuals with completed tertiary education rose from 10% in 1991 to 24% in 2001 (OECD, 2004). Alongside the increase in average schooling levels, a large proportion of high-educated workers entered jobs that required less schooling than they had obtained. As these workers are typically penalised in terms of wages, it is intriguing to speculate that a rise in the proportion of over-educated workers may have resulted into higher wage dispersion within educational groups.

Our estimates show that average returns to education decreased over the period considered. This process was not homogenous across population groups. It was more pronounced for workers with a university degree and over-educated women, and less pronounced for men with university education at the bottom tail of the wage distribution and women with university education at the top tail of the wage distribution. As regards the effects of over-education on wage inequality, we find increasing wage dispersion within over-educated workers with a

tertiary level. This process, together with the rising proportion of over-educated workers in the Spanish labour market, had a positive impact on within-groups inequality.

The rest of the paper is organized as follows. Section 1 briefly presents the data set, variables, and estimating sample used in the paper. Section 2 motivates the analysis by reporting some facts on wage inequality in Spain. Section 3 presents the quantile regression model. Section 4 explores the relation between education and wage inequality using cross-section data for the year 2001. Section 5 documents changes in the conditional wage structure that have taken place over the last years. The role that education and over-education have had in shaping the wage distribution is discussed. Section 6 presents the concluding remarks. The paper includes additionally two Appendices. Appendix A contains a detailed description of the data source and variables used in the analysis. Appendix B contains additional tables.

1. Data and Variables

We use the Spanish waves of the ECHP. This survey contains personal and labour market characteristics, including monthly wage, maximum level of completed education, hours worked, tenure, experience, sector, firm size, marital status and immigrant condition, and covers the 1994-2001 period.

We focus on wage earners in the private sector, aged between 18 and 60, who work normally between 15 and 80 hours a week, and are not employed in the agricultural sector. Thus, self-employed individuals, as well as those whose main activity status is paid apprenticeship, training, and unpaid family worker have been excluded from the sample.

In the ECHP individuals are asked to report the maximum level of education that they have completed according to three categories: less than upper secondary, upper secondary and tertiary education. For the sake of simplicity, throughout the paper we denote these categories by, respectively, primary or less, secondary, and tertiary education.

Table 1 contains a set of descriptive statistics. Relative to men, women work less hours, earn lower wages, are more educated, have less experience and tenure, and are more prone to work in the service sector.

---------- insert Table 1 about here -------

2. Some facts on wage inequality

During the second half of the eighties and the first half of the nineties wage inequality increased in Spain. This phenomenon was partially accounted for by the evolution of wage differentials across education groups (Barceinas *et al.,* 2000, Cantó *et al.*, 2000).

Using more recent data, we find that from 1994 onwards wage inequality tended to decrease. Changes were small, though. As Table 2 shows, the Gini index, the ratio between wages at the 1st and the 5th deciles, and the ratio between wages at the 1st and the 9th deciles fell, respectively, from .31, 1.91, and 4.46 to .30, 1.90, and 4.08. Differentiating between education groups, we find that wage inequality decreased within secondary and primary workers and increased within tertiary workers. At the end of the period, wage inequality is highest among the high-educated.

---------- insert Table 2 about here -------

We also found that inequality between education groups tended to decrease over the period considered. In 2001 tertiary and secondary workers earned, respectively, 47.0% and 13.2% more than workers in the lowest education category. In 1994, these differentials were 72.4% and 26.5%, respectively.

To sum up, the observed decrease in overall wage inequality can be attributed to decreases in within-groups inequality and, more primarily, between-groups inequality. This evidence is taken from raw statistics, which do not control for the groups' characteristics. In what follows, we investigate what has been the marginal contribution of education and over-education to the observed patterns.

3. The model

The quantile regression model can be written as

$$ln\, w_i = X_i \beta_\theta + e_{\theta i} \qquad \text{with } Quant_\theta(\, ln\, w_i | X_i) = X_i \beta_\theta \tag{1}$$

where X_i is the vector of exogenous variables and β_θ is the vector of parameters. $Quant_\theta(ln\ w_i|\ X_i)$ denotes the θth conditional quantile of *ln w* given *X*. The θth regression quantile, $0<\theta<1$, is defined as a solution to the problem

$$\underset{\beta \in R^k}{Min}\left\{ \sum_{i:y_i \geq x_i\beta} \theta |ln\ w_i - X_i\beta_\theta| + \sum_{i:y_i < x_i\beta} (1-\theta)|ln\ w_i - X_i\beta_\theta| \right\} \quad (2)$$

which, after defining the check function $\rho_\theta(z)=\theta z$ if $z \geq 0$ or $\rho_\theta(z)=(\theta - 1)z$ if $z < 0$, can be written as

$$\underset{\beta \in R^k}{Min}\left\{ \sum_i \rho_\theta(\ ln\ w_i - X_i\beta_\theta) \right\} \quad (3)$$

This problem is solved using linear programming methods. Standard errors for the vector of coefficients are obtainable by using the bootstrap method described in Buchinsky (1998).

The use of OLS assumes that the marginal impact of education is constant across quantiles. In this case, the marginal effect of having one additional level of education can be represented by a shift (to the right) of the conditional wage distribution. In contrast, by estimating quantile returns we can describe changes not only in the location but also in the shape of the conditional wage distribution. If returns to education are increasing over the wage distribution and we give an extra level of education to workers who are seemingly equal but located at different quantiles, then their wages will become more dispersed. Thus, differences in quantile returns can be used as a measure of within-groups inequality. Similarly, changes in the conditional returns can be used to describe changes in wage dispersion.

As a starting point, we propose Specification 1 to calculate returns to schooling,

$$ln\,w_i = \alpha_\theta + \delta_{\theta 1} X_i + \beta_{\theta 1}\, secondary_i + \beta_{\theta 2} tertiary_i + e_{\theta i} \quad (4)$$

where *ln* w_i is the logarithm of the gross hourly wage and X_i is a vector of explanatory variables, including experience (and squared), tenure, marital status, immigrant condition, sector (industry or service), and firm size. The construction of these variables is described in Appendix A. The

dummies *secondary* and *tertiary* are activated only when the individual's maximum level of education is, respectively, secondary or tertiary education. Thus, *primary education or less* is the excluded education category.

The use of dummies rather than years of schooling is motivated by two reasons. First, the use of education groups highlights the non-linearities of the response of wages to additional education. As we show, dispersion across quantiles increases non-monotonically as we move towards higher levels of education. Second, we believe that the labour market reward to formal qualifications is better captured by levels rather than by years of schooling.

4. Empirical results

In this section we calculate OLS returns and conditional returns to education at five representative quantiles: .10, .25, .50, .75, and .90. This is done separately for men and women. To simplify the analysis, we do not control for female self-selection into the labour market[2].

In Table 3 we report the results. The full sets of coefficients are reported in Tables 1B and 2B in Appendix B.

---------- insert Table 3 about here -------

A glance to the OLS returns shows that more educated individuals earn significantly higher wages. The wage premium to a tertiary and secondary level is, respectively, 38.8% and 14.7% for men and 43.0% and 17.4% for women.

Next, we turn to the estimates at different quantiles. We find that returns to education are not constant over the wage distribution. Thus, for example, the average return to tertiary education

[2] This is also the perspective used in Gardeazabal and Ugidos (2004), who use spanish data to analyze the gender wage gap over the wage distribution. In a similar work, De la Rica, Dolado, and Llorens (2005) control for female selectivity and find, using the ECHP, that the inverse of the Mill's ratio is not significant in the wage equation. Based on this evidence, we assume that working women are a representative sample.

for men, 38.8%, masks a return of 29.6% in the lowest quantile and 53.0% in the top quantile. To facilitate the analysis, in Figures 1 and 2 we plot the quantile-return profiles. For men and women, the coefficient of tertiary education is clearly increasing as we move towards higher quantiles. That is, workers at high-pay jobs earn substantially higher returns from university education than workers at low-pay jobs. The coefficient of secondary education exhibits less dispersion across quantiles. Still, it is slightly increasing for men and decreasing for women.

---------- insert Figures 1 and 2 about here -------

The quantile analysis uncovers the connection between wage dispersion and tertiary education: the conditional wage distribution of workers with university education is more disperse than the conditional wage distribution of workers with less educational attainment. If we give tertiary education to workers who have the same observable characteristics but are located at different quantiles of the wage distribution, then their wages will become more dispersed. Thus, an educational expansion towards tertiary education is expected, ceteris paribus, to boost wage inequality.

4.1. Over-education

In this section, we split the sample into workers who are over-educated and workers who are in jobs commensurate with their qualifications. Then, we calculate conditional returns to education separately for the two groups. The return differential between these two groups corresponds to the pay penalty of over-education. By calculating this differential at different quantiles we can asses the impact of over-education on within-groups dispersion at different points of the wage distribution. In addition, this allows us to test whether wage inequality among university graduates is lower after controlling for over-education.

There are several approaches to measure the degree of over-education, each of one having its own limitations[3]. Following most other authors, we use the worker's self assessment regarding

[3] These approaches are basically three. The first method, "job analysis", involves the systematic evaluation by expert job analysts who judge the level and type of education required for particular occupations. The main drawback of this approach is that, due to the time and cost taken to analyze occupations, job requirements often become available long after they have been measured and are

the match between the worker's skills and the firm's job requirements. In particular, we use two questions included in the ECHP,

- *Do you feel that you have skills or qualifications to do a more demanding job than the one you have now?*
- *Have you had formal training or education that has given you skills needed for your present type of work?*

We consider as over-educated workers those who answer "yes" to the first question and "no" to the second question[4]. According to this definition, in 2001 the proportion of over-educated men and women was, respectively, 26.6% and 27.8%. These figures are in line with those reported for other countries[5].

To explore the effects of over-education, we propose Specification 2,

$$\ln w_i = \alpha_\theta + \delta_{\theta 1} X_i + \beta_{\theta 1}\, secondary_i + \beta_{\theta 2} tertiary_i + \beta_{\theta 3} oversecondary_i + \beta_{\theta 4} overtertiary_i + e_{\theta i} \qquad (5)$$

typically used for a very long period of time. Thus it does not take into account that technological and organizational developments may change the requirements. Moreover, such information is typically not available in most household surveys. The second method, the "statistical" approach, consists on measuring the mean (or median) level of schooling in each occupation and then classifying workers into under-educated, adequately-educated and over-educated, depending on whether their schooling level is, respectively, below, equal to, or above the mean (or median). The main weakness of this approach is that, due to jobs aggregation within occupations, it will always describe a certain proportion of workers as over-education. This will occur even if occupations are disaggregated at the 3-digit level (in the ECHP occupations are disaggregated only at the 2-digit level). Moreover, this method only looks at educational requirements, and disregards other human capital characteristics such as experience and skill. Finally, the third method uses the worker's self-assessment. In this case, the worker describes the educational attainment that he needs for his current job. This method has the advantage of analyzing individual jobs, rather than occupational categories. Moreover, it allows workers to report changes in the job requirements each time the survey is carried out. As a shortcoming, the method is based on the individual's perception, which may be biased. For further details on these measurement methods, see Hartog (2000) and Sloane (2002).

[4] Sloane (2002) warns that in some measures of over-education "reference is made to the level of education rather than the type of education. Thus a worker may still be mismatched if the level of education is appropriate, but its type inappropriate, such as an English graduate being hired as a statistician" (p. 7). By considering simultaneously the above questions, we take into account both the level and type of education. These questions have been also used by Alba and Blázquez (2002), who exploit the panel structure of the ECHP to investigate the relation between job promotions and over-education.

[5] See Groot and Van den Brink (2000) for a review of international studies analyzing the extent of over-education in several countries.

where *secondary* and *tertiary* are activated if the worker is not over-educated (adequately-educated, henceforth) and has, respectively, secondary or tertiary education, and *oversecondary* and *overtertiary* are activated if the worker is over-educated and has, respectively, secondary or tertiary education[6]. The reference category is workers with primary education or less[7].

As Table 4 shows, an over-educated worker earns less than a similarly educated worker whose skills are fully utilized. This wage differential is substantially large: 17.6% for men and 26.7% for women with university education and 14.1% for men and 12.7% for women with secondary education. Two things are worth noting. First, secondary education fails to attract a significant wage premium if the worker is over-educated. Second, the premium earned by over-educated women with a tertiary degree is lower than the premium earned by women with secondary education who are adequately-educated.

---------- insert Table 4 about here -------

These results indicate that, by driving a wedge between matched and mismatched workers, over-education has a positive impact on wage inequality within educational levels. The quantile analysis reveals that, moreover, this impact is not constant over the wage distribution. This can be better seen in Figures 3 and 4. The pay penalty of over-education differs across quantiles. For men in the tertiary group, it is much lower at the top quantile than at the other quantiles. This implies that among university graduates, over-education contributes to enlarge the middle and bottom part of the wage distribution. For men in the secondary group, the effects of over-education are larger at the top quantile than at the other quantiles. Within this group, thus, over-

[6] Our wage equation is inspired by Verdugo and Verdugo (1989), who use over-education dummies for different educational levels. An alternative specification that has been used in the literature is the ORU model, in which years of schooling are decomposed into required, surplus and deficit years of schooling in relation to those necessary to do the job. Relative to our wage equation, the ORU model has one advantage: it controls for the amount of over-education. However, it presents two shortcomings. First, it assumes that the impact of over-education on wages is constant over all education levels. Second, and more important, in the quantile regression framework the use of years of schooling rather than levels of education would assume that the marginal impact of education (and over-education) on within-groups dispersion is the same for all education levels. Clearly this is not the case, since, as we show, higher education has a much larger impact on within-groups dispersion than secondary and primary education.

[7] Note that our reference category, primary education or less, includes both adequately-educated and over-educated workers. This is motivated by the fact that, in computations not reported here, we found that over-education in this group is not associated with a statistically significant pay penalty.

education contributes to enlarge the top tail of the wage distribution. For women, the pay penalty of over-education fluctuates across quantiles without a clear tendency.

---------- insert Figures 3 and 4 about here ------

There are two additional findings arising from the quantile analysis. First, the differential between the tertiary and secondary level is increasing over the wage distribution. This pattern holds for men and women and for all possible comparisons between adequately-educated and over-educated workers. Thus, for example, over-educated men with higher education earn on average 4.6% and 18.7% more, respectively, than adequately-educated men with a secondary level and over-educated men with a secondary level. However, these differentials are -.02% and 13.1% in the bottom quantile and as high as 22.9% and 48.9% in the top quantile. According to these results, an educational expansion from secondary to tertiary education is expected, regardless of the educational match attained by university students, to increase overall wage inequality.

Second, the return to a tertiary level earned by the adequately-educated is increasing over the wage distribution, going from 32.9% to 52.2% among men and from 48.2% to 58.8% among women. This pattern indicates that over-education itself can not explain why conditional wage dispersion is substantially higher among university graduates than among workers with less education. Notwithstanding this, over-education contributes to enlarge wage differentials among university graduates. In Specification 1, the .90-.10 differential for the tertiary group was, respectively, 23.4% for men and 19.3% for women. In Specification 2 this differential is 19.3% for adequately-educated men and 10.6% for adequately-educated women. It seems, therefore, that in a world without educational mismatches the relation between higher education and wage dispersion would be existent but less acute.

An alternative interpretation of our results regards the quality of over-educated workers. Chevalier (2003) and Green *et al.* (1999) find evidence that over-educated workers have a weaker endowment of unobservable characteristics. They also report that some types of educational qualifications are associated with a higher probability of being over-educated. Thus, it may be argued that the over-educated earn less because they have lower ability and their

education is of lower quality or of the wrong type. These ideas are summarized by Sloane (2002), who argues that "what is referred in the literature as over-education simply reflects the heterogeneity of individual abilities and skills within particular qualifications" (p. 13). In this scenario, controlling for over-education would pick up these differences in abilities and skills and, consequently, would split the sample into groups with more homogenous characteristics. We should expect, therefore, that dispersion across quantiles within adequately-educated and over-educated workers is smaller than within a single group with adequately-educated and over-educated workers pooled together. As we have shown, dispersion across quantiles diminishes slightly after controlling for over-education. However, wage inequality is still large among adequately-educated workers with tertiary education. To put it differently, differences in ability, quality and type of education leading to over-education can not satisfactorily account for the dispersion of returns across quantiles. We suspect that other differences (in ability, quality and type of education) not necessarily leading to over-education may be responsible for the positive impact of higher education on wage dispersion. The acquisition of new data containing detailed information on the type of qualifications, ability scores, school quality, and occupational categories would prove fruitful to shed further light on this issue.

5. Changes over time

In this section we examine how the impact of education and over-education on wages evolved from 1994 to 2001. We draw on Specification 2 to perform the analysis.

In Table 5 we summarize changes in OLS returns to education. The general pattern is decreasing earnings differentials across education levels. As regards the impact of over-education on within-groups dispersion, we find different patterns. For men, the pay penalty of over-education decreased from 28.4% to 17.6% in the tertiary group and increased from 3.8% to 14.1% in the secondary group. For women, the pay penalty of over-education increased from 13.6% to 27.6% in the tertiary group and decreased from 15.7% to 12.7% in the secondary group. In other words, the role of over-education in generating within-groups dispersion became more acute among men with secondary education and women with higher education and less acute among men with tertiary education and women with secondary education.

The previous analysis is confined to changes in average wage differentials. Thus, it disregards changes in the conditional wage distribution of different population groups. To address this issue, in Figures 5-8 we analyze changes in quantile returns. The estimates for 1994 are reported in Table 3B of Appendix B. Increases (decreases) in the .90-.10 spread correspond to increases (decreases) in the dispersion of wages within groups.

---------- insert Figures 5-8 about here -------

We start by analyzing changes in the quantile-return profile for the adequately-educated workers. As Figures 5 and 6 show, education premia decreased, particularly for university graduates. Among men with university education and women with secondary education, this process was more pronounced at the middle and upper quantiles than at the bottom quantile. In other words, the wage distribution of these two groups became more compressed. Among women with university education, the decline of returns was more pronounced at the lower quantiles, which resulted in higher wage dispersion within this group. Overall, these results indicate that over the sample period the tendency of higher education to be more valued at high-pay jobs became less acute for men and more acute for women.

In Figures 7 and 8 we focus on the sample of over-educated workers. The most prominent result is the sharp increase in wage inequality within university graduates. From 1994 to 2001, the .90-.10 spread of tertiary education increased from 18.5% to 29.5% among men and from -27.4% to -3.6% among women. Over this period, therefore, the conditional wage distribution of over-educated workers with a university degree became substantially more dispersed[8]. This pattern could be the result of increasing heterogeneity within this group. A candidate explanation is greater variation in the type and quality of educational qualifications. In recent years, there has been an increase in the number of institutions providing higher education, which has probably contributed to enlarge skills differential among university graduates. Alongside this process, there have been important changes in the types of degrees provided by universities. Education, social, and media studies have become increasingly demanded. Whilst these courses have

[8] It is worth noting that in 1994 tertiary education appeared to be a better investment for the low-earnings women than for the high-earnings women. This situation, which contributed to reduce wage inequality among university graduates, disappeared by 2001.

become popular, students in these areas may have faced difficulties in finding adequate jobs and, consequently, have taken up mismatched work.

From the previous analysis, we can draw important conclusions regarding the role that tertiary education has had in shaping wage inequality. The wage premium earned by tertiary educated workers decreased over the period considered, which contributed to reduce wage inequality through the between- dimension. As regards within-groups inequality, different patterns across population groups emerge. On the one hand, changes in conditional dispersion were small among adequately-educated workers. Still, for university graduates in this group wage inequality decreased among men and increased among women. On the other hand, changes were substantial among over-educated workers with a university degree. For this group, the wage distribution became increasingly dispersed, which contributed to increase overall wage inequality through the within- dimension. In the case of women, this process was reinforced by an increase in the wage gap between the adequately-educated and the over-educated.

Furthermore, changes in the structure of pay were accompanied by changes in the composition of the workforce. On the one hand, the number of university graduates rose. Given the positive association between tertiary education and wage dispersion, this educational expansion had a positive impact on wage inequality. Alongside this process, the proportion of over-educated workers increased. From 1994 to 2001, it went from 16.7% to 26.6% among men and from 19.1% to 27.8% among women. Given that these workers are penalised in terms of wages, and the increasing wage dispersion among university graduates in this group, the expansion of the over-education phenomenon contributed to raise overall wage inequality through the within-dimension.

6. Conclusions

In this paper we explored the connection between education, over-education, and wage inequality in Spain. We used the quantile regression technique to calculate returns to education at different points of the wage distribution. Our findings were several. First, the returns to tertiary education are highly increasing as we move towards higher quantiles of the conditional wage distribution. Since higher education is a better investment for the earnings-rich, an

educational expansion towards tertiary education is expected, ceteris paribus, to boost overall wage inequality.

Second, over-educated workers earn substantially less than their adequately educated and matched peers. This market outcome results into higher wage dispersion within educational groups. Moreover, the impact of over-education on within-groups inequality is not constant over the wage distribution. Among men with university education, this impact is larger at the bottom tail of the distribution, while the opposite occurs among men with secondary education.

Third, we asked whether or not over-education is responsible for the positive association between higher education and within-groups dispersion. We found that, even though over-education contributes to enlarge wage differentials among university graduates, wage inequality is also large among adequately-educated workers in the tertiary level. We concluded, therefore, that over-education itself can not explain why the conditional wage distribution of workers with university education is more disperse than the conditional wage distribution of workers with less educational attainment. Arguably, there are a number of other potential causes. Higher dispersion in skill and ability requirements among individuals with higher education, and differences in the types and qualities of qualifications awarded by universities could account for some of the observed variation. A complementary view is that higher education does not function as a screening device and, consequently, the group of university graduates is rather heterogeneous in terms of ability. If ability interacts with schooling, then returns to education must be higher among workers at high-pay jobs, i.e., with more ability. The acquisition of new data containing detailed information on the type of qualifications, ability scores, school quality, and occupational categories may help to test these hypotheses.

Fourth, we investigated to what extent the over-education phenomenon has contributed to increase wage inequality in Spain. The proportion of over-educated workers rose markedly over the years considered. Alongside this process, important changes in the structure of pay took place. Among university graduates, wage dispersion rose substantially within over-educated workers and, in the case of women, the pay penalty of over-education increased. These changes resulted into higher wage dispersion.

A clear implication of our analysis regards the demand for education. To the extent that prospective students are not aware of the characteristics which will place them at some point of the wage distribution, the returns to their educational investment are largely unpredictable. This uncertainty is reinforced by the fact that they may end up in jobs for which they are over-educated and, thus, earn lower wages than their matched peers with similar education. It seems therefore that from an individual perspective investing in education is subject to a substantial amount of wage risk.

There are a number of reasons why policy makers should be concerned about over-education. Like unemployment, over-education could be seen as an indicator of the extent to which the labour market underutilises available human capital. Dolado *et al.* (2000) report that over the last years less educated workers have been crowded out from their traditional jobs towards jobs that require no educational qualifications, while a large proportion of high-educated workers has entered jobs that require less schooling than they have obtained. Considering education as an individual investment, this process has resulted in a huge waste of resources. Our results indicate that, in addition, it has had a positive impact on wage inequality.

We are aware that, from an individual perspective, over-education may be a temporary phenomenon. High-educated individuals may take up mismatched work to acquire other forms of human capital and move into matched work as their work experience increase. This "stepping stone" hypothesis has been suggested by Sicherman (1991). What is not in doubt, however, is that for some workers over-education is a long-run phenomenon[9]. Our findings indicate that if the incidence of over-education continues to increase, further and persistent wage inequality whithin high-educated workers can be expected.

Finally, there is evidence that in Europe the incidence of over-education has increased over time (Hartog, 2000). Unfortunately, existing knowledge on the connection between over-education and wage inequality is still too limited. Our analysis for Spain can be easily extended to other European countries that integrate the ECHP. The data harmonization provided by this data set would allow for a straight comparison between different countries. To our eyes, assessing the

[9] Thus, for example, Dolton and Vignoles (2000) and Sloane, Battu and Seaman (1999) have shown for the UK that a substantial fraction of workers remain in jobs for which they are over-qualified during long periods.

impact that the over-education phenomenon is having in the European wage structure is a compelling task for future research.

Appendix A. Description of data source and estimating samples

The European Community Household Panel (ECHP) is available from 1994 to 2001 for Spain. It has a sample size of about 5,000 households and 14,000 individuals, who are interviewed over time. They report personal and family characteristics, including marital and educational status, as well as gross monthly wages and worked hours. We have dropped workers with a monthly wage rate that is less than 10% or over 10 times the average wage. This correction for outliers affects only 1.9% of the total sample. In the following, we describe the variables used in the analysis,

Gross hourly wage. Defined as monthly gross salary in the main job divided by four times the weekly hours worked in the main job.

Level of education. Individuals are asked to report the maximum level of completed schooling, according to three categories: less than upper secondary, upper secondary, and tertiary education. These education categories are constructed following the ISCED-97 classification.

Experience. Defined as age minus age of first job.

Tenure. Defined as the difference between the year of the survey and the year of the start of the current job. We have constructed three categories: from 1 to 4 years, from 5 to 14 years, and 15 years or more.

Married. It is a dummy that takes the value 1 if the individual is married, zero otherwise.

Immigrant. It is a dummy activated if the individual was born in a foreign country.

Industry. It is a dummy that takes the value 1 if the individual works in the industry sector, zero if he works in the service sector. The agricultural sector, which accounted for 6% of the working population in 2001, was dropped on the account of the particularities of this sector.

Firm size. Individuals are asked to report the number of employees that actually work in their firm. We have constructed four categories, from 1 to 19 employees, from 20 to 99 employees, from 100 to 499 employees, and 500 employees or more.

Appendix B. Additional Tables

Table 1B. OLS and Quantile Regression (2001) – Dependent variable: Ln. Gross hourly wage

	Men					
	OLS	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
Tertiary	0.388***	0.296***	0.307***	0.336***	0.464***	0.530***
	(0.029)	(0.058)	(0.048)	(0.037)	(0.044)	(0.054)
Secondary	0.147***	0.105***	0.093***	0.152***	0.182***	0.162***
	(0.028)	(0.051)	(0.036)	(0.024)	(0.030)	(0.032)
Experience*100	0.039***	0.049***	0.032***	0.027***	0.025***	0.026***
	(0.005)	(0.009)	(0.006)	(0.005)	(0.004)	(0.005)
(Experience*100)^2	-0.001***	-0.001***	-0.001***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure: 5-14 years	0.208***	0.343***	0.201***	0.130***	0.118***	0.134***
	(0.026)	(0.056)	(0.029)	(0.026)	(0.024)	(0.054)
Tenure: ≥ 15 years	0.387***	0.511***	0.343***	0.264***	0.328***	0.464***
	(0.033)	(0.070)	(0.045)	(0.030)	(0.044)	(0.063)
Married	0.081***	0.176**	0.053	0.037	0.047	0.057*
	(0.027)	(0.079)	(0.037)	(0.026)	(0.032)	(0.035)
Immigrant	0.028	0.033	-0.142	0.049	-0.055	0.032
	(0.108)	(0.220)	(0.148)	(0.088)	(0.155)	(0.375)
Industry	0.023	0.102**	0.097***	0.052**	-0.067***	-0.121***
	(0.025)	(0.055)	(0.032)	(0.024)	(0.025)	(0.028)
Firm size: 20-99 employees	0.090***	0.077***	0.073	0.087***	0.099***	0.078***
	(0.028)	(0.054)	(0.030)	(0.022)	(0.026)	(0.027)
Firm size: 100-499 employees	0.166***	0.144***	0.210***	0.177***	0.213***	0.174***
	(0.041)	(0.063)	(0.042)	(0.032)	(0.030)	(0.043)
Firm size: ≥ 500 employees	0.263***	0.357***	0.251***	0.259***	0.234***	0.218***
	(0.043)	(0.054)	(0.038)	(0.041)	(0.050)	(0.061)
Constant	5.973***	5.184***	5.860***	6.174***	6.481***	6.713***
	(0.053)	(0.079)	(0.077)	(0.049)	(0.048)	(0.038)

Note: i) * signals significant at the 10% level, ** signals significant at the 5% level, and *** signals significant at the 1% level; ii) standard errors in parenthesis; iii) OLS estimation is heteroskedastic-robust; iv) quantile standard errors are obtained using 500 replications. The reference individual is a worker with less than secondary education, less than 5 years of tenure, single, not immigrant, working in the service sector in a firm with less than 20 employees

Table 2B. OLS and Quantile Regression (2001) – Dependent variable: Ln. Gross hourly wage

	Women					
	OLS	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
Tertiary	0.430***	0.375***	0.430***	0.414***	0.479***	0.568***
	(0.044)	(0.118)	(0.087)	(0.059)	(0.038)	(0.059)
Secondary	0.174***	0.240***	0.172***	0.154***	0.150***	0.198***
	(0.047)	(0.099)	(0.077)	(0.051)	(0.051)	(0.069)
Experience*100	0.045***	0.082***	0.050***	0.037***	0.027***	0.030***
	(0.007)	(0.015)	(0.009)	(0.007)	(0.006)	(0.010)
(Experience*100)^2	-0.001***	-0.002***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure: 5-14 years	0.379***	0.658***	0.406***	0.341***	0.240***	0.168***
	(0.041)	(0.110)	(0.073)	(0.052)	(0.039)	(0.069)
Tenure: ≥ 15 years	0.563***	0.648***	0.467***	0.556***	0.484***	0.383***
	(0.063)	(0.117)	(0.079)	(0.083)	(0.062)	(0.121)
Married	0.052	0.052	0.071*	-0.034	0.034	0.088**
	(0.039)	(0.092)	(0.045)	(0.042)	(0.037)	(0.045)
Immigrant	-0.344*	-0.242	-0.351	-0.171	-0.305*	0.163
	(0.210)	(0.759)	(0.289)	(0.201)	(0.171)	(0.312)
Industry	0.091**	0.338***	0.140***	0.065*	-0.017	-0.009*
	(0.040)	(0.103)	(0.063)	(0.041)	(0.038)	(0.052)
Firm size: 20-99 employees	0.105**	0.134***	0.156**	0.081*	0.048	0.064
	(0.046)	(0.076)	(0.081)	(0.045)	(0.049)	(0.060)
Firm size: 100-499 employees	0.195***	0.072*	0.198**	0.156***	0.188***	0.187**
	(0.057)	(0.101)	(0.088)	(0.060)	(0.053)	(0.086)
Firm size: ≥ 500 employees	0.249***	0.382	0.297**	0.197**	0.258***	0.210***
	(0.067)	(0.125)	(0.080)	(0.087)	(0.078)	(0.085)
Constant	5.614***	4.380***	5.251***	5.855***	6.158***	6.348***
	(0.071)	(0.165)	(0.139)	(0.076)	(0.066)	(0.067)

Note: i) * signals significant at the 10% level, ** signals significant at the 5% level, and *** signals significant at the 1% level; ii) standard errors in parenthesis; iii) OLS estimation is heteroskedastic-robust; iv) quantile standard errors are obtained using 500 replications. The reference individual is a worker with less than secondary education, less than 5 years of tenure, single, not immigrant, working in the service sector in a firm with less than 20 employees

Table 3B. Conditional returns to over-education by education levels (1994)

MEN	OLS	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
TERTIARY ADEQUATELY-EDUCATED	**0.504*****	0.346***	0.403***	0.478***	0.553***	0.628***
	(0.038)	(0.068)	(0.045)	(0.032)	(0.039)	(0.060)
TERTIARY OVER-EDUCATED	**0.220*****	0.134	0.165*	0.253***	0.224***	0.319***
	(0.076)	(0.263)	(0.113)	(0.071)	(0.079)	(0.164)
SECONDARY ADEQUATELY-EDUCATED	**0.203*****	0.152**	0.170***	0.172***	0.218***	0.252***
	(0.048)	(0.082)	(0.036)	(0.039)	(0.042)	(0.066)
SECONDARY OVER-EDUCATED	**0.165*****	0.145	0.201***	0.124***	0.108**	0.098
	(0.056)	(0.105)	(0.070)	(0.039)	(0.059)	(0.086)
WOMEN	OLS	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
TERTIARY ADEQUATELY-EDUCATED	**0.566*****	0.548***	0.531***	0.522***	0.605***	0.598***
	(0.067)	(0.205)	(0.083)	(0.055)	(0.052)	(0.048)
TERTIARY OVER-EDUCATED	**0.430*****	0.512***	0.484***	0.420***	0.350***	0.238
	(0.096)	(0.171)	(0.139)	(0.124)	(0.096)	(0.152)
SECONDARY ADEQUATELY-EDUCATED	**0.240*****	0.312**	0.249***	0.186***	0.206***	0.275***
	(0.054)	(0.136)	(0.061)	(0.051)	(0.050)	(0.051)
SECONDARY OVER-EDUCATED	**0.083**	0.151	0.074	0.092	0.218*	0.194**
	(0.218)	(0.552)	(0.376)	(0.145)	(0.145)	(0.142)

Note: i) * signals significant at the 10% level, ** signals significant at the 5% level, and *** signals significant at the 1% level; ii) standard errors in parenthesis; iii) OLS estimation is heteroskedastic-robust; iv) quantile standard errors are obtained using 500 replications. The reference individual is a worker with less than secondary education, less than 5 years of tenure, single, not immigrant, working in the service sector in a firm with less than 20 employees

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Tables

Table 1. Descriptive statistics (2001)

	Men		Women	
	Mean	St. dev	Mean	St. dev
No. of observations	1,749		937	
Age	37.00	10.54	34.13	9.58
Married	0.64	0.48	0.50	0.50
Immigrant	0.01	0.78	0.02	0.70
Weekly hours	43.32	7.27	38.70	6.19
Ln (monthly wage)	14.48	11.63	14.07	11.16
Ln (hourly wage)	6.78	8.26	6.51	7.95
Experience	19.14	12.25	14.07	10.91
Education				
Tertiary	25.27		37.25	
Secondary	22.18		26.25	
Primary	52.54		36.50	
Tenure				
0-4 years	56.83		64.57	
5-14 years	21.78		22.84	
≥ 15 years	9.26		5.12	
Sector				
Industry	56.95		25.72	
Services	43.05		74.28	
Firm size				
1-19 employees	46.77		53.26	
20-99 employees	29.90		25.29	
100-499 employees	14.87		14.73	
≥ 500 employees	8.46		6.72	

Table 2. The evolution of inequality by education groups (from 1994 to 2001)

	Total Sample			Tertiary			Secondary			Primary		
	Gini	**W1/W5**	**W1/W9**	Gini	W1/W5	W1/W9	Gini	W1/W5	W1/W9	Gini	W1/W5	W1/W9
2001	**0.30**	**1.90**	**4.08**	0.30	1.80	4.21	0.29	1.80	4.07	0.24	1.58	3.23
1994	**0.31**	**1.91**	**4.46**	0.28	1.78	3.56	0.29	1.86	4.14	0.26	1.64	3.93

Table 3. Conditional returns to education (2001)

MEN	**OLS**	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
TERTIARY	**0.388*****	0.296***	0.307***	0.336***	0.464***	0.530***
	(0.029)	(0.058)	(0.048)	(0.037)	(0.044)	(0.054)
SECONDARY	**0.147*****	0.105**	0.093***	0.152***	0.182***	0.162***
	(0.028)	(0.051)	(0.036)	(0.024)	(0.030)	(0.032)
WOMEN	**OLS**	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
TERTIARY	**0.430*****	0.375***	0.430***	0.414***	0.479***	0.568***
	(0.044)	(0.118)	(0.087)	(0.059)	(0.038)	(0.059)
SECONDARY	**0.174*****	0.240**	0.172***	0.154***	0.150***	0.198***
	(0.047)	(0.099)	(0.077)	(0.051)	(0.051)	(0.069)

Note: i) * signals significant at the 10% level, ** signals significant at the 5% level, and *** signals significant at the 1% level; ii) standard errors in parenthesis; iii) OLS estimation is heteroskedastic-robust; iv) quantile standard errors are obtained using 500 replications. The reference individual is a worker with less than secondary education, less than 5 years of tenure, single, not immigrant, working in the service sector in a firm with less than 20 employees

Table 4. Conditional returns to education and over-education by education levels (2001)

MEN	**OLS**	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
TERTIARY ADEQUATELY-EDUCATED	**0.415*****	0.329***	0.335***	0.378***	0.495***	0.522***
	(0.038)	(0.074)	(0.042)	(0.033)	(0.039)	(0.036)
TERTIARY OVER-EDUCATED	**0.239*****	0.185	0.184**	0.222***	0.242***	0.480***
	(0.082)	(0.242)	(0.096)	(0.055)	(0.085)	(0.157)
SECONDARY ADEQUATELY-EDUCATED	**0.193*****	0.187***	0.121***	0.173***	0.204***	0.251***
	(0.034)	(0.061)	(0.038)	(0.036)	(0.038)	(0.041)
SECONDARY OVER-EDUCATED	**0.052**	0.054	-0.049	0.077	0.067**	-0.009
	(0.041)	(0.061)	(0.058)	(0.057)	(0.029)	(0.043)
WOMEN	**OLS**	θ =.10	θ =.25	θ =.50	θ =.75	θ =.90
TERTIARY ADEQUATELY-EDUCATED	**0.472*****	0.482***	0.470***	0.449***	0.541***	0.588***
	(0.051)	(0.132)	(0.091)	(0.059)	(0.049)	(0.066)
TERTIARY OVER-EDUCATED	**0.205****	0.281**	0.070	0.218**	0.252***	0.245***
	(0.097)	(0.257)	(0.184)	(0.075)	(0.095)	(0.085)
SECONDARY ADEQUATELY-EDUCATED	**0.210*****	0.303***	0.229***	0.162***	0.167***	0.233***
	(0.046)	(0.104)	(0.062)	(0.050)	(0.054)	(0.059)
SECONDARY OVER-EDUCATED	**0.083**	0.204	0.021	0.025	0.114**	0.052
	(0.085)	(0.273)	(0.143)	(0.090)	(0.062)	(0.117)

Note: i) * signals significant at the 10% level, ** signals significant at the 5% level, and *** signals significant at the 1% level; ii) standard errors in parenthesis; iii) OLS estimation is heteroskedastic-robust; iv) quantile standard errors are obtained using 500 replications. The reference individual is a worker with less than secondary education, less than 5 years of tenure, single, not immigrant, working in the service sector in a firm with less than 20 employees

Table 5. OLS returns to education and pay penalty of over-education (1994-2001)

MEN WITH TERTIARY EDUCATION	1994	2001	2001–1994
ADEQUATELY-EDUCATED	50.4	41.5	-8.9
OVER-EDUCATED	22.0	23.9	1.9
PAY PENALTY OF OVER-EDUCATION	28.4	17.6	-10.8
MEN WITH SECONDARY EDUCATION	1994	2001	2001–1994
ADEQUATELY-EDUCATED	20.3	19.3	-1.0
OVER-EDUCATED	16.5	5.2	-11.3
PAY PENALTY OF OVER-EDUCATION	3.8	14.1	10.3
WOMEN WITH TERTIARY EDUCATION	1994	2001	2001–1994
ADEQUATELY-EDUCATED	56.6	47.2	-9.4
OVER-EDUCATED	43.0	20.5	-22.5
PAY PENALTY OF OVER-EDUCATION	13.6	27.6	14.0
WOMEN WITH SECONDARY EDUCATION	1994	2001	2001–1994
ADEQUATELY-EDUCATED	24.0	21.0	-3.0
OVER-EDUCATED	8.3	8.3	0.0
PAY PENALTY OF OVER-EDUCATION	15.7	12.7	-3.0

Figures

Figure 1 – Conditional returns to education – Men (2001)

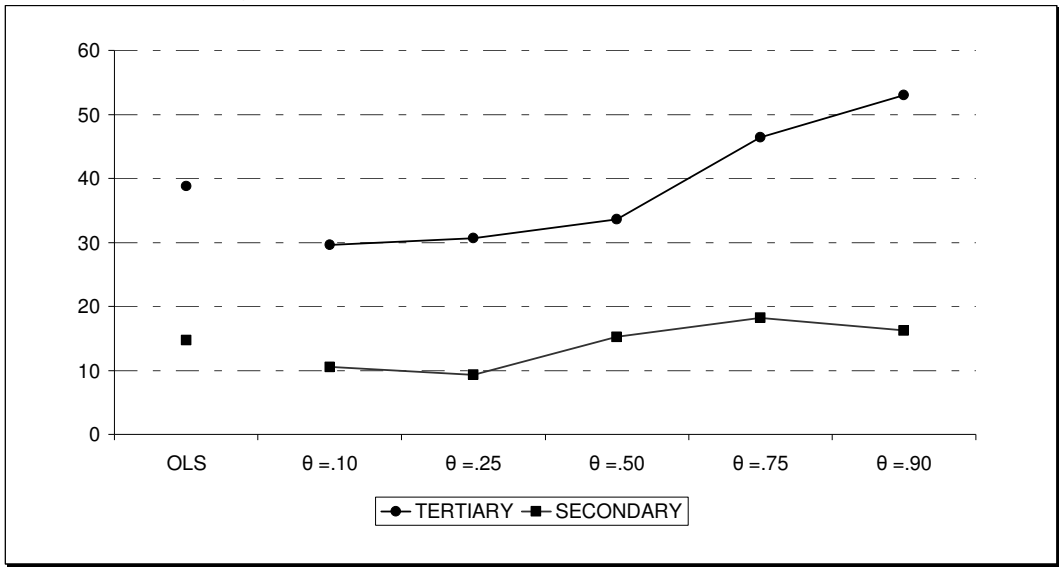

Figure 2 – Conditional returns to education – Women (2001)

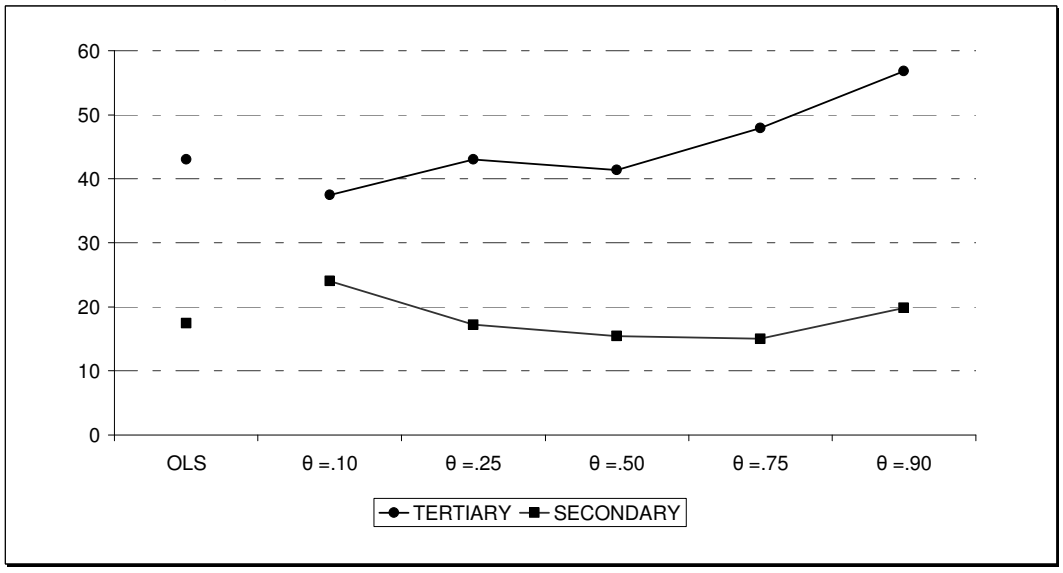

Figure 3 – Conditional returns to education and over-education – Men (2001)

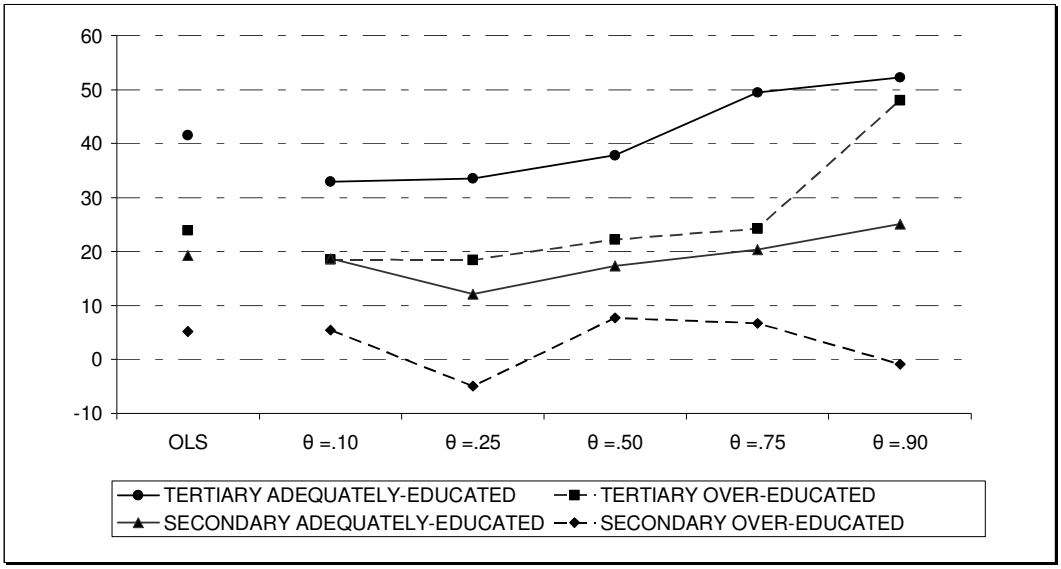

Figure 4 – Conditional returns to education and over-education – Women (2001)

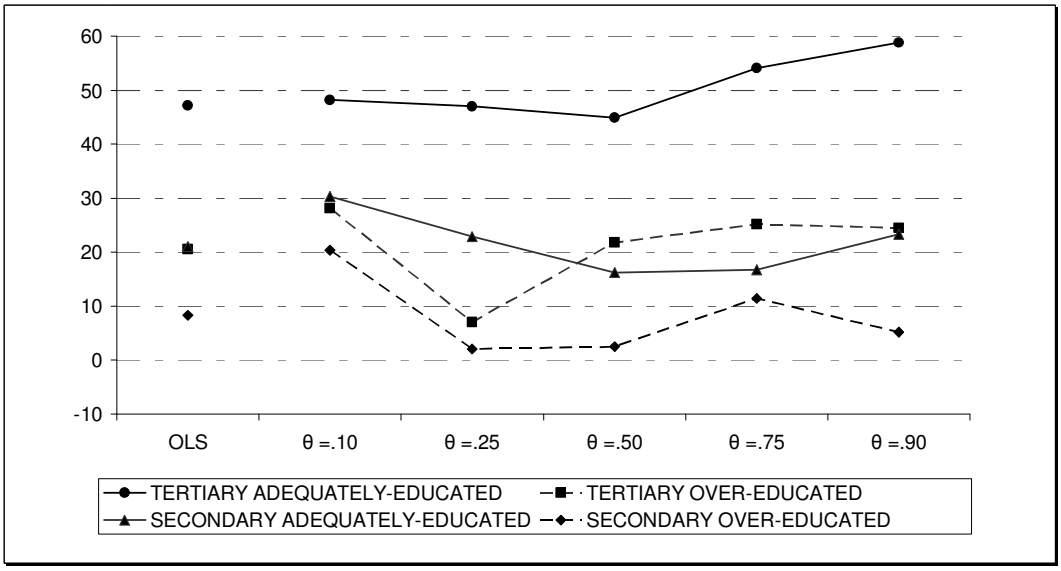

Figure 5 – Changes in conditional returns to education – Men (1994-2001)

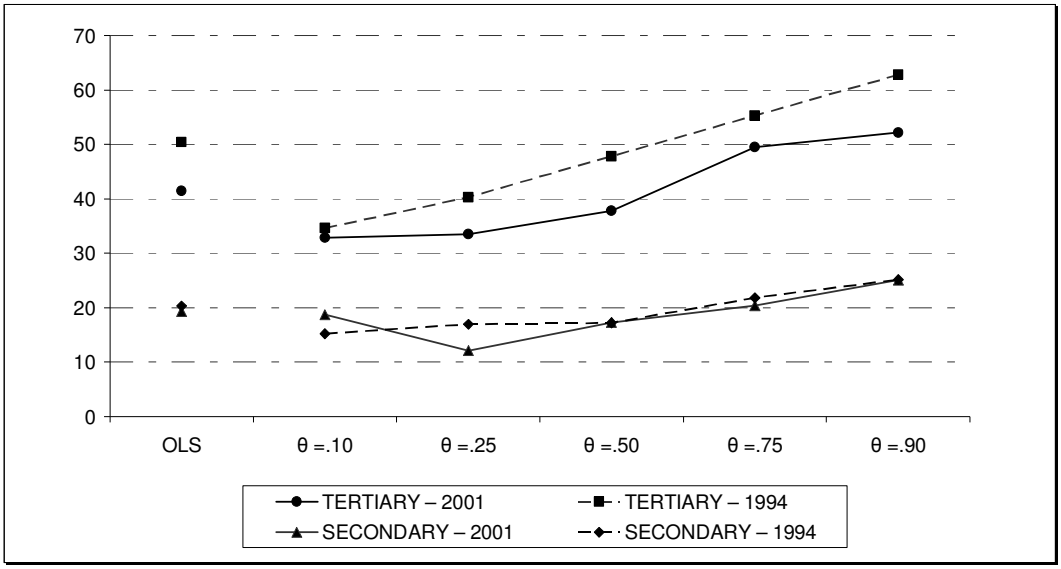

Figure 6 – Changes in conditional returns to education – Women (1994-2001)

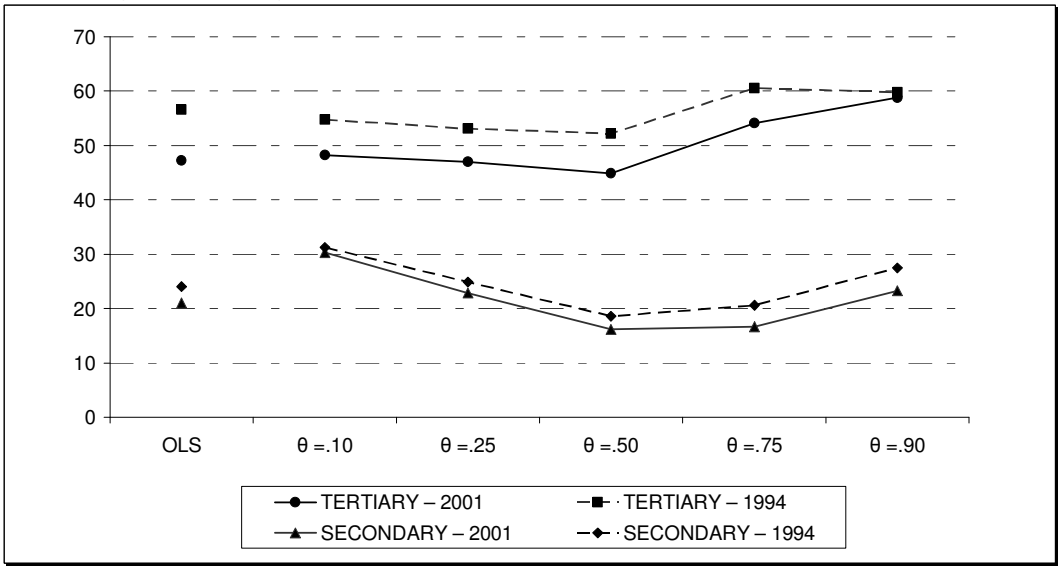

Figure 7 – Changes in conditional returns to over-education – Men (1994-2001)

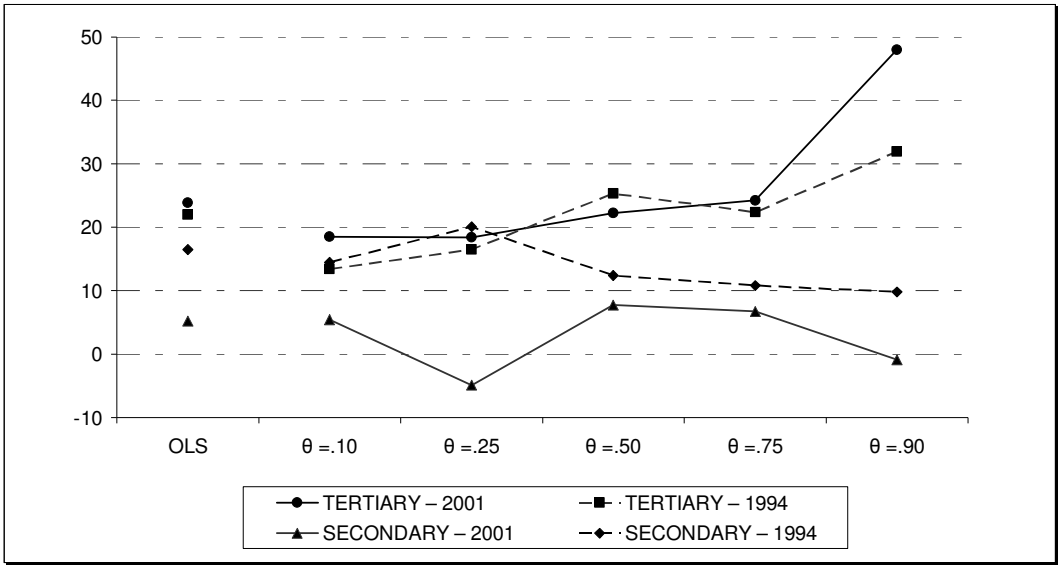

Figure 8 – Changes in conditional returns to over-education – Women (1994-2001)