Title: The signalling role of over-education and qualifications mismatch

Authors: Inmaculada Garcia-Mainar, Victor M. Montuenga

PII: S0161-8938(19)30022-5
DOI: https://doi.org/10.1016/j.jpolmod.2019.02.015
Reference: JPO 6497

To appear in: *Journal of Policy Modeling*

Received date: 22 July 2018
Revised date: 12 January 2019
Accepted date: 8 February 2019

Please cite this article as: Garcia-Mainar I, Montuenga VM, The signalling role of over-education and qualifications mismatch, *Journal of Policy Modeling* (2019), https://doi.org/10.1016/j.jpolmod.2019.02.015

The signalling role of over-education and qualifications mismatch

Inmaculada Garcia-Mainar , Victor M. Montuenga*

**Department of Economic Analysis, University of Zaragoza, C/ Gran Vía 2, 50005, Zaragoza, Spain (e-mail: vimontue@unizar.es)*

Corresponding author: Victor M. Montuenga

Address: *Department of Economic Analysis, University of Zaragoza, C/ Gran Vía 2, 50005, Zaragoza, Spain* E-mail: *vimontue@unizar.es*

Abstract

Over-education may arise from the voluntary decisions of individuals to acquire more qualifications than those required in the workplace, such that over-education may have a signaling role that allows workers to compensate for the lack of certain other skills, or to gain access to the labor market. This paper analyses the signaling role of over-education in Spain, a country characterised by a strongly-segmented labor market with high unemployment levels, and a large number of over-educated. Using micro data for a representative sample of Spanish workers, three different methods are applied to provide evidence that educational mismatch plays a clear signaling role. Policy implications are derived to alleviate inefficiencies in the allocation of educational resources and in the incentives of workers to use over-education as a signal.

JEL classification: I26, J24, J28

Keywords: human capital, over-education, rate of return, signaling

1. Introduction

In the literature of the economics of education, human capital and signaling theories are often advanced to explain the positive relationship between years of education (or credentials) and wages. If education is productivity-enhancing, then public funding of education is taken for granted (Annabi, 2017). By contrast, if education has only a signaling role, public expenditure on education is a waste of resources. Whereas the empirical consensus concludes that signaling may play a role, this is minimal compared with the productivity-enhancing role, and there is increasing evidence at the international level that a significant proportion of workers are employed in jobs requiring less education than they have obtained (OECD 2011). This phenomenon of over-education is a matter of great interest in current research (see the meta-analyses by Groot and Maassen van den Brink 2000; Rubb 2003, and the surveys by Hartog 2000; Sloane 2003; McGuinness 2006; and Leuven and Oosterbeek 2011). Whereas over-education is routinely considered to be suboptimal, a consequence of a mismatch due to search or job frictions, the increasing dispersion in ability and/or skills among equally-educated workers may induce individuals to voluntarily acquire more qualifications than those they can productively use in their jobs (McGuinness and Sloane, 2011).

The potential role of over-education as a signaling device has been frequently overlooked in the literature. This low interest stems from the general belief that over-education is a source of inefficiency and is a deviation from the rational behavior of individuals, since over-education entails lower wages than earned by equally-educated workers who are in properly-matched jobs. Under a signaling approach, however, over-education may be inefficient at the social level, but it may, in fact, stem from rational individual behavior. Less experienced or less able workers may over-educate to signal employers that they are indeed qualified for a job, to compensate for the lack of other skills or to disguise themselves among other equally-educated, but more able, individuals. Firms may find over-education useful in assessing the ranking of a particular individual on the ability spectrum (Green et al. 2002), or as an indication of adaptive capacities (Lene 2011). The signaling role of over-education may be especially important in periods of recession, and/or in areas where unemployment is high, since the decision to invest in education is not only regarded as a way to have access to higher wages but also as a way of insuring against unemployment (Arulampalam 2001; Charlot et al. 2005; Fernandez 2006). Albrecht and Vroman (2002) and Verhaest and Omey (2009) show that being unemployed produces a greater stigma than working at a job for which the individual is

over-educated. Similarly, Iriondo and Perez-Amaral (2016) argue that individuals who experience an involuntary job change and/or significant periods of unemployment are more likely to be over-educated.

In this context, the excess of education may constitute an additional waste of resources when it is publicly funded, with social returns being below private returns (Iriondo and Perez-Amaral, 2016). Whether or not this is the case, policy measures aiming to reduce over-education -due to mismatch, mobility costs, or asymmetric information- may be insufficient if incentives for the voluntary acquisition by individuals of additional education remain. Additional policies should then be implemented in order to reduce the signaling role of over-education. The aim of this paper is to examine the possible role of signaling in the generalization of over-education in the Spanish labor market and the proposal of policies to alleviate the associated problems.

Spain is an interesting case study for several reasons. First, from an international perspective, the proportion of over-educated workers is among the highest within the OECD countries (using the statistical method, OECD (2011) shows that one third of workers in Spain are over-educated and one fourth are severely over-educated).[1] Second, employment protection legislation has been quite restrictive, at least until the last labor reform in 2012,[2] which generated a strongly-segmented market between permanent and temporary workers. The temporary rate has been the highest within the EU, above 30% until the onset of the Great Recession, generating a dual market and favoring the volatility of employment over time (Bentolila et al. 2012).[3] In this line, the Spanish unemployment rate has been consistently among the highest within the EU for decades, and has risen to values over 25% during the Great Recession. Third, returns to education are low compared to many EU countries (De la Fuente and Jimeno 2009) and they have declined over time (Felgueroso et al. 2016; Izquierdo and Lacuesta 2012; Murillo et al. 2012). All of this suggests an interest in studying the potential signaling role of over-education in Spain.

[1] The statistical method is one of the ways of measuring over-education. OECD (2011) considers workers to be over-educated when the difference between the educational level achieved by the worker and that required for the job is just one level (in ISCED categories), with severe over-education being defined when the difference is greater than one level.

[2] The synthetic index used by the OECD to measuring rigidity in the labor market was over 3 in Spain in 2006, the second highest within the OECD, and it has declined to a value slightly above 2, below the OECD average.

[3] The temporary rate has declined to a value around 25%, 10 percentage points lower than in 2005 but still among the highest within the EU.

An initial challenge is how to define over-education and how to measure it. We must first distinguish between over-education/educational mismatch and skill mismatch; and, second, we must specify how both types of mismatch are measured. As explained below, we use subjective indicators of education and skill mismatch, which are dictated by data availability. Specifically, our data comes from a representative national sample of Spanish workers combining objective information relative to personal and job/related characteristics, and subjective information on educational mismatch, working conditions, and attitudes towards work.

We test the signaling role of over-education using three alternative methods; first, by comparing the returns to education between different groups of workers and different degrees of mismatch; second, by analyzing the attitude of workers to their educational mismatch; and, finally, by using an exogenous variation in educational legislation. With respect to the first method, we adapt the methodology in Wolpin (1977) and Riley (1979), and divide our samples into screened (wage earners) and unscreened workers (self-employed), and then compare their rates of return. While the returns to over-education of the screened may be rewarding in both productivity gains and educational signs, those of the unscreened are purely due to productivity gains, so that the differences may be interpreted as revealing the signaling value of over-education; if differences are negligible, over-education has no signaling role. We carry out separate estimates for different types of educational and skill mismatch, as discussed below. Additionally, we control for selectivity into employment status and skill heterogeneity.

The second approach includes different exercises exploring a common idea: how well the over-educated feel at the workplace and their willingness to move to other jobs. Our hypothesis is as follows. When individuals are over-educated, and probably not very satisfied in the current job, then they would search for another job in which they are not over-educated and more satisfied. This transitory stage in over-education would point to an absence of signaling. The third exercise consists of a natural experiment based on a change in educational legislation, derived from the implementation of a new education law in academic year 1991-92 (*Ley Orgánica de Ordenación General del Sistema Educativo*, LOGSE, passed in 1990) that replaced a previous one (*Ley General de Educación*, LGE, 1970). The key aspect of the new law is the extension of compulsory education from 14 to 16 years old. Our hypothesis is that, if individuals over-educate to signal, an extension in compulsory schooling would likely see an increase in over-

education, since more years in non-compulsory schooling are now necessary to be able to launch a credible signal. Furthermore, the implementation of LOGSE took place at different times across the Spanish regions, which provides exogenous regional variations in which to test whether over-education increased after the inception of the new law.

Our results show that returns to over-education in those groups in which signaling is unimportant (the self-employed) are lower. We interpret this as showing a signaling role of over-education. Nevertheless, the over-educated are found to be less job-satisfied and more prone to search for another job, indicating that they would prefer a job with a better match. Job satisfaction and willingness to change the job depend on the type of educational mismatch. Individuals we label as genuinely over-educated are less satisfied and more eager to move than those who are identified as apparently over-educated, so that the signaling role of over-education may vary across different groups of individuals. Finally, our natural experiment finds that the inception of the new law conveys a positive effect on over-education, which again supports the validity of the signaling role of over-education. In this context, we discuss a range of sources for the role of over-education as a signal and what kind of policies would be helpful in reducing its effects. In general, education policies should aim to reduce the asymmetric information firms face when hiring new workers, such as abilities or skills, or institutional quality and fields of study. Further, pursuing a better adjustment between what the labor market demands and what workers supply, seems a reasonable objective. General labor market policies that strive for a reduction in unemployment, in fixed-term and in part-time contracts, and those reinforcing not only more and better education, but also the acquisition of appropriate skills, would reduce the need for individuals to obtain additional unproductive education.

The structure of the paper is as follows. Section 2 presents a summary of the literature and Section 3 describes the data and the concept of mismatch used to study the signaling role of over-education. In Section 4, we study the returns to education, comparing wage earners with the self-employed. Section 5 analyses the relationship between educational mismatch and job satisfaction, job search, and job mobility. Section 6 uses the change in the educational law in 1990 as a natural experiment for studying the evolution of over-education. Finally, Section 7 concludes.

2. Literature review

Skill heterogeneity among equally-educated individuals makes over-education different from being over-skilled. Specifically, as education is only one of several individual skill components, it is not clear whether a person identified as over-educated would indeed have a negative job/qualification match if all skill components were taken into account. Over-educated workers may lack the necessary skills to perform more demanding jobs and use their "surplus" schooling to compensate for deficient human capital in other respects (Chevalier 2003; Green and McIntosh 2007). They are not, however, over-educated, because not all aspects of their human capital are observed (Allen and van der Velden 2001; Green et al. 2002, Mateos-Romero et al., 2017). Thus, it is possible that a sizeable portion of the over-educated are only apparent because workers with a particular education level may have low values of other, unobserved, aspects of human capital, such as ability or other skills, leading to a negative correlation between ability and over-education (McGuinness and Bennet 2007; Leuven and Oosterbeek 2011; Iriondo and Perez-Amaral, 2016). [4] In this view, over-educated workers are actually in jobs commensurate with their human capital, with this thereby explaining why the over-educated are paid less than well-matched workers.

It is in this context of skill heterogeneity among the over-educated where the signaling value of over-education may appear. Less experienced workers may over-educate to signal employers that they are indeed qualified for a job. Similarly, less able individuals may become over-educated, not only to compensate for the lack of other skills, but also to disguise themselves among other, now equally-educated, but more able, individuals. This idea is embraced by a more general view that assumes that individuals find incentives to systematically acquire more skills than they can productively use in their jobs. In the literature on the relationship between educational levels and earnings, diverse theories of signaling, filtering, credentialism, sorting, or screening - which we term as signaling, for short -, suggest that at least some of the skills acquired by workers are not actually needed to fulfil job tasks, but rather have the sole purpose of signaling the level of the worker's productivity to potential employers who have only imperfect information

[4] These low levels of skills can be of innate characteristics (McGuinness and Wooden 2009) or be due to the spread of tertiary education and college institutions, which has given rise to an increase in heterogeneity in the distribution of graduate abilities and of university quality (Chevalier 2003; Ordine and Rose, 2009). They may be also due to the choice of the academic degree, with large differences in the skills provided by humanistic and arts studies, in comparison to those provided by the sciences and engineering, more valued in the labor market (Frenette, 2004; Green and McIntosh, 2007).

(see Weiss, 1995, for a survey). Analogously, different models have been proposed in the literature on the use of an excess of education as a signal.

Indirect evidence is presented in Albrecht and Van Ours (2006), who find that when there are channels other than education levels to provide information about worker productivity, the role of education in hiring new employees diminishes. On their part, in default of other information, firms may use over-education to sort individuals' ability (Green et al. 2002; Lene 2011; Thurow 1975). By contrast, in some cases, workers may wish to mask their lack of skills. Thus, Ordine and Rose (2009) and Chevalier and Lindley (2009) find that the less-skilled become over-educated using low-quality institutions, to disguise themselves among other similarly-educated, but higher-skilled, workers. Similarly, Bedard (2001) shows that when access to university is restricted, low-ability workers find incentives to over-educate and mask their true skill level among a pool of graduate individuals. According to Arcidiacono et al. (2010), ability is observed nearly perfectly for college graduates, but is revealed to the labor market only gradually for high school graduates, so that starting wages markedly differ between both groups. Consequently, high-school graduates may find incentives to enrol in university to achieve higher earnings from the outset, right after being hired. A rather different view can be seen in Chatterji et al. (2003), where a theoretical model is developed in which firms pay an extra wage to the over-educated in exchange for paying efficiency wages to avoid monitoring costs and inducing a higher effort.

In slack labor markets, where unemployment is substantial, over-education may be used also by individuals as a signal to either gain access to the labor market, to improve their position in wage bargaining, or to show adaptability to a changing environment in the job market (Charlot et al., 2005; Fernandez, 2006; Lene, 2011). Likewise, Charlot and Decreuse (2005, 2010) argue that over-education may arise in strongly-segmented labor markets with high unemployment, since the less-skilled want access to high-skill jobs due to the existence of matching frictions.

This is the benchmark for our analysis. The Spanish labor market is marked by these two latter aspects: a very high unemployment rate (over 20% during the Great Recession), and strong differences across diverse groups of workers, fundamentally between permanent and temporary workers (Bentolila et al. 2012). For example, Ortiz (2010) finds that over-education is more common among permanent workers in Spain, since over-education allows workers not to achieve a better match, but to secure a job. Similarly,

attaining credentials is frequently more valued than skill acquisition in Spain and other Southern European countries (OECD 2011), especially in the public sector (Dolado et al. 2009; Ortiz 2010). Some other issues related to over-education and signaling also make Spain an interesting test case. First, despite that the average level of education is low (about 40% of the active population has attained compulsory educational level only; see Table A1 in the Appendix), it has increased steadily,[5] producing high rates of over-education, over 25%, especially among graduates (OECD 2011; Verhaest and van der Velden 2013). Second, in contrast to other countries, being a university graduate does not necessarily avoid being in a low-skill job in the early years of the career (Lene 2011). These aspects can be interpreted as emphasizing the signaling role that over-education may have in Spain.

3. Data

The data used in this paper come from the Spanish Quality of Work Life Survey (*Encuesta de Calidad de Vida en el Trabajo,* ECVT henceforth). The ECVT is an on-going programme which focuses on employment relationships and on the valuation and attitudes of employees towards work. The survey addresses the employed over age 16 as being representative of the total employed population, and covers a number of issues relating to working conditions, which allows us to control for a range of individual and job attributes. In particular, we focus on those that have to do with the human capital accumulation of individuals and their self-perceived job-match. Our sample of 28,730 individuals is constructed from pooling the last four consecutive available waves, from 2007 to 2010.

Educational mismatch is computed from a subjective point of view.[6] Specifically, we first make use of the worker's responses to the following question.

- *Do you think that your current job is adequate according to your educational level?*

With the possible answers being

1. *Yes, correct*. We label this as adequately educated
2. *No, below*. We label this as over-educated

[5] According to OECD, in 1992, 15% of the population between 25 and 64 had attained tertiary education. In 2015, the percentage had increased to 35.8%.

[6] General assessments of this and alternative measures can be seen in Hartog (2000) and Groot and Maassen van den Brink (2000).

3. *No, above*. We label this as under-educated
4. *No, different*. We label this as mismatched.

Almost 78% of sample individuals consider they hold a job position that adequately matches their attained educational levels, with around 19% declaring they feel over-educated. Provided that less than 3% of surveyed individuals choose answers 3 and 4, we discard these individuals in our analyses.[7] As a consequence, the selected sample ultimately consists of 27,927 observations, of which 10,482 (37.5%) correspond to women and 17,445 (63.5%) to men; 5,397 (19.2%) correspond to the self-employed.

A second question we consider is:

- *To what extent is your educational level useful for your job?*

Each individual rates between 0, *not at all*, and 10, *very much*. Near one half of surveyed individuals rates below 7 (the median value is 7.2). In order to keep things more tractable, we consider that the portion of the sample rating between 0 and 5 have acquired educational skills that are hardly applicable to their jobs (*non-useful skills*), whereas the half rating 6 or above are thought to make great use of their acquired educational skills (*useful skills*).[8]

Taking responses to both questions, we can construct a classification of employees according to a self-evaluated mismatch (see Table 1). We define as "properly matched" those who answer 1 to the first question and simultaneously rate 6 or more to the second question. They represent almost two thirds of the whole sample. Those who answer 2 to the first question are labelled as over-educated. During the period 2007-2010, the average proportion of the over-educated is near 19%. We can distinguish between "apparent", those who report 6 or above to the second questions, and "genuine", those who report 5 or below. More than one half of over-educated (10.5% of the total observations) report that they perform tasks that are closely related (6 or more) to their educational level. Thus, they are apparently over-educated. Consequently, only 8.8% of all individuals can be considered as genuinely over-educated. The remaining individuals, about 15% of observations, correspond to individuals who report there is not much of a relationship

[7] Apart from a possible reluctance of individuals to acknowledge being under-educated or mismatched, it is reasonable to consider that experience and on-the-job training may help workers to reduce the self-perception of being under-educated or mismatched. That is, a lower-than-required educational attainment, or a different array of skills for a specific job, may be counterbalanced by more continuous training, or learning-by-doing, so that the employee feels that, eventually, education and/or skills more appropriate to the requirements of that particular job will be acquired.

[8] Other possibilities have been also considered in estimations. Although the percentage of individuals in each group varies, estimated results do not significantly change with respect to those presented in the next sections.

between their realized studies and the tasks they perform at work. These are more difficult to classify; we designate them as "unadjusted".[9] These four categories extend the notion of over-education to a more ample view of educational and skill mismatch. These will be considered in our subsequent analyses to partially control for skill heterogeneity among individuals.

(Table 1 about here)

4. Returns to education

Most of the literature agrees that over-education generates a wage penalty, relative to an equally-educated worker in a matched job, and a wage premium, relative to a less-educated worker in a well-matched job.[10] In this context, an important question is whether this wage premium is due to a productivity-enhancing effect only, or if, additionally, signaling may also be at work. In the education literature, the productivity-enhancing role of education is usually tested, as predicted by the human capital theory, against its signaling role, following different approaches (see Riley, 2001, for a survey; and Chevalier et al., 2004, for a recent analysis in the UK). One of these tests is to distinguish between workers who require screening and workers who do not. In unscreened sectors, a worker's productivity can be easily ascertained, hence educational signaling is unimportant. In this line, the earlier work by Wolpin (1977) and Riley (1979) settles the basis for making comparisons, through the estimation of Mincerian-type wage equations, between screened and unscreened and comparing their rates of return. If returns to education among the unscreened (self-employed) exist, they can only be attributed to productivity effects since they do not need to signal. On the other hand, among the screened (wage earners), returns to education comprise both productivity and signaling effects so that their returns are expected to be greater.[11]

[9] Thus, we extend Chevalier (2003), and others, by explicitly considering the group of those workers who, despite being in a matched job, report being disappointed with their education/job match. For a similar approach, see Mateos-Romero et al. (2017).

[10] Groot and Maasen van den Brink (2000) conducted a cross-country meta-analysis of 25 studies using various subjective and objective measures of over-education. The study reported that the "mean" return to a year of required education was 7.9%, a year of surplus education, 2.6%, and a year of deficit education, -4.9%. Whereas the choice of definition had a large effect on the incidence of over-education, the authors did not find any of the methodological approaches to significantly influence estimated returns (for similar results, see Rubb 2003). This has led some commentators to claim that measurement errors may then not be a problem (McGuinness, 2006) while others has criticised this conclusion (Leuven and Oosterbeek, 2011).

[11] Diverse evidence confirms that returns to education are lower among the self-employed (see Brown and Sessions 1998; García-Mainar and Montuenga-Gomez 2005 and references therein).

Along these lines, we can carry out an analogous analysis focusing on over-education, by comparing returns between these different groups of workers to test the signaling hypothesis. If over-education is productivity-enhancing, we should observe positive returns from over-education for both the screened and the unscreened, with these returns being greater for the screened since they include the signaling value. At the same time, if returns are higher for those workers who are adequately matched, relative to those who are over-educated, a wage penalty for over-education should exist. If over-education does not have a productivity-enhancing role, positive returns from over-education for the unscreened should not be observed, and potential positive returns from over-education to the screened would be completely due to a signaling role.

To test these possibilities, and in order to consider education and skill mismatch, we estimate the Mincer-type wage equation (1) and compute the rates of returns from a year of education for the four types of employed previously defined:

$$ln\ w_i = \alpha + \beta_0\ Edu_i + \beta_1\ Unad._i + \beta_2\ Appar\_overed._i + \beta_3\ Genu\_overed._i + \delta' X_i + \varepsilon_i \quad (1)$$

where *Edu* is years of education, and *X* includes experience in quadratic terms. No other controls are added in order for β_0 to fully capture the link between education and earnings. *Unad.*, *Appar_overed.*, and *Genu_overed.* are dummy variables indicating the group to which the worker belongs. β_0 is the return to education of a properly-matched worker. The sum $\beta_0+\beta_1$ captures the educational return for the unadjusted; $\beta_0+\beta_2$ the corresponding return to the apparently over-educated; and, finally, $\beta_0+\beta_3$ the return to the genuinely over-educated. We prefer this specification to others commonly used in the literature, with separate samples, because we avoid estimation problems due to the reduced size of the over-educated sample.

In the survey, there is no information about required education, so that *Edu* represents attained schooling. The educational level is reported by the interviewed individuals, according to 9 categories. To convert this information into years of education, we associate to each educational level the number of years required to achieve the corresponding credential. These are presented in Table A1 in Appendix A. Since individuals in the sample have been educated under different educational schemes, the educational categories are defined differently before and after 1992, so that we must consider the age of the individual when assigning the number of years. Our measure of income is net monthly full-time individual earnings, which respondents categorized into one of 9 possible income brackets. We arbitrarily assign the value of €500 and €6,500 for

the first and for the last open-ended brackets (less than €600 and more than €6,000, respectively).

Equation (1) is estimated following the interval regression (Stewart, 1983). This expression serves for comparing returns to education among wage earners and self-employed. Results of estimating equation (1) for the four groups defined are presented in Table 2 (Panel A) where the estimates correspond to the sum of the estimated coefficient β_0 (the properly-matched) plus the conforming β_i for each group $(i=1,...,3)$.

(Table 2 about here)

We first note that mismatch imposes a wage penalty, which is different for each degree of mismatch. The penalty for wage earners is of a magnitude close to 15% for the unadjusted; it increases to values around 23% for the apparently over-educated; and reaches values of about 40% for the genuinely over-educated. A similar pattern is observed in the subsample of men and women, with returns for women again being higher than those of men, and suffering lower penalties from the mismatch. In the case of the self-employed, the penalties follow a steeper profile, since returns for the genuinely over-educated are approximately one half of those for the properly-matched.

Several conclusions may be drawn from these results. First, the estimated coefficients are all statistically significant and different from zero, indicating that additional years of education are associated with higher earnings. Second, returns are higher for wage earners than for the self-employed, with these results holding for the overall sample as well as for the male and female subsamples. This confirms that education and over-education both play a double role as productivity-enhancing and as a signal, with the signaling value of over-education being higher for women. Third, being mismatched is penalized with lower wages. Fourth, penalties for the genuinely over-educated are considerably higher than those for the unadjusted and apparently over-educated, confirming the existence of heterogeneity among similarly educated individuals.

At this point, we take into account the existence of two possible sources of bias: self-selection into type of employment,[12] and time- invariant unobserved heterogeneity. We deal with selectivity into self- or paid-employment using Heckman's procedure, by adding a selection equation including the same regressors as in equation (1), plus several dummies indicating the father's occupational category and an additional dummy indicating whether the mother was working when the respondent was sixteen years old.

[12] Given that our sample is of the employed only, we do not control for selectivity into employment.

These variables are supposed to explain the decision to work in a particular group, but are not to affect wages. Results shown in Panel B in Table 2 are similar to those in Panel A,[13] so that selectivity bias may be unimportant for the returns.

Regarding unobserved heterogeneity, some authors, such as Chevalier (2003), Frenette (2004), and Tsai (2010) show that when controlling for it through fixed effects estimations, or explicitly dealing with distributional skills or the field of specialization, the wage penalty for over-education is reduced, and may even disappear. These results lead to the contention that many individuals who are considered as over-educated in fact are not, because some of the skills and abilities they possess do not match those needed in their jobs at the corresponding educational level, and thus they are only apparently over-educated.

The way we investigate this issue is dictated by data availability. In addition to considering the four types defined from the self-perception of individuals about the job match, as in Table 2, and given that our data is not in longitudinal form, we construct a pseudo-panel to control for heterogeneous skill distribution. We divide the sample into homogeneous groups (cohorts) according to different variables, to form a panel structure of the data. This is undertaken by computing the mean value in each variable for any individual according to the two genders, 17 NUTS II regions, 4 years, 2 labor statuses (self-employed and wage earner), and four types of adjustment (no mismatch, unadjusted, apparently over-educated, and genuinely over-educated). These sample means act as proxies for the population means since the sample size is sufficiently large. This makes up a total of 1,632 observations, with earnings calculated as the log of the mean value in each interval.

$$\ln \overline{w}_{ct} = \alpha + \beta_0 \overline{Edu}_{ct} + \beta_1 \overline{Unad.}_{ct} + \beta_2 \overline{Appar\_overed.}_{ct} + \beta_3 \overline{Genu\_overed.}_{ct} + \delta \overline{X}_{ct} + \overline{\varepsilon}_{ct} \quad (2)$$

Equation (2) is estimated by fixed effects and controlling for self-selection where each panel cell is weighted by the number of observations in the first year of the sample, 2007 (Wooldridge 1995). Estimates are shown in Panel C in Table 2.[14] The pattern observed is similar to that discussed in previous estimates. This again confirms the signaling value of over-education and suggests that the estimation of the enhancing-productivity role of over-education is not strongly affected by unobserved heterogeneity. Our results, hence,

[13]The results of the first stage are not shown, to save space, but are available on request.
[14]Men and women subsamples are not estimated due to the reduced sample size.

coincide with those of Green and McIntosh (2007), McGuinness and Bennett (2007), Chevalier and Lindley (2009), Green and Zhu (2010), and Lene (2011), who use different ability measures, and find that a wage penalty for the over-educated does exist. Similarly, Dolton and Silles (2008), Korpi and Tahlin (2009), Verhaest and Omey (2012), Iriondo and Perez-Amaral (2016) control for selection bias and measurement error issues and still arrive at the finding that workers earn more in adequate jobs for which they are over-educated.[15]

5. Job satisfaction, job search and job mobility.

In this section, we investigate whether different aspects related to educational mismatch in the workplace, such as job satisfaction or voluntary turnover, may be considered as indicators of the presence of signaling in over-education. In principle, mismatched workers may feel no, or little, job satisfied and may then look for another job in which they can feel better off. However, empirical evidence on the topic is far from reaching homogenous conclusions. Whereas some authors have shown that the over-educated are less satisfied in their jobs than adequately-matched workers and hence more prone to search for another job (Tsang et al., 1991; Verhaest and Omey, 2009), others have provided empirical evidence supporting the absence of a relationship between over-education and job satisfaction (Groot and Maassen van den Brink, 2000; Büchel, 2002) and even a positive relationship between over-education and firm productivity (Kampelman and Ryck, 2012). Sloane (2003) argues that, unlike educational mismatches, skill mismatches have a strong negative impact on job satisfaction (see also, Allen and van der Velden, 2001; and Green and Zhu, 2010).

One possible explanation for these non-conclusive results, which we explore in this section, is that individuals who over-educate to signal may be no less satisfied than the adequately-matched if they aim to mask or compensate for their lack of skills, or for access to employment. In these circumstances, they may have no incentive to look for another job and would remain mismatched for a very long period in their career. By contrast, individuals who are genuinely mismatched probably feel very unsatisfied and

[15] Iriondo and Perez-Amaral (2016) find that the return of an additional year of schooling above the job educational requirements is small. However, they observe a distinct behavior across ages: wages of workers under 35 largely depend on educational attainment, while those of workers over 35 depend mainly on job educational requirements.

would try to look for new jobs providing a better match, implying that the mismatch would be of a transitory nature.

Our database allows us to study these aspects of job satisfaction, job search, and job mobility in order to provide some insights into the signaling role of over-education. With respect to the first two aspects, the ECVT asks the surveyed individuals to rate from 0 (*no*) to 10 (*very high*) their job satisfaction at the current work and whether or not they are looking for another job. To study the first aspect, we use a standard job satisfaction equation which regresses job satisfaction on the same set of independent variables as in equation (2), plus others including gender, tenure, marital status, three dummies indicating having children (of different ages), a dummy indicating whether it is the first job, and dummies of industry, occupation, and years. This is estimated by ordered probit, where self-selection is addressed with the same controls as in Section 4.

In Table 4, we present the marginal effects of a change in the mismatch status, with the reference category being properly matched, on the probability of achieving a high score (8 or above) on the job satisfaction scale. For both groups of workers, wage earners and the self-employed, the genuinely over-educated are the most dissatisfied, followed by the apparently over-educated, and then the unadjusted. The same pattern is observed when considering men and women separately. We interpret these results as the unadjusted and the apparently over-educated obtaining gains in job satisfaction with respect to the genuinely over-educated (for a similar result in the UK, see Green and Zhu, 2010). The loss in job satisfaction is somewhat smaller for the self-employed than for wage earners, except in the case of the apparently over-educated, which suggests some signaling value of over-education. Specifically, workers in the screened group feel more damaged by mismatch than do the unscreened, which may be indicating higher expectations than those we would otherwise expect from more years of education in an adequate match.

(Table 3 about here)

The second aspect, job search, is investigated by estimating the probability of looking for another job. We do not have data on whether the search effectively results in a move; it is only capturing intention, not an accomplishment. Specifically the question in the survey reads as: *Are you looking for another job?*, where possible answers are *Yes* or *No*. Table 4 shows the estimates of a probit equation where self-selection is also controlled for. The regressors, both in the probit and in the participation equations, are the same as in the job satisfaction case. Results show that the genuinely over-educated are more prone to search for another job, with the apparently over-educated showing lower coefficients.

The incentives to voluntary turnover are even lower, but statistically significant, in the case of the unadjusted.

(Table 4 about here)

We now control, in addition to self-selection, for unobserved heterogeneity through pseudo-panel estimation as defined in Section 4, using OLS. Results are shown in the lower parts of Tables 3 and 4. The general pattern is similar to those obtained with the pooled data. The worse the match, the greater the reduction in job satisfaction, and the greater the incentives to search for another job. We note, however, that incentives to voluntary turnover, if unadjusted, are not statistically or significantly different from those properly matched.

The results from these two exercises show that the genuinely over-educated are the least satisfied and the most willing to look for another job. The apparently over-educated and the unadjusted do not feel as punished by mismatch as the genuinely over-educated. They obtain some gain from educational mismatch, which we may interpret as the credentials obtained by those two groups having some signaling value, even though they are not as satisfied at the workplace as those who are adequately educated.

This evidence on signaling is quite indirect. Ideally, we would like to test this on more specific grounds. For example, if we could have information on actual individual job mobility, and not only on prospects of job mobility, we could check whether the move has actually taken place, if mismatch has been reduced after the job change, and if satisfaction has improved. We do not have such data but, using the information available, Garcia-Mainar and Montuenga-Gomez (2017) analyse the "temporary" nature of each mismatch by comparing the situation at present with that at the first job. They find that, at least part of the initial mismatch seems to be resolved throughout the professional lifetime/career of individuals. However, not all the initial mismatch disappears, even for those in older cohorts, suggesting that some degree of mismatch persists over time, which, among other explanations, may also be due to signaling in over-education. They argue that Spanish workers may over-educate to signal in order to get into employment, but once there they feel less than fully satisfied and try to look for another job which may better fit their skills.

6. The increase in the minimum school leaving age

In this section, we follow Bedard (2001) and Chevalier et al. (2004) who, based on Lang and Kropp (1986), exploit differences in education levels in response to a change in the

minimum level of education. The rationale is that, under the signaling view, exogenous increases to schooling would affect an individual's ranking. That is, any reform that affects the education decision of a specific group will have a spillover effect on other groups not directly affected; if a low-productivity group were to increase its education because of a policy intervention, the more productive group would also want to invest in more education in order to continue to distinguish themselves from the less- educated.

The Spanish educational law LOGSE, passed in 1990, increased the number of compulsory schooling years from 8 to 10, by extending the minimum school leaving age from 14 to 16 years old. This change in legislation has been explored to check its influence on two recent features of the Spanish economy: the halt in the declining trend in dropout rates (Felgueroso et al. 2014), and the cognitive development following the introduction of universal high-quality childcare for 3-years-old (Felfe et al. 2015). The hypothesis investigated in this section is whether the implementation of this new educational law in academic year 1991-92 (which replaced the previous LGE) contributed, among other factors, to increase over-education.

We carry out two different exercises to test the signaling hypothesis. In both cases, we make use of the fact that the LOGSE was rolled out at different times across regions within Spain. First, following Duflo (2001) and Felgueroso et al. (2014), we construct an exposure to LOGSE index that serves as an identification strategy to analyse whether the change in the law contributed to increasing over-education. This is a reasonable natural experiment exercise, since the differences in timing and velocity for each region of carrying out the LOGSE were uncorrelated with the initial level of over-education of these regions, since they were due to (region) political and organizational factors.[16] In the second case, we follow Felfe et al. (2015) and test our hypothesis within a standard differences-in-differences model (DiD). In both approaches, we estimate the influence of the change in the educational law on a variable capturing education and skill mismatch.

In the first case, the main difficulty in testing the effect of the law change in over-education is that the system, for a particular individual studied, is unknown. Since the introduction of the LOGSE progressed differently across schools and regions, we do not know exactly whether an individual was exposed to the change or not. We must then use an instrument that allocates the level of exposure to the LOGSE to each individual. We can clearly consider three periods: before 1991, only the LGE was in place and hence

[16] Felfe et al. (2015:395) claim that "the timing of implementation varied considerably across regions due to a scarcity of qualified teachers and constraints on classroom space in existing primary schools".

treatment=0 for all individuals; between 1991 and 1999, both the LGE and LOGSE coexist, with differences across regions, and hence some individuals will be allocated to 0 and others to 1, depending on their region; from 2000 onwards only LOGSE is in place so treatment=1 for all individuals. In consequence, the index of exposure is constructed as follows: 1 if exposed to the LOGSE, zero if exposed to the LGE and a number between 0 and 1 indicating the probability of exposure to LOGSE. The exposure index is calculated as the percentage of individuals of each cohort who are in LOGSE in their region in the secondary and bachelor level.

We estimate equation (3) which, besides the individual index of exposure to the LOGSE, includes the same variables as in previous specifications, plus regional variables

$$Y_{iqr} = \alpha + X'_{iqr}\beta + \gamma I_{iqr} + \delta Z_{qr} + u_{iqr} \quad (3)$$

where Y_{iqr} denotes the dependent variable (educational mismatch) of individual *i* from birth cohort *q* in region *r*, *X* is a vector of individual and labor characteristics, *I* denotes the exposure level, and *Z* is a regional variable, the unemployment rate. Equation (3) is estimated under three different specifications: i) an ordered probit model in which the dependent variable is an ordered variable on the level of mismatch: it takes value 1 for properly/matched, 2 for unadjusted, 3 for apparently over-educated, and 4 for genuinely over-educated; ii) a probit model in which the dependent variable is a dummy with value 1 if the individual is over-educated and 0 otherwise; finally, iii) an OLS model with the same dependent variable as in case i) and clustering standard errors at the region level.[17]

In the case of the DiD estimation model, the specification to be estimated is:

$$Y_{iqr} = \alpha + X'_{iqr}\beta + \gamma_1 T_{iqr} + \gamma_2 Post_t + \theta(T \times Post)_{iqrt} + \delta Z_{qr} + u_{iqr} \quad (4)$$

where *T* is a binary variable indicating whether or not individual *i* lives in one of the fast-implementing regions. Following Felfe et al. (2015), we select in this group those regions, the fast regions, in which the proportion of pupils affected in the first year after the passage of the law was higher than 50%.[18] *Post* is a dummy equal to 1 if, for each year, the individual had the corresponding age to be affected by the LOGSE, in the case where the law was passed in all regions at the same time, and 0 otherwise.[19] Finally, the

[17] The difference between specifications in cases i) and iii) is the assumption of ordinality or cardinality in the dependent variable. Ferrer-i-Carbonell and Frijters (2004), among many others, show that estimated results from one or another specification are qualitatively similar.

[18] These fast regions are Asturias, Aragon, Balearic Islands, Castile-Leon, Castile-La Mancha, Catalonia, Extremadura, Murcia, Navarre, and Rioja. Andalusia, the Basque Country, Canary Islands, Cantabria, Galicia, Madrid and Valencia, are considered as the slow regions.

[19] In the sample, we only include those who were born between 1966 and 1986, since individuals born after 1986 were all affected by the reform.

treatment variable *T* is interacted with variable *Post*, and *Z* captures the same regional variable as in equation (3). This model is estimated by OLS clustering of standard errors at the region level.

Results of estimating equations (3) and (4) appear in Tables 5 and 6, respectively. Table 5 shows the results of the index of LOGSE exposure variable, *I*, in the three alternative estimations.[20] The results indicate that more exposure to LOGSE is associated with a higher degree of education mismatch for all workers, a result that is fundamentally driven by the women's case, since this variable is not significant in the men's subsample. Only when estimating by a probit is the coefficient for the whole sample non-significant.

(Table 5 about here)

Table 6 shows the results for the DiD analysis. The interaction term *Treatment x Post* measures the average effect of the increase in over-education in fast regions, versus the increase in over-education in slow regions. This variable is significant and positive, indicating a clear effect of the law change. For this estimate to be causal, the assumption of common trends needs to be fulfilled. Two placebo tests have been estimated to test it. Placebo Test 1 considers a random assignment of the fast regions. Specifically, we consider that the fast regions are those in the second half, when they are sorted by alphabetical order, with the *Treatment x Post* variable found to be non-significant. The same occurs with Placebo Test 2 that considers that the reform affected workers with year of birth between 1961 and 1970 only.

(Table 6 about here)

Both approaches confirm the notion that a mandatory increase in the minimum school leaving age causes all education levels to rise, for more able individuals to still signal their ability, compared to less able individuals, thus spreading the phenomenon of over-education. Therefore, a signaling value of over-education is clearly found in the Spanish labor market.

7. Conclusions

Testing the signaling role of education is important in assessing whether public financing of education is a waste of resources. This task has become more important in recent decades, when the phenomenon of over-education has proliferated, especially in

[20] In the first estimation, an ordered probit, the coefficient is not interpreted directly and it is necessary to calculate the marginal effects. We have ensured that these marginal effects indicate more mismatch with a higher index level.

developed countries. Over-education has been basically considered as an inefficient result of the matching process. However, various studies have provided some evidence supporting the idea that over-education may result from the rational behaviour of individuals. Workers who lack certain skills, or who find it difficult to enter into employment may over-educate to overcome these difficulties, reaching positions which otherwise they could not attain.

In this paper, we use several approaches to test the validity of a signaling role in over-education. We study Spain as an interesting case since its labor market is characterized by a large number of over-educated workers, high unemployment, strong segmentation, and clearly declining returns to education over time - all circumstances that favor the expansion of over-education. The data used in this work come from a national representative sample of Spanish workers combining objective information relative to personal and job-related characteristics and subjective information on attitudes to work and education variables. We test the signaling role of over-education using three alternative methods; first, by comparing the returns to over-education among different groups of workers and different degrees of job mismatch; by analyzing the extent of the relationship between educational mismatch and job satisfaction, job search, and job mobility; and, finally, by using an exogenous variation in educational legislation.

Our results show that returns to over-education in those groups in which signaling is unimportant (the self-employed) are lower. This result is robust against biases coming from self-selection or individual heterogeneity. The over-educated are found to be less job-satisfied and more prone to search for another job, indicating that they would prefer a job with a better match. It is noted that job satisfaction and willingness to change the job depend on the type of educational mismatch. That is, some of the over-educated do not really feel much less satisfied than those who are adequately-matched, and it may be that they have voluntarily decided to over-educate themselves, perhaps to avoid the signal that they have lesser skills, or to escape from unemployment. Finally, our natural experiment finds that the inception of the new law conveys a positive effect on over-education, which again supports the validity of the signaling role of over-education.

Given the heterogeneous distribution of skills across workers, we show that the signaling role of over-education is not the same across groups of the mismatched. The unadjusted and apparently over-educated are not so very different from the adequately-matched, compared to the genuinely over-educated, for whom most of over-education is indeed a consequence of a poor match, and who are willing to abandon their status of

over-educated. Our results confirm that some part of self-perceived over-education is productivity-enhancing, and is then partially compensated with extra rewards. However, a sizeable level of over-education is found to be due to signaling; that is to say, workers acquire more than productive education. The idea that over-education is the result of mismatch due to inefficiencies in the labor market has led to suggestions of policy interventions both in the labor market functioning and in the education system.

Regarding labor market, active labor market policies pursuing more information on workers and vacancies for achieving a better match, extending training over time through life-long learning, or favouring hiring conditions to firms, are all reasonable proposals to reduce the expansion of over-education (Iriondo and Perez-Amaral, 2016). This is especially true in the case of Spain, where the unemployment rate among younger workers, the long-term unemployment rate, and the temporary rate are all remarkably high. These policies would also help in reducing the incentives for some workers to use over-education as a way to escape from unemployment or job insecurity.

A second line of attack is to reform the education system. The objective is to bring together what firms demand and what workers may offer. Among other things, the educational system should provide individuals with the skills firms require, and better career guidance to improve the match (Iriondo and Perez-Amaral, 2016). For the former point, measures such as early child intervention and the avoidance of grade retention (Agasisti and Cordero, 2013, 2017; Heckman et al., 2013; Pedraja-Chaparro et al., 2015), as well as upgrading teacher performance (Hanushek, 2011 and Meroni et al., 2015) may be useful. For the latter, public information about the fields of specialisation that firms demand would help high school students to know which studies and majors would allow for better prospects in the labor market.

These recommendations would not be sufficient in themselves, however, if observed over-education is a consequence, at least partially, of signaling. We have discussed in this paper the various ways in which individuals voluntarily decide to over-educate. Since this additional education generates additional waste of effort by individuals - and additional waste of public resources,[21] - policy intervention to alleviate the problems of asymmetric

[21] In Spain, as in many other advanced countries, education is highly subsidized (Iriondo and Perez-Amaral, 2016).

information needs to be addressed. That is, it is needed not only so that the education system can endow individuals with adequate abilities, knowledge, and skills, but also to develop a system of credentials that actually convey this information as a proper reflection of the worker's true productivity. Thus, on the one hand, although educational attainments or credentials are a national system of recognition and evaluation, a significant heterogeneity across university and faculty institutions exists, and the elaboration of indices and rankings of such institutions would serve to assess the quality of graduates. On the other hand, an important source of asymmetric information is that some skills may be unobservable. Effort should be devoted by the public sector to finding some system to credit and disseminate reliable information on skills acquired by workers in different aspects, such as social ability, relational skills, IQ tests, and so on.

Some attempts have recently been made in Spain along these lines. Labor market policies aiming to increase flexibility and reduce instability have been set up in the aftermath of the Great Recession, and seem to have spurred economic growth, even though the long-term effects are yet to be realised (the unemployment rate has decreased but is still over 15%, with the temporary rate still above 25%). More profound reforms aiming to pursue more and better education and training, more research, and more innovation are still to come. The problems of political instability should not stand in the way of the accomplishment of such policies.

Funding

The Spanish Women's Institute (grant code 261168-190), the Autonomous Government of Aragón (Consolidated Research Group number S13), and the University of Zaragoza (grant number UZ2015-SOC-01).

Acknowledgements

We would like to thank Yu Zhu, as well as participants at the II International Conference on Sociology of Public and Social Policies, the XI Spanish Labor Economics Meeting and 28th EALE Conference for helpful comments on earlier drafts of this paper.

Appendix. Descriptive statistics

(Table A about here)

References

Agasisti, T. & Cordero, J.M. (2013). Educational disparities across regions: A multilevel analysis for Italy and Spain. *Journal of Policy Modeling*, 35(6), 1079-1102.

Agasisti, T. & Cordero, JM. (2017). The determinants of repetition rates in Europe: Early skills or subsequent parents' help? *Journal of Policy Modeling*, 39(1), 129-146.

Annabi, N. (2017). Investments in education: What are the productivity gains? *Journal of Policy Modeling*, 39(3), 499-518.

Albrecht, J. & Van Ours, S. (2006). Using employer hiring behavior to test the educational signaling hypothesis. *Scandinavian Journal of Economics*, 1083, 361-372.

Albrecht, J. & Vroman, S. (2002). A matching model with endogenous skill requirements. *International Economic Review*, 43, 283-305.

Allen, J. & Van der Velden, R. (2001). Educational mismatches versus skill mismatches: Effects on wages, job satisfaction, and on-the-job search. *Oxford Economic Papers*, 533, 434-452.

Arcidiacono, P., Bayer, P. & Hizmo, A. (2010). Beyond signaling and human capital: education and the revelation of ability, *American Economic Journal: Applied Economics*, 2, 76-104.

Arulampalam, W. (2001). Is unemployment really scarring? Effects of unemployment experiences on wages. *The Economic Journal*, 111, 585–606.

Bedard K. (2001). Human capital versus signaling models: University access and high school dropouts. *Journal of Political Economy*, 109, 749–775.

Bentolila, S., Cahuc, P., Dolado, JJ. & Le Barbanchon, T. (2012). Two-tier labor markets in the great recession: France versus Spain. *Economic Journal* 122, 155-87.

Brown, S., & Sessions, J. G. (1998). Education, employment status and earnings: A comparative test of the strong screening hypothesis. *Scottish Journal of Political Economy*, 18, 397-404.

Büchel, F. (2002). The effects of over-education on productivity in Germany. The firm's viewpoint. *Economics of Education Review*, 213, 263-276.

Charlot, O. & Decreuse, B. (2005). Self-selection in education with matching frictions. *Labor Economics*, 12, 251–267.

Charlot, O. & Decreuse, B. (2010). Over-education for the rich, under-education for the poor: A search-theoretic microfoundation. *Labor Economics*, 17, 886–896.

Charlot, O., Decreuse, B. & Granier, P. (2005). Adaptability, productivity, and educational incentives in a matching model. *European Economic Review*, 49, 1007–1032.

Chatterji, M., Seaman, P. & Singell L. Jr (2003). A test of the signaling hypothesis. *Oxford Economic Papers*, 55, 191-215.

Chevalier, A. (2003). Measuring over-education. *Economica*, 70, 509–531.

Chevalier, A., Harmon, C., Walker, I. & Zhu Y. (2004). Does education raise productivity, or just reflect it? *The Economic Journal*, 114, 499-517.

Chevalier, A. & Lindley, J. (2009). Over-education and the skills of UK graduates. *Journal of the Royal Statistical Society: Series A*, 172, 307–337.

De la Fuente, A. & Jimeno, JF. (2009). The private and fiscal returns to schooling in the E.U. *Journal of the European Economic Association*, 76, 1-30.

Dolado, J. J., Jansen, M. & Jimeno, J. F. (2009). On the job-search in a matching model with heterogeneous jobs and workers. *Economic Journal*, 119, 200–228.

Dolton, P. J. & Silles, M. A. (2008). The effects of over-education on earnings in the graduate labor market. *Economics of Education Review*, 272, 125–139.

Duflo, E. (2001). Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment. *American Economic Review,* 914, 795-813.

Felfe, C., Nollenberger, N. & Rodríguez-Planas, N. (2015). Can't buy mommy's love? Universal childcare and children's long-term cognitive development. *Journal of Population Economics*, 28, 393-422.

Felgueroso, F., Gutiérrez-Doménech, M. & Jiménez-Martín, S. (2014). Dropout trends and educational reforms: The role of the LOGSE in Spain. *IZA Journal of Labor Policy*, 31, 1-24.

Felgueroso, F., Hidalgo-Perez, M. & Jiménez-Martín, S. (2016). Explaining the fall of the skill wage premium in Spain. *The Manchester School*, 849, 390-435.

Fernández, C. (2006) The Role of Education Vis-à-vis Job Experience in Explaining the Transitions to Employment in the Spanish Youth Labor Market. *Spanish Economic Review*, 8, 161–87.

Ferrer-i-Carbonell, A. & Frijters, P. (2004). How Important Is Methodology for the Estimates of the Determinants of Happiness? *The Economic Journal* 114, 641–59.

Frenette, M. (2004) The Overqualified Canadian Graduate: The Role of the Academic Program in the Incidence, Persistence, and Economic Returns to Overqualification. *Economics of Education Review*, 23, 29–45.

García-Mainar, I. &VM. Montuenga-Gómez (2005) Education Returns of Wage Earners and Self-employed Workers: Portugal vs. Spain. *Economics of Education Review*, 24, 161-70.

Garcia-Mainar, I. & VM. Montuenga (2017). Subjective educational mismatch and signaling in Spain. DT Econz 2017-03. University of Zaragoza, Spain. Available at https://ideas.repec.org/p/zar/wpaper/dt2017-03.html

Green, F. & McIntosh, S. (2007). Is there a genuine under-utilization of skills among the over-qualified? *Applied Economics*, 39, 427–39.

Green, F., McIntosh, S. & Vignoles, A. (2002) The utilization of education and skills: evidence from Great Britain. *The Manchester School* 70, 792–811.

Green, F. & Zhu, Y. (2010). Overqualification, job dissatisfaction, and increasing dispersion in the returns to graduate education. *Oxford Economic Papers*, 624, 749-63.

Groot, W. & Maassen van den Brink, H. (2000). Over-education in the labor market: A meta-analysis. *Economics of Education Review*, 192: 149–58.

Hanushek, E. (2011). The economic value of higher teacher quality. *Economics of Education Review*, 30(3): 466-479.

Hartog, J. (2000). Over-education and earnings: where are we, where should we go? *Economics of Education Review*, 192, 131–47.

Heckman, J, Pinto, R. & Savelyev, P. (2013) Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. American Economic Review 103(6):2052-2086.

Iriondo, I., & Pérez-Amaral, T. (2016). The effect of educational mismatch on wages in Europe. *Journal of Policy Modeling*, *38*(2), 304–323.

Izquierdo, M. & Lacuesta, A. (2012). The contribution of changes in employment composition and relative returns to the evolution of wage inequality: the case of Spain. *Journal of Population Economics*, 252, 511-543.

Kampelmann, S. & Ryck, F. (2012). The impact of educational mismatch on firm productivity: Evidence from linked panel data. *Economics of Education Review*, 31, 918-931.

Korpi, T. & Tahlin, M. (2009). Educational mismatch, wages, and wage growth: Over-education in Sweden, 1974-2000. *Labor Economics*, 16, 183–193.

Lang, K. & Kropp, D. (1986). Human capital versus sorting: The effects of compulsory attendance laws. *Quarterly Journal of Economics*, 101, 609-624.

Lene, A. (2011). Occupational downgrading and bumping down: The combined effects of education and experience. *Labor Economics,* 18, 257–269.

Leuven, E. & Oosterbeek, H. (2011). Over-education and mismatch in the labor Market. In Hanushek, E.A., Machin, S. & Woessmann, L. eds: *Handbook of the Economics of Education*, 4, 283-326.

Mateos-Romero, L., Murillo-Huertas, I., & Salinas-Jiménez, M.M. (2017). Wage effects of cognitive skills and educational mismatch in Europe. *Journal of Policy Modeling,* 39, 909–927.

McGuinness, S. (2006) Over-education in the labor market. *Journal of Economic Surveys*, 203, 387–418.

McGuinness, S. & Bennett, J. (2007). Over-education in the graduate labor market: a quantile regression approach. *Economics of Education Review,* 26, 521–531.

McGuinness, S. & Sloane, P. (2011). Labour market mismatch among UK graduates: An analysis using REFLEX data. *Economics of Education Review*, 30(1), 130-145.

McGuinness, S. & Wooden, M. (2009). Overskilling, job insecurity, and career mobility. *Industrial Relations*, 48, 265–286.

Meroni, E., Vera-Toscano, E., & Costa, P. (2015). Can low skill teachers make good students? Empirical evidence from PIAAC and PISA. *Journal of Policy Modeling*, *37*(2), 308–323.

Murillo, I.P., Rahona, M. & Salinas, M.M. (2012). Effects of educational mismatch on private returns to education: An analysis of the Spanish case 1995-2006. *Journal of Policy Modeling,* 345, 646-659.

OECD (2011). *Right for the Job: Over-Qualified or Under-Skilled*, OECD Employment Outlook 2011, OECD Publishing, Paris, 191-235.

Ordine, P. & Rose. G. (2009). Over-education and instructional quality: A theoretical model and some facts. *Journal of Human Capital*, 31, 73-105.

Ortiz, L. (2010). Not the right job, but a secure one: Over-education and temporary employment in France, Italy and Spain. *Work, Employment and Society*, 241, 47-64.

Pedraja-Chaparro, F., Santín, D. & Simancas, R. (2015). Determinants of grade retention in France and Spain: Does birthmonth matter? *Journal of Policy Modeling*, *37*(5), 820–834.

Riley, J. G. (1979). Testing the educational screening hypothesis. *Journal of Political Economy* 87, S227-S251.

Riley, J. G. (2001). Silver signals: Twenty-five years of screening and signaling. *Journal of Economic Literature*, 392, 432-478.

Rubb, S. (2003). Over-education in the labor market: a comment and re-analysis of a meta-analysis. *Economics of Education Review*, 22, 621–629.

Sloane, P. (2003). Much ado About Nothing? What does the Over-education Literature Really Tell us. In Büchel, F., De Grip, A., & Mertens, A., eds, *Over-education in Europe; Current issues in theory and policy*, 11–45. Edward Elgar.

Stewart, M. B. (1983). On least squares estimation when the dependent variable is grouped. *Review of Economic Studies*, 50, 737-753.

Thurow, L. (1975). *Generating inequality*. Basic Books.

Tsai, Y. (2010). Returns to over-education: A longitudinal analysis of the U.S. labor market. *Economics of Education Review*, 294, 606–617.

Tsang, M., Rumberger, R. & Levin, H. (1991). The impact of surplus schooling on worker productivity. *Industrial Relations* 30, 209–28.

Verhaest, D. & Omey, E. (2009). Objective over-education and worker well-being: A shadow price approach. *Journal of Economic* Psychology, 30, 469-481.

Verhaest, D. & Omey, E. (2012). Over-education, under-education and earnings: Further evidence on the importance of ability and measurement error bias. *Journal of Labor Research*, 33, 76-90.

Verhaest, D. & R. van der Velden (2013). Cross-country differences in graduate over-education. *European Sociological Review*, 293, 642-653.

Weiss, A. (1995). Human capital vs. signaling explanation of wages. *Journal of Economic Perspectives*, 9, 133-154.

Wolpin, K.I. (1977). Education and screening. *American Economic Review*, 67, 949-958.

Wooldridge, J. (1995). Selection corrections for panel data models under conditional mean independence assumptions. *Journal of Econometrics*, 68, 115–132.

TABLE 1
Definitions and percentages of educational mismatch

~~Question 2~~ / Question 1	*Non-useful skills (0-5 rate)* 25.3%	*Useful skills (6-10 rate)* 74.6%
Adequately educated (80.7%)	Unadjusted (15.4%)	Properly matched (65.3%)
Over-educated (19.3%)	Genuinely over-educated (8.8%)	Apparently over-educated (10.5%)

Source: Own elaboration from ECVT 2007-2010.

TABLE 2

Returns to average year of education by group of worker and type of match

Worker Group		*Properly*	*Unadjusted*	*Apparently over-educated*	*Genuinely over-educated*	*N obs.*	*Log L/R²*
Panel A							
Total							
	Wage earners	0.052***	0.045***	0.040***	0.031***	22,530	-35113.85
	Self-employed	0.040***	0.036*	0.023***	0.019***	5,397	-10081.09
Men							
	Wage earners	0.051***	0.044***	0.039***	0.029***	13,668	-21606.95
	Self-employed	0.040***	0.036****	0.026***	0.023***	3,777	-7069.57
Women							
	Wage earners	0.063***	0.055***	0.051***	0.042***	8,862	-12396.41
	Self-employed	0.044***	0.034***	0.029***	0.023***	1,620	-2777.59
Panel B. (controlling biases of selectivity)							
Total							
	Wage earners	0.053***	0.047***	0.041***	0.031***	22,530	-31550.63
	Self-employed	0.039***	0.036*	0.021***	0.018***	5,397	-9132.33
Men							
	Wage earners	0.052***	0.045***	0.040***	0.030***	13,668	-19550.96
	Self-employed	0.038***	0.034*	0.021***	0.018***	3,777	-6473.86
Women							
	Wage earners	0.066***	0.058***	0.054***	0.045***	8,862	-11001.85
	Self-employed	0.048***	0.038***	0.034***	0.030***	1,620	-2451.74
Panel C. (Pseudo-panel estimations with sample selection, Wooldridge, 1995)							
	Wage earners	0.053***	0.048***	0.040***	0.025***	1,088	0.48†
	Self-employed	0.039**	0.039***	0.017***	0.009***	544	0.28†

Notes: Experience in quadratic terms is also included. †R^2. * significant at 10%; ** significant at 5%; *** significant at 1%.
Source: estimation with ECVT 2007-2010 data.

TABLE 3

Job satisfaction estimation with sample selection. Marginal effects

		Unadjusted	*Apparently over-educated*	*Genuinely over-educated*	*N obs.*	*Log L*	R^2
Total							
	Wage earners	-0.105***	-0.200***	-0.325***	20,236	-6671.67	0.04
	Self-employed	-0.050***	-0.216***	-0.271***	4,901	-4101.52	0.04
Men							
	Wage earners	-0.093***	-0.221***	-0.335***	12,376	-10187.78	0.04
	Self-employed	-0.042**	-0.225***	-0.267***	3,468	-2883.52	0.04
Women							
	Wage earners	-0.134***	-0.177***	-0.314***	7,860	-6459.98	0.04
	Self-employed	-0.070*	-0.202***	-0.287***	1,433	-1197.77	0.05
Pseudo-panel estimations with sample selection (Wooldridge, 1995)							
	Wage earners	-0.070***	-0.008***	-0.105***	1,088		0.24
	Self-employed	-0.051***	-0.039***	-0.024***	544		0.15

Notes: Other regressors: Gender, experience (quadratic), tenure (quadratic), marital status, first job, industry and occupation. *Source*: estimation with ECVT 2007-2010 data. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 4

Job search with sample selection

		Unadjusted	*Apparently over-educated*	*Genuinely over-educated*	*N obs.*	*Log L*	R^2
Total							
	Wage earners	0.106***	0.459***	0.644***	20,236	-5871.53	0.13
	Self-employed	0.226***	0.525***	0.652***	4,901	-1030.92	0.08
Men							
	Wage earners	0.105***	0.474***	0.659***	12,376	-3639.22	0.13
	Self-employed	0.262***	0.475***	0.511***	3,468	-725.65	0.05
Women							
	Wage earners	0.109***	0.426***	0.612***	7,860	-2218.55	0.14
	Self-employed	0.060	0.618***	0.859***	1,388	-287.79	0.18
Pseudo-panel estimations with sample selection (Wooldridge, 1995)							
	Wage earners	0.011	0.003***	0.008***	1,088		0.11
	Self-employed	0.014	0.007***	0.037**	544		0.39

Notes: Other regressors: Gender, experience (quadratic), tenure (quadratic), marital status, first job, industry, and occupation. *Source:* estimation with ECVT 2007-2010 data. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 5

Estimation of the LOGSE effect on educational mismatch. Index of LOGSE

	Total			*Men*			*Women*		
	Coef	St error	Log L/ R^2ad	Coef	St error	Log L/ R^2adjusted	Coef	St error	Log L/ R^2a
Ordered probit	0.073***	0.026	-25,722	0.042	0.035	-15,983	0.111***	0.041	- 9,523
Probit	0.048	0.032	-10,917	0.005	0.045	-6,347	0.095**	0.047	-4,520
OLS	0.058***	0.020	0.09	0.029	0.026	0.07	0.090***	0.031	0.13
N	26,764			16,692			10,072		

Notes: Other regressors: Gender, experience (quadratic), tenure (quadratic), marital status, first job, industry and occupation. *Source*: estimation with ECVT 2007-2010 data. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 6

Estimation of the LOGSE effect on educational mismatch. Differences in differences

	Differences in differences		*Placebo test 1*		*Placebo test 2*	
	Coef	St error	Coef	St error	Coef	St error
Treatment	-0.077**	0.032	-0.007	0.025	0.091***	0.019
Post	-0.005	0.023	0.047***	0.011	0.011	0.029
Treatment x Post	0.068**	0.031	-0.026	0.024	0.017	0.034
R^2	0.10		0.07		0.10	
N	13,535		14,851		13,535	
High studies						
Treatment	-0.025**	0.012	0.003	0.050	0.051	0.040
Post	-0.083	0.050	0.065***	0.021	-0.080*	0.044
Treatment x Post	0.017**	0.008	0.019	0.045	0.027	0.048
R^2	0.23		0.19			
N	3,888		3,833			
Secondary studies						
Treatment	-0.116**	0.052	0.039	0.048	0.088	0.094
Post	0.026	0.020	0.088***	0.020	0.055	0.050
Treatment x Post	0.100**	0.048	-0.102	0.750	0.012	0.062
R^2	0.10		0.09		0.10	
N	5,077		4,860		5,077	

Notes: Placebo test 1: considers that the region implementing LOGSE first are the 8 to 17 in alphabetic order. Placebo test 2: considers that the LOGSE affects only those born between 1965 and 1970. Other regressors: Gender, experience (quadratic), tenure (quadratic), marital status, first job, industry and occupation. *Source*: estimation with ECVT 2007-2010 data. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A
Theoretical years of study duration.

	ISCED97 classification	Previous and LGE-70	LOGSE-90	Share (%)
Illiterate	NA	0	0	0.13
Pre-primary	0	5	6	3.02
Primary	1	5	6	15.56
Lower Secondary	2	8	10	21.24
Upper secondary	3	12	12	10.11
Vocational short	3	10	12	10.50
Vocational long/	5B	13	14	13.28
Short Bachelor	5A, 6	15	15	10.76
Long Bachelor and above	6, 7, 8	17	17	14.40

LGE: General Law of Education (LGE acronym in Spanish) lasting from 1970 until 1992. LOGSE: Organic Law of Sorted Educational System (LOGSE). It was passed in 1990 and set up in after 1992.
Share: averaged value from ECVT 2007-2010 data.