

SUBJECTIVE EDUCATIONAL MISMATCH AND SIGNALLING IN SPAIN

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JEL classification: D82, I26, J24, J28, J62

Keywords: human capital, educational mismatch, rate of return, signalling

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Abstract

Educational mismatch may arise from the voluntary decisions of individuals to acquire more qualifications than those required in the workplace. In these cases, the mismatch may have a signalling role that allows workers to compensate for the lack of certain other skills, or to gain access to the labour market. The aim of this paper is to analyse the signalling role of educational mismatch in Spain, a country characterised by a strongly-segmented labour market with high unemployment levels, and a large number of mismatched individuals. Using micro data for a representative sample of Spanish workers, we use three different methods to test the signalling value of educational mismatch. First, we compare education returns between groups of workers: those who need to signal to employers that they are qualified, against those who do not need to signal. Second, we analyse the relationship between educational mismatch and different features such as job satisfaction, job search, and job mobility. In both cases, we apply controls for selectivity bias and unobserved heterogeneity. Third, we use a natural experiment based on a change in the minimum school-leaving age, affecting education incentives. The results obtained provide evidence that educational mismatch plays a clear signalling role.

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1. Introduction

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, usually called over-education, over-qualification or skill underutilization - terms that we use interchangeably - is a matter of great interest in current research (see the meta-analyses by Groot and Maassen van den Brink, 2000; Rubb, 2003b, 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. They find incentives, for example, to signal their true skill level, if it is above the average or, by contrast, if their skill level is below the average, to try to mask it.

The potential role of over-education as a signalling device has been frequently overlooked in the literature. In the survey by Leuven and Oosterbeek (2011), we learn that “this source of overinvestment in schooling (signalling) has not been addressed in the over-education literature”; in the survey by Hartog (2000), the sorting model is cited only in a footnote; and in Sloane (2003) and McGuinness (2006), the topic is not even mentioned. This low level of interest stems from the general belief that over-education is a source of inefficiency and is a deviation from the rational behaviour of individuals, since over-education entails lower wages than earned by equally-educated workers who are in properly-matched jobs. Additionally, for firms, an over-educated workforce results in lower productivity, lower job satisfaction, and greater absenteeism and voluntary turnover while, for society as a whole, an over-educated population leads to lower rates of growth and a waste of resources (McGuinness, 2006).

Under a signalling approach, however, over-education may be inefficient at the social level, but it may, in fact, stem from rational individual behaviour. To the extent that the expansion of higher education has generated an increase in the number of university graduates, this has led to greater heterogeneity in skills, and in the area of specialisation among equally-educated workers (Chevalier, 2003; Sloane, 2003). A number of arguments support the idea that over-education can also be a voluntary decision of workers. Thus, 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, which is an essential criterion in the selection of workers (Lene, 2011). This signalling role of over-education may be especially important in periods of recession, and/or in areas where unemployment is high, since, in these cases, 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; Fernández, 2006). Thus, Charlot et al. (2005) develop a model in which an excess of education increases the probability of individuals to leave unemployment. Charlot and Decreuse (2005, 2010) have proposed models in which over-education may result from strongly-segmented labour markets with high unemployment and large search costs. Lene (2011), with data from the OECD, shows that achieving tertiary credentials is a safeguard against becoming trapped in low-skilled jobs, especially in early labour market experiences. Finally, Albrecht and Vroman (2002) and Verhaest and Omeij (2009) show that being unemployed produces a greater stigma than working at a job for which the individual is over-educated.

The aim of this paper is to examine the possible role of signalling in the generalization of over-education in the Spanish labour market, although testing the hypothesis of signalling is not without its problems. The “controversy” of human capital theory, as against signalling, is a common topic of discussion in the literature on education returns, since both lead to a similar prediction: a positive correlation between education and earnings, and different methods have been proposed for testing one alternative against the other (Weiss, 1995; Riley, 2001; Arcidiacono et al., 2010). In the case of over-education, we face further problems of how to define over-education and how to measure it. Thus, 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 signalling role of over-education using three alternative methods; first, by comparing the returns to education between different groups of workers and different degrees of educational mismatch; second, by analysing the attitude of workers to their

educational mismatch and the degree of persistence over time of over-education; and, finally, by using an exogenous variation in educational legislation. With respect to the first method, following the methodologies of Wolpin (1977) and Riley (1979), we 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 signalling value of over-education; if differences are negligible, over-education has no signalling 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. Whereas self-selection is addressed through the use of participation equations, skill heterogeneity is dealt with, at the individual level, through the self-reporting by individuals of how well they feel their level of education fits with their current job; and, at the cohort level, through the construction of a pseudo-panel.

The second approach includes three different exercises exploring a common idea: how well the over-educated feel at the workplace and their willingness to move to other jobs. Specifically, we analyse in turn i) job satisfaction in the present job, ii) the willingness to look for another job, and iii) comparing current over-education with educational mismatch in the first job. Our hypotheses are as follows. When individuals are over-educated, and not very satisfied in the current job, then they would probably 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 signalling. If, by contrast, the over-educated individual feels fine in the current job and is not looking for another job, over-education may persist over time and over-education can be seen acting as a signal to gain access to the labour market, or to compensate for the lack of other unobserved skills, or both.

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.

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 Furthermore, over 40% of workers hold jobs in areas that are unrelated to their field of study; 55% among the over-educated (OECD, 2011). Second, employment protection legislation is quite restrictive (Venn, 2009), at least until the last labour reform in 2012, which has generated a strongly-segmented market between permanent and temporary workers. The temporary rate has been the highest within the EU, around 30%, during the last 30 years, generating a dual market and favouring the volatility of employment over time (Bentolila et al., 2012). 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 (Budría and Moro-Egido, 2008; Felgueroso et al., 2010; Izquierdo and Lacuesta, 2012; Murillo et al., 2012) with wage inequality also having decreased (Lacuesta et al., 2011).² Finally, there is mixed evidence about the permanent character of over-education and the possibilities of promotion or upward mobility. Alba-Ramirez (1993) and Alba-Ramirez and Blazquez (2003) present evidence in favour of over-education being temporary, and workers moving up the occupational ladder, with García-Serrano and Malo (1996, 2003) arguing for a more permanent character of over-education. All of this suggests an interest in studying the potential signalling role of over-education in Spain.

¹ The statistical method is one of the ways of measuring over-education. This and other methods are later briefly discussed in the text - for more on the methodology of measurement, see Groot and Maassen van den Brink (2000) and Hartog (2000). 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 wage premium for graduates has not been reduced so sharply in other countries (Walker and Zhu, 2008).

Our results show that returns to over-education in those groups in which signalling is unimportant (the self-employed) are lower. We interpret this as showing a signalling 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. Although we have information on prospective mobility (and not actual mobility), this result is corroborated when we compare the situation of over-education at present with that at the first job, since we observe that over-education is reduced over that span of time. On principle, this may be interpreted as going against the signalling role of over-education, but it must be noted that job satisfaction and willingness to change the job depend on the type of educational mismatch, as discussed below. Individuals who feel genuinely over-educated are less satisfied and more eager to move than those who are only apparently over-educated, so that the signalling 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 signalling role of over-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 signalling 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

Several models have been proposed in the literature as possible explanations for the existence of over-education. The traditional argument, based on the human capital theory, which predicts that over-education is temporary in essence, is recurrently unsupported by the empirical evidence (Robst, 1995b; Dolton and Vignoles, 2000; Rubb, 2003a; Brynin and Longhi, 2009; McGuinness and Wooden, 2009; Baert et al., 2013).³ A possible alternative, the job competition theory, offers a demand-side explanation for the existence of over-education which is permanent in nature. Competition for high wages between workers creates a job queue, in which jobs are

³ An exception is Frei and Sousa-Poza (2012) who show that over-education in Switzerland is fundamentally of a transitory character.

ranked by earnings. Simultaneously, workers are ranked by education level in the labour queue, so that highly-educated persons are matched to high-paying jobs (Thurow, 1975). As the educational attainments of workers increase, there is a shift in the distribution of workers in the labour queue, so that the low-skilled are ‘bumped down’ into lower-wage jobs, or ‘crowded out’ of the labour market into unemployment, resulting in high-skilled individuals being forced to accept jobs lower in the job queue, thus experiencing over-education.

Both models can be easily tested in the ORU (Over-, Required-, Under-education) framework (Duncan and Hoffman, 1981). These authors decompose attained education into three parts: i) required education; ii) over-education, the amount of education attained by the worker in excess of what the current job requires; and iii) under-education, the amount of education required by the job in excess of what the worker has attained. The three schooling components can be inserted into a standard Mincer wage equation, with the coefficient of required education showing the total schooling return for adequately-matched workers; and the coefficients of over-education, and under-education capturing the return for each year in addition, or in default, respectively, to required education. In this framework, the human capital theory predicts that the years of over-education do not have an extra wage effect relative to required education, so that the coefficients of over- and required education should be equal, whereas the job competition theory predicts that the over-education coefficient is equal to zero.⁴

This decomposition has been repeatedly used in empirical work (see Rubb, 2003b, for a meta-analysis, Hartog, 2000, McGuinness, 2006 and Leuven and Oosterbeek, 2011, for surveys), with both hypotheses, the human capital and job competition, being strongly rejected by empirical research. The standard result is that the coefficient of over-education is found to be positive, but lower than the coefficient of required education, with the coefficient of under-education being negative. That is, over-educated workers earn more than adequately-matched workers in the same kinds of job, but less than adequately-matched workers with the same amount of education; with the converse pattern holding for under-educated workers. In other terms, over-educated workers face a wage penalty compared to equally-educated individuals who are job-matched.

⁴ In the case of the human capital theory, the coefficient of under-education is of the same value, but opposite sign to that of required (and over-) education, whereas in the case of the job competition theory that coefficient is also zero.

The results just described have led many authors (see Sloane, 2003; McGuinness, 2006) to give support to an assignment theory (Sattinger, 1993), which rests on the notion that not all similarly-educated workers are equally productive in all jobs. According to this theory, over-education arises when workers are allocated to positions where their skills are under-utilised, and persists until a more efficient allocation occurs. This theory explains why over-education may fade away at the individual level, but remains at the societal level. The existence of labour market frictions in the process of job search and job matching - because of imperfect information (Jovanovic, 1979) or the lack of experience and/or tenure (Rubb, 2003a) - provokes mismatch in the allocation of workers to jobs. For some authors, this mismatch is of a transitory character, since it disappears in the course of upward career mobility (Sicherman and Galor, 1990; Sicherman, 1991; Alba-Ramírez, 1993). Accordingly, new entrants to the labour market hold high levels of formal education and accept positions for which they are apparently over-educated, while they gain knowledge and skills and occupation-specific human capital through experience or tenure.⁵ Although the empirical evidence shows mixed results for the career-mobility hypothesis, most recent studies tend to challenge it (see Baert et al., 2013 and references therein) and find that over-education is also a permanent phenomenon at the individual level.

In these latter case, 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 (Chevalier, 2003; Green and Macintosh, 2007). That is, it may be the case that over-education is only capturing the heterogeneity of skill levels achieved within groups of apparently homogeneous educational attainment; 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 (Ingram and Neumann, 2006). 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). That is, while the typical measures of over-education implicitly

⁵ A similar argument is utilised in standard search theory, but the conclusions do not entirely coincide. Albrecht and Vroman (2002), Gautier et al. (2002), Dolado et al. (2009) and Lene (2011) propose several versions of matching models with heterogeneous jobs and workers, in which high-skilled workers may end up in low-skill jobs. Once there, and depending on different assumptions, these workers may decide optimally to continue searching for a better match, or remain in that job. Therefore, skill mismatch may be transitory for some workers, but permanent for others.

assume that all workers with a given education level are perfect substitutes, 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, in such a way that ability and over-education are negatively correlated (McGuinness and Bennet, 2007; Leuven and Oosterbeek, 2011).⁶ 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. In consequence, there is no role for mobility to a high-level job over time for those who are apparently over-educated, since individuals are indeed properly matched to the jobs. Over-education, then, could be transitory only for those who are genuinely over-educated (Chevalier, 2003; Chevalier and Lindley, 2009).⁷ It is in this context of skill heterogeneity among the over-educated where the signalling 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 signalling, filtering, credentialism, sorting, or screening - which we term as signalling, 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 signalling the level of the worker's productivity to potential employers who have only imperfect information (Arrow, 1973; Spence, 1973; Stiglitz, 1975; see Weiss, 1995, for

⁶ These low levels of skills can be of innate characteristics (Rubb, 2003a; 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 (Robst, 1995a; 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, which used to be more valued in the labour market (Dolton and Vignoles, 2000; Frenette, 2004; Green and McIntosh, 2007).

⁷ Other explanations for permanent over-education include: first, the spatial mobility theory, which suggests that individuals in small, local labour markets with limited capacity to migrate or commute are more likely to be over-educated (Büchel and van Ham, 2003); and, second, the differential over-education theory, which posits that married women are more likely to be over-educated as their job choice is dictated by the husband's choice (Frank, 1978; Büchel and Battu, 2003). Both theories have received little support in the empirical literature (see OECD, 2011). Additional views include the idea that education provides nonpecuniary benefits (see the survey in Oreopoulos and Salvanes, 2011) or a signal of status (Brynin and Longhi, 2009).

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; Moen, 1999; Lene, 2011). 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 labour 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 labour markets, where unemployment is significant, over-education may be used also by individuals as a signal to either gain access to the labour market, to improve their position in wage bargaining, or to show adaptability to a changing environment in the job market (Charlot et al., 2005; Fernández, 2006; Lene, 2011). Likewise, Charlot and Decreuse (2005, 2010) argue that over-education may arise in strongly-segmented labour 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 labour 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 (Di Pietro and Urwin, 2006; OECD, 2011), especially in the public sector (Dolado et al., 2009; Ortiz, 2010). Some other issues related to over-education and signalling 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 A in the Appendix), it has increased steadily⁸, producing high rates of over-education, over 25%, especially among graduates (OECD 2011; Verhaest and Verhoven, 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 emphasising the signalling 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), produced by the Spanish Ministry of Employment. The ECVT is an on-going programme, since 1999, which focuses on employment relationships and on the valuation and attitudes of employees towards work. The survey addresses the employed over age 16, living in households, 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 is constructed from pooling the last four consecutive available waves, from 2007 to 2010. Using a longer sample is possible, but not advisable. The questionnaire was different before and after 2004. The survey was not carried out in 2005 and, in 2006, information was not present for some of our variables of interest. All this leads us to collect information only for the period 2007-2010. It 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.

The over-education literature typically considers four ways to measure educational mismatch: two are subjective and two are objective. Subjective measures come from worker self-assessments. A direct measure corresponds to the answer to the question

⁸ In 1992, 15% of the population between 25 and 54 had attained tertiary education. In 2007, the percentage had increased to 32% (see Lacuesta et al., 2011).

whether the individual feels over- or under-educated for the work they do, whereas an indirect measure is obtained by comparing the actual education level of the workers with the self-report of the required education level in their job. The objective definitions are also of two types. The first is based on a comparison between the actual education level and the job-level requirements, established from an evaluation by professional job analysts. The second objective measure of over-education is statistical, obtained by comparing years of education attained by an individual with an indicator of the aggregate education level in the occupation in which that individual works. Conceptually, the most appropriate measures come from job analysts, but this is often difficult to implement and keep up-to-date, due to high costs and frequent changes in occupation classification. The statistical definition, used for instance by the OECD (2011), is basically used when the database does not allow one of the other measures (Chevalier, 2003; McGuinness, 2006). The main advantage of the subjective definition is that, in principle, it is based on all the relevant information (Green and Zhu, 2010); even though it can be affected by classification error, since the researcher does not generally know how workers judge their own matching status (Chevalier, 2003). General assessments of the different measures can be seen in Hartog (2000) and Groot and Maassen van den Brink (2000).

We have computed educational mismatch from a subjective point of view. 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
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.⁹

⁹ 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,

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*. The answer given to this question may be interpreted as an indicator of skills utilization, since it may well be the case that an individual declares herself as adequately matched and, simultaneously, reports a low degree of usefulness of her studies in her current job. Looking at the answers to this second question, near one half of surveyed individuals rates below 6, with the median value at 7.2. In order to keep things more tractable, we consider that the half 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*).

Taking responses to both questions, we can construct a classification of employees according to a self-evaluated skill 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 17%. 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 (9.5% 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 7.2% of all individuals can be considered as genuinely over-educated.

The remaining individuals, more than 18% of observations, correspond to individuals who report there is not much of a relationship between their realized studies and the tasks they perform at work. These are more difficult to classify; they are skill/mismatched, incorrectly/matched or under-skilled. In short, we designate them as “unadjusted”.¹⁰ 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.

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. As a reference, OECD (2011), with data from the 2005 wave of European Social Working Condition, shows that less than 10% of Spanish workers feel under-skilled when a subjective measure is used, as against roughly 30% when a statistical measure is used.

¹⁰ 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.

(Table 1 about here)

Looking at different subgroups, it can be seen in Table 2 that, whereas over-education is more common among females, the unadjusted are more frequently men. There is a lower proportion of the over-educated among the self-employed, 10%, than among wage-earners, 18%, with apparent over-education dominating genuine over-education in both cases. However, the proportion of unadjusted workers is somewhat higher for the self-employed than for wage-earners. The subsamples of men and women roughly reproduce these patterns.

(Table 2 about here)

Finally, the ECVT also provides information on the worker's perception of the match in the first job, where the first job is where the worker was during at least three consecutive months for the first time. Specifically, the question reads as follows

- *To what extent is/was your first job adapted to your labour aspirations?*

with the answer rating between 0, *not at all*, and 10, *very much*.

4. Returns to education

As mentioned earlier, and despite that the empirical evidence is not conclusive, 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 (Groot and Massen van den Brink, 2000; Rubb 2003b, for meta-analyses; Sloane, 2003; McGuinness, 2006; Leuven and Oosterbeek, 2011, for surveys).¹¹ In this context, an important question is whether this wage premium is due to a productivity-enhancing effect only, or if, additionally, signalling 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 signalling role, following different approaches (see Riley, 2001, for a survey; and Chevalier et al., 2004, for a

¹¹ 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, 2003b). This has led some commentators to claim that measurement errors may then not be a problem. For example, McGuinness (2006: p. 399) states that “one might reasonably conclude from such cross-country studies that whilst there are serious concerns relating to the low correlation between the various measures of over-education, the balance of the evidence would suggest that, in terms of estimating the incidence and returns to over-education, the various approaches generate broadly consistent evidence”. This conclusion has been criticised by Leuven and Oosterbeek (2011).

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 signalling 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 signalling effects so that their returns are expected to be greater.¹²

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 signalling 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 signalling 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 signalling role.

To test these possibilities, we first estimate a Mincer-type wage equation (1) separately for over-educated and adequately-educated and compute the returns from a year of education

$$\ln w_i = \alpha + \beta_0 Edu_i + \delta'X_i + \varepsilon_i \quad (1)$$

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. β_0 is the return to education from an additional year of education. 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 A in the Appendix. Since individuals in the sample have

¹² 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).

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.¹³ Our measure of income is net monthly individual earnings, which respondents categorized into one of 9 possible income brackets. We 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 different groups of workers.

In order to consider education and skill mismatch, we additionally estimate the Mincer-type wage equation (2) and compute the rates of returns for the four types of employed previously defined:

$$\ln w_i = \alpha + \beta_0 \text{Edu}_i + \beta_1 \text{Unad}_i + \beta_2 \text{Appar_overed}_i + \beta_3 \text{Genu_overed}_i + \delta'X_i + \varepsilon_i \quad (2)$$

where *Unad.*, *Appar_overed.*, and *Genu_overed.* are dummy variables indicating the group to which the worker belongs. *X* is defined as above and β_0 now 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.

Table 3 shows the estimates of parameter β_0 in expression (1) for the over-educated and the adequately-matched. All are positive and statistically significant. One clear result is that there exists a pay penalty for the over-educated, relative to the adequately-educated. Estimates of coefficient β_0 are clearly higher for those who report feeling adequately matched, with the difference being more than double in the case of the self-employed. Looking now at the differences between groups of workers, returns to an additional year of education are, as expected, greater for wage earners - relative to the self-employed - for both adequately-matched and over-educated workers. These results are also obtained in the subsamples of men and women. This is evidence of the existence of a wage penalty for the over-educated and of the (plausible) signalling role played by education.

(Table 3 about here)

Whereas in Table 3 individuals are classified into adequately-matched and over-educated, it may be the case that individuals who self-classify as over-educated, since

¹³ A new educational law in 1990 increased compulsory schooling age from 14 to 16 years old and initiated several organizational changes. These are discussed later in the paper.

their educational level is above what is required by the job, they are not so when other aspects of human capital are considered. Thus, individuals with the same educational level may differ in unobserved characteristics, such as skills, ability, the type or field of education received, and the quality of institution providing the schooling, so that differences in accumulated human capital may exist. Similarly, individuals who self-considered as adequately matched may find their skills lacking in utility, so that they feel skill-mismatched. In order to focus now on these differences, at least partially, we consider the four groups defined in Section 3 and estimate equation (2). 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. Results of estimating equation (2) for the four groups defined are presented in Table 4 (Panel A) where the estimates correspond to the sum of the estimated coefficient β_0 (the properly-matched) plus the conforming β for each group. They offer a picture similar to that in Table 3, but allow us to identify the penalty associated with each type of mismatch.

(Table 4 about here)

We first note that educational 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 those who feel properly-matched and make little use of their acquired skills (unadjusted); it increases to values around 23% for those who feel over-educated but make a large use of their acquired skills (the apparently over-educated); and reaches values of about 40% for those labelled as 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 results in Tables 3 and Panel A in Table 4. 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 signalling value of over-education being higher for women. The differences between wage earners and the self-employed are, on average,

0.02 for women, as against 0.01 for men. Third, being mismatched is penalised with lower wages. Our results thus converge with those of most of the literature using cross-sectional information, in that those who suffer from educational mismatch are, on average, less productive and receive a smaller payoff for each year of schooling than the adequately-matched workers with the same educational level. Fourth, and also coincident with prior literature, 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 (Oosterbeek, 1993): first, self-selection into type of employment;¹⁴ and second, time-invariant unobserved heterogeneity arising from an unknown distribution of skills or ability across workers, or because of differences in the field of specialisation or in the quality of the institution that provided the schooling.

A simple result may be an indirect indicator of possible problems of self-selection. We find that returns to education for mismatched wage-earners are not much lower than those for the adequately-educated among the self-employed. This suggests that the choice of the sector where an individual works may not be random, so that we must control for possible self-selection into a particular group. We deal with selectivity into self- or paid-employment using Heckman's (1979) procedure, by adding participation restrictions, where some additional regressors must be included to explain the decision to work in a particular group, but that are not supposed to affect wages. The selection equation includes the same regressors as in equation (2), plus a series of controls including 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. Panel B in Table 4 offers estimates of equation (2) where self-selection into each workers' group is controlled for.¹⁵ Estimates are similar to those in Panel A, so that selectivity bias may be unimportant for the returns. Again, evidence of signalling is found when comparing the samples of wage earners and the self-employed for all types of mismatch.

Regarding unobserved heterogeneity, some authors, such as Bauer (2002), Chevalier (2003), Dolton and Vignoles (2000), Frenette (2004), and Tsai (2010) show that when controlling for it through fixed effects estimations, or explicitly dealing with

¹⁴ Given that our sample is of the employed only, we do not control for selectivity into employment.

¹⁵ The results of the first stage are not shown, to save space, but are available on request.

distributional skills or the field of specialisation, 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 4, 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 (Deaton, 1985). 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 labour 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.

$$\ln w_{ct} = \alpha + \beta_0 \text{Edu}_{ct} + \beta_1 \text{Unad}_{ct} + \beta_2 \text{Appar_overed}_{ct} + \beta_3 \text{Genu_overed}_{ct} + \delta X_{ct} + \varepsilon_{ct} \quad (3)$$

We follow Wooldridge (1995) to control for self-selection when estimating equation (3) by fixed effects, where each panel cell is weighted by the number of observations in the first year of the sample, 2007. Estimates of returns to education and educational mismatch for the overall sample are shown in Panel C in Table 4.¹⁶ The pattern observed is similar to that discussed in previous estimates. This again confirms the signalling value of over-education and suggests that the estimation of the enhancing-productivity role of over-education is not strongly affected by unobserved heterogeneity.

In this sense, although our results run against what we previously stated, they coincide with those of Green and McIntosh (2007), McGuinness and Bennett (2007), Brynin and Longhi (2009), 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. While Leuven and Oosterbeek (2011) challenge this result, because of the absence of control for measurement errors, Dolton and Silles (2008),

¹⁶Men and women subsamples are not estimated due to the reduced sample size.

Korpi and Tåhlin (2009), and Verhaest and Omeij (2012) 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. These authors argue that it is possible that potential downward biases of the over-education wage penalty, due to self-selection or measurement errors, may well cancel out with the upward bias derived from ability, so that measurement-error-corrected (IV) panel estimates do not drift apart from those of simply applying OLS. The lack of appropriate instruments prevents us from dealing with measurement errors. These are likely to arise in our case, due to the way years of education are imputed from educational attainments. While we acknowledge this limitation, we cannot know the extent and effect of this bias in our results.

An additional, noticeable result is that returns for the genuinely over-educated are much lower than for other groups of the mismatched. Furthermore, their returns are lower than for those workers with lower educational attainment who are properly adjusted. This shows that the genuinely over-educated are obtaining no gain from additional years of education. Apart from job-search frictions impeding an adequate match, it may also be the case that genuinely over-educated workers use additional years of education as a way to gain access to employment, disregarding any monetary compensation from these extra years. We explore this possibility in the following section.

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 signalling in over-education. In principle, mismatched workers may feel no, or little, job satisfaction 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 Omeij, 2006, 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. An indirect evidence of this is that, as shown in Tables 3 and 4, returns for the unadjusted and the apparently over-educated in the screened sector are not very different to those for the properly-matched in the unscreened sector. Thus, mismatched workers in a screened sector, where signalling may be present, actually do not receive lower returns than those in sectors where signalling is absent. In consequence, these individuals may choose to remain as mismatched, and thus we should observe little difference in job-satisfaction and a not very different propensity to voluntary turnover between properly-matched and mismatched. In these circumstances, mismatching would have a permanent character and individuals would remain mismatched for a very long period in their career. By contrast, individuals who are genuinely mismatched probably feel very unsatisfied and would try to look for new jobs providing a better match, implying that the mismatch would be of a transitory nature. We study these aspects of job satisfaction, job search, and job mobility in order to provide some insights into the signalling role of over-education.

Our database allows us to do that. 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 5, 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 signalling 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 5 about here)

The second aspect is investigated by estimating the probability of searching for another job. However, 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 6 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 in the case of the unadjusted. Here, the differences between wage earners and the self-employed throughout the mismatch statuses are less systematic. Probably, the search mechanism of the self-employed has a different character than that of the wage earners, so no clear conclusion can be derived from comparing both groups of workers.

(Table 6 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 5 and 6. 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. One can deduce, hence, that they obtain some gain from educational mismatch, which we may interpret as the credentials obtained by those two groups having some signalling value, even though they are not as satisfied at the workplace as those who are adequately educated.

Of course, this evidence on signalling 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 to us we can analyse the “temporary” nature of any mismatch by comparing the situation at present with that at the first job.¹⁷ To do so, we make use of the responses to two questions related to educational adjustment, noting that they do not provide exactly the same information. Regarding the present job, we use the first of the questions described in Section 3. Thus, our definition of over-educated includes those workers who feel their current job is below their educational level. Regarding the initial job, (the initial job is that in which the worker was engaged for more than three consecutive months) the question is *To what extent was your first job adapted to your labour aspirations?*, with possible answers ranging from 0 (*not at all*) to 10 (*very much*).

We construct, for each cohort of individuals born between 1944 and 1988, the percentage of the over-educated at the present, and the percentage of those workers who feel that their first job hardly (less than 6 on the 0-10 scale) adapted to their labour aspirations. The comparison over time between both percentages provides a broad view of how fast over-education is reduced as individuals grow older. Of course, this is only an approximation and one important drawback of our approach is that we are not analysing individual job mobility, but cohort job mobility, under the assumption that each cohort distributes independently from other cohorts. An additional pitfall in our approach is that younger workers have had fewer possibilities to alleviate any initial mismatch. And yet, it still provides interesting insights on the transitory (or not) character of educational mismatch.

Figures 1.a, 1.b and 1.c show this for the whole, male, and female samples, respectively. A first point to note is that, in the three samples, both series - the one reflecting the lack of initial adaptation and the one showing current over-education -

¹⁷ Unfortunately, we do not know the entire professional career, nor the jobs occupied between the initial and the current job.

trend upwards, indicating that over-education now in Spain is more extensive than in past decades (both for those who are in the first job and for those who are not). A second point is that the slope is steeper in the case of workers who feel currently over-educated, so 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 signalling in over-education. This general pattern is replicated when distinguishing between men and women. As in the previous exercises in this section, the evidence offered shows that the part of over-education that is of a permanent character is sizeable, and does not exclude that signalling plays some role for individuals who become over-educated.

(Figure 1 about here)

Overall, we find that those who are genuinely over-educated are less satisfied and more prone to voluntary turnover than the apparently over-educated, and these latter are less satisfied than those who feel adequate but whose acquired skills lack utility. The results observed do not absolutely confirm that signalling exists (to compensate for the lack of skills different from education, or to gain access to the labour market) when the mismatched are satisfied and are not willing to move; nor that signalling is totally absent, since the mismatched are less satisfied than the properly matched and more prone to look for another job. We can interpret this as an indication 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. This is a clear possibility in a slack labour market, as in Spain, with individuals becoming over-educated to enter the labour market or to achieve a permanent position. However, once this is attained, they may feel still less satisfied than their adequately-matched counterparts, who have had no need to over-educate. In consequence, we cannot discard the possibility of over-education having a value as a signal that, however, does not fully compensate for the loss in job satisfaction with respect to the properly-matched.

6. The increase in the minimum school leaving age

The tests described in Section 4 argue that differences in returns to over-education across different types of workers can identify signalling effects. The different analyses carried out in Section 5 do not discard over-education as having a signalling value. In

order to provide more evidence on this matter, we follow Bedard (2001) and Chevalier et al. (2004) who, based on Lange and Kropp (1986), exploit differences in education levels in response to a change in the minimum level of education. The rationale behind this is that, under the signalling view, exogenous increases to schooling would affect an individual's ranking (Oreopoulos and Salvanes, 2011). 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 signalling 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 (2000) 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 organisational factors.¹⁸ 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

¹⁸ Felfe et al. (2015) 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”.

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 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.¹⁹

We estimate equation (4) which, besides the individual index of exposure to the LOGSE, includes the same variables as in specification (3), plus regional variables

$$Y_{iqr} = \alpha + X'_{iqr}\beta + \gamma I_{iqr} + \delta Z_{qr} + u_{iqr} \quad (4)$$

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 labour characteristics, I denotes the exposure level, and Z is a regional variable, the unemployment rate. Equation (4) 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 if adequately/matched; finally, iii) an OLS model with the same dependent variable as in case i) and clustering standard errors at the region level.²⁰

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

$$Y_{iqr} = \alpha + X'_{iqr}\beta + \gamma_1 T_{iqr} + \gamma_2 Post_t + \theta(T \times Post)_{iqr} + \delta Z_{qr} + u_{iqr} \quad (5)$$

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

¹⁹ This probability is calculated as the percentage of individuals of each cohort who are in LOGSE in their region in the secondary and bachelor level.

²⁰ The difference between specifications in cases i) and iii) is with 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.

the passage of the law was higher than 50%.²¹ *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.²² Finally, the treatment variable *T* is interacted with variable *Post*, and *Z* captures the same regional variable as in equation (4). This model is estimated by OLS clustering of standard errors at the region level.

Results of estimating equations (4) and (5) appear in Tables 7 and 8, respectively. Table 7 shows the results of the index of LOGSE exposure variable, *I*, in the three alternative estimations.²³ 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 8 shows the results for the DiD analysis. The interaction term *Treatment* $\times$ *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. In other words, in the absence of the reform, the outcomes for treated and comparison workers should have evolved in parallel. Figure 2 shows the series of over-education of workers by year of birth in fast and slow regions implementing LOGSE. We can see that trends in both types of region seem parallel.²⁴ Two placebo tests have been estimated to validate the visual impression. Placebo Test 1 considers that the fast regions are in the second half, when they are sorted by alphabetical order, with the *Treatment* $\times$ *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 7 about here)

(Table 8 about here)

²¹ These fast regions are Asturias, Aragon, Balearic Islands, Castile-Leon, Castile-La Mancha, Catalonia, Extremadura, Murcia, Navarre, and Rioja. The rest, Andalusia, the Basque Country, Canary Islands, Cantabria, Galicia, Madrid and Valencia, are considered as the slow regions.

²² 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.

²³ 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.

²⁴ Although the average over-education in fast regions is above that in slow regions, it does not mean that regions in which over-education was high implemented the law earlier than regions in which over-education was low. There is significant heterogeneity within groups.

(Figure 2 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 signalling value of over-education is clearly found in the Spanish labour market.

7. Conclusions

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 signalling role in over-education. Since using a single measure of educational mismatch (over-education) may be too restrictive, as it may pool together workers who differ in the nature of their match, we consider different groups according to their educational mismatch: the apparently over-educated, individuals who are over-educated but feel their educational level is useful for their current job; the genuinely over-educated, individuals who are over-educated and feel their educational level is completely without utility in their current job; and finally, the unadjusted, those individuals who are not over-educated but do not find their educational level of use in their current job. Lacking the appropriate data, this partially captures individual unobserved heterogeneity.

We study Spain as an interesting case since its labour market is characterised by a large number of over-educated workers, high unemployment, strong segmentation, and clearly declining returns to education over time. 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 signalling role of over-education using three alternative methods; first, by comparing the returns to education among different groups of workers and different degrees of job mismatch; by analysing 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 signalling is unimportant (the self-employed) are lower. This result is robust against biases coming from self-selection or individual heterogeneity. We interpret this as showing a signalling 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. Although we have information only on prospective mobility (not real mobility), this result is corroborated when comparing situations of over-education at present with that at the first job, since we observe that over-education declines over time. Whereas this may be interpreted as going against the signalling role of over-education, it is noted that job satisfaction and willingness to change the job depend on the type of educational mismatch. Individuals who feel genuinely over-educated are less satisfied and more eager to move than those who are only apparently over-educated, and the unadjusted. It suggests, thus, that the signalling role of over-education varies 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 signalling role of over-education.

In summary, the group of the mismatched in Spain seems to be quite heterogeneous. Our results show that there exist a number of individuals stuck in undesirable positions for which they are genuinely over-educated, but in a position that very likely is preferred to being unemployed. There are also workers who show some degree of mismatch due to shortages in different forms of capital accumulation (lower school quality, lesser skills, shorter work experience,...) who may have used over-education as a way to mask their deficiencies and to enter the labour market. Finally, there are other workers, perhaps at the beginning of an upwardly-oriented career-path, who are unsatisfied in the workplace and looking for another job. They have probably signalled to gain access to the labour market and use mismatch as a stepping stone to attain a better match. Although there may be some other workers who unintentionally remain mismatched, we provide evidence showing that the signalling value of over-education is of substantial importance for many individuals in Spain.

Appendix

(Table A about here)

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Table 1
Definitions and percentages of educational mismatch

Question 1	Question 2	Non-useful skills (0-4 rate)	Useful skills (5-10 rate)
		25.3%	74.6%
Adequately matched (83.2%)		Unadjusted (18.1%)	Properly matched (65.1%)
Over-educated (16.7%)		Genuinely over-educated (7.2%)	Apparently over-educated (9.5%)

Source: Own elaboration from ECVT 2007-2010.

Table 2

Percentages of educational mismatch by group of workers. Pooled information

Worker group		Adequately matched (1)=(2)+(3)	Properly matched (2)	Unadjusted (3)	Over- educated (4) = (5) + (6)	Apparently over- educated (5)	Genuinely over- educated (6)	N obs.
Total		83.28	65.15	18.13	16.72	9.48	7.24	27927
Gender								
	Men	85.42	64.91	20.51	14.58	7.96	6.62	17445
	Women	79.76	65.57	14.19	20.24	11.98	8.26	10482
Employment status								
	Wage earners	81.75	64.21	17.54	18.25	10.40	7.85	22530
	Self-employed	89.72	69.1	20.62	10.28	5.61	4.67	5397
Men								
	Wage earners	83.74	63.65	20.09	16.26	8.90	7.36	13077
	Self-employed	91.51	69.46	22.05	5.49	4.56	3.93	3615
Women								
	Wage earners	78.71	65.08	13.63	21.28	12.69	8.59	8531
	Self-employed	74.95	68.27	17.26	14.47	8.05	6.42	1541

Source: Own elaboration from ECVT 2007-2010.

Table 3

Returns to average year of education by group of worker

Worker group		Adequately matched				Over-educated			
		Coefficient	Standard		N obs.	Coefficient	Standard		N obs.
			error	Log L			error	Log L	
Total									
	Wage earners	0,053***	0.0007	-27810.76	17665	0,040***	0.0015	-5914.71	3943
	Self-employed	0,042***	0.0019	-8629.15	4626	0,016***	0.0062	-962.21	530
Men									
	Wage earners	0,052***	0.0008	-17440.03	10950	0,039***	0.0020	-3311.21	2127
	Self-employed	0,042***	0.0021	-6174.25	3308	0,014*	0.0075	-564.21	307
Women									
	Wage earners	0,066***	0.0010	-9488.34	6715	0,049***	0.0021	-2443.51	1816
	Self-employed	0,045***	0.0453	-2269.88	1318	0,034***	0.0098	-368.94	223

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

Table 4. 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/R ²
Panel A							
Total							
	Wage earners	0.052***	0.045***	0.040***	0.031***	22530	-35113.85
	Self-employed	0.040***	0.036*	0.023***	0.019***	5397	-10081.09
Men							
	Wage earners	0.051***	0.044***	0.039***	0.029***	13668	-21606.95
	Self-employed	0.040***	0.036***	0.026***	0.023***	3777	-7069.57
Women							
	Wage earners	0.063***	0.055***	0.051***	0.042***	8862	-12396.41
	Self-employed	0.044***	0.034***	0.029***	0.023***	1620	-2777.59
Panel B. (controlling biases of selectivity)							
Total							
	Wage earners	0.053***	0.047***	0.041***	0.031***	22530	-31550.63
	Self-employed	0.039***	0.036*	0.021***	0.018***	5397	-9132.33
Men							
	Wage earners	0.052***	0.045***	0.040***	0.030***	13668	-19550.96
	Self-employed	0.038***	0.034*	0.021***	0.018***	3777	-6473.86
Women							
	Wage earners	0.066***	0.058***	0.054***	0.045***	8862	-11001.85
	Self-employed	0.048***	0.038***	0.034***	0.030***	1620	-2451.74
Panel C. (Pseudo-panel estimations with sample selection, Wooldridge, 1995)							
	Wage earners	0.053***	0.048***	0.040***	0.025***	1088	0.48 ^a
	Self-employed	0.039**	0.039***	0.017***	0.009***	544	0.28 ^a

Source: estimation with ECVT 2007-2010 data. Experience in quadratic terms is also included. ^aR². * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. 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***	20236	-6671.67	0.04
	Self-employed	-0.050***	-0.216***	-0.271***	4901	-4101.52	0.04
Men							
	Wage earners	-0.093***	-0.221***	-0.335***	12376	-10187.78	0.04
	Self-employed	-0.042**	-0.225***	-0.267***	3468	-2883.52	0.04
Women							
	Wage earners	-0.134***	-0.177***	-0.314***	7860	-6459.98	0.04
	Self-employed	-0.070*	-0.202***	-0.287***	1433	-1197.77	0.05
Pseudo-panel estimations with sample selection (Wooldridge, 1995)							
	Wage earners	-0.070***	-0.008***	-0.105***	1088		0.24
	Self-employed	-0.051***	-0.039***	-0.024***	544		0.15

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

Table 6. 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***	20236	-5871.53	0.13
	Self-employed	0.226***	0.525***	0.652***	4901	-1030.92	0.08
Men							
	Wage earners	0.105***	0.474***	0.659***	12376	-3639.22	0.13
	Self-employed	0.262***	0.475***	0.511***	3468	-725.65	0.05
Women							
	Wage earners	0.109***	0.426***	0.612***	7860	-2218.55	0.14
	Self-employed	0.060	0.618***	0.859***	1388	-287.79	0.18
Pseudo-panel estimations with sample selection (Wooldridge, 1995)							
	Wage earners	0.011	0.003***	0.008***	1088		0.11
	Self-employed	0.014	0.007***	0.037**	544		0.39

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

Table 7. Estimation of the LOGSE effect on educational mismatch. Index of LOGSE.

		Total		Men			Women		
		St	Log L/ error	Coef	St	Log L/ error	Coef	St	Log L/ error
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	

Source: estimation with ECVT 2007-2010 data. * significant at 10%; ** significant at 5%; *** significant at 1%.

Other regressors: Gender, experience (quadratic), tenure (quadratic), marital status, first job, industry and occupation.

Table 8. 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	

Source: estimation with ECVT 2007-2010 data. * significant at 10%; ** significant at 5%; *** significant at 1%.

Placebo test 1: considers that the regions implementing LOGSE first are the 8 to 17 in alphabetic order. Placebo test 2: considers that the LOGSE affects only those born between 1961 and 1970.

Other regressors: Gender, experience (quadratic), tenure (quadratic), marital status, first job, industry, and occupation.

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.

Figure 1.a
Overeducation in actual job and first job no adapted to their aspirations

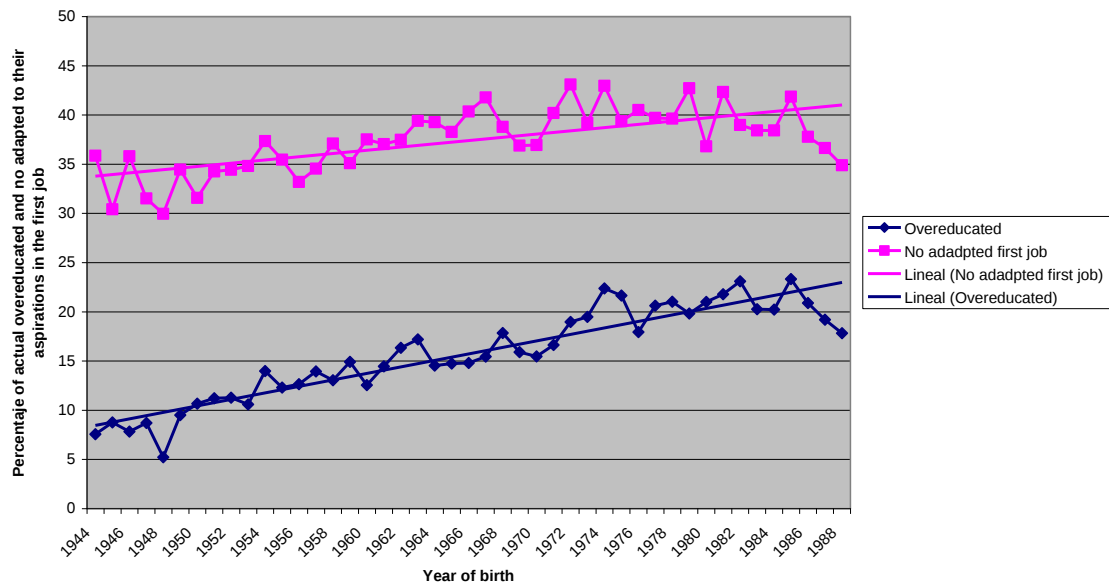


Figure 1.b
Overeducation in actual job and first job no adapted to their aspirations. Men

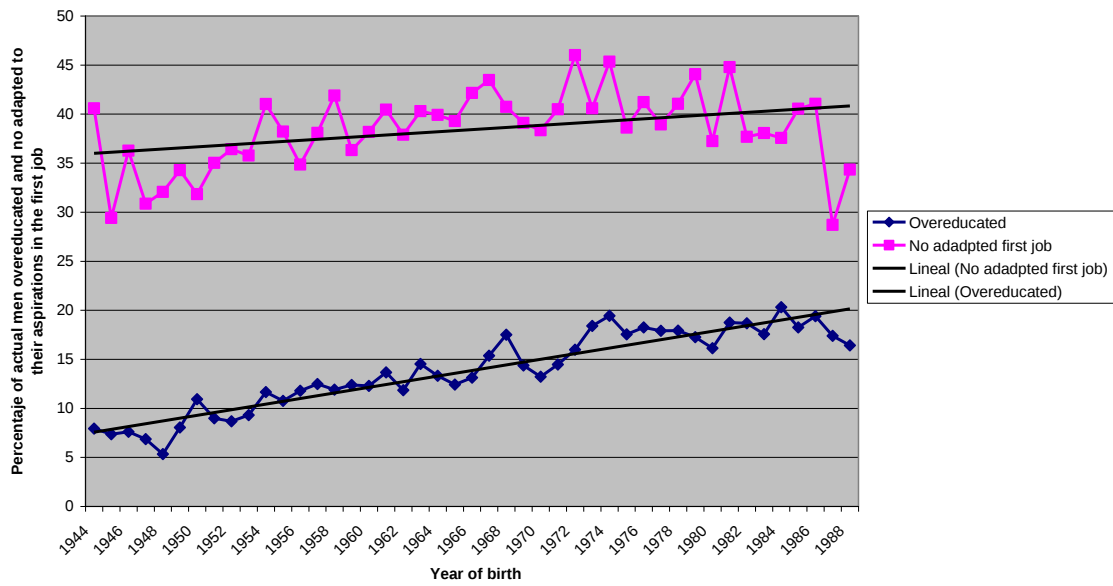


Figure 1.c
Overeducation in actual job and first job no adapted to their aspirations. Women

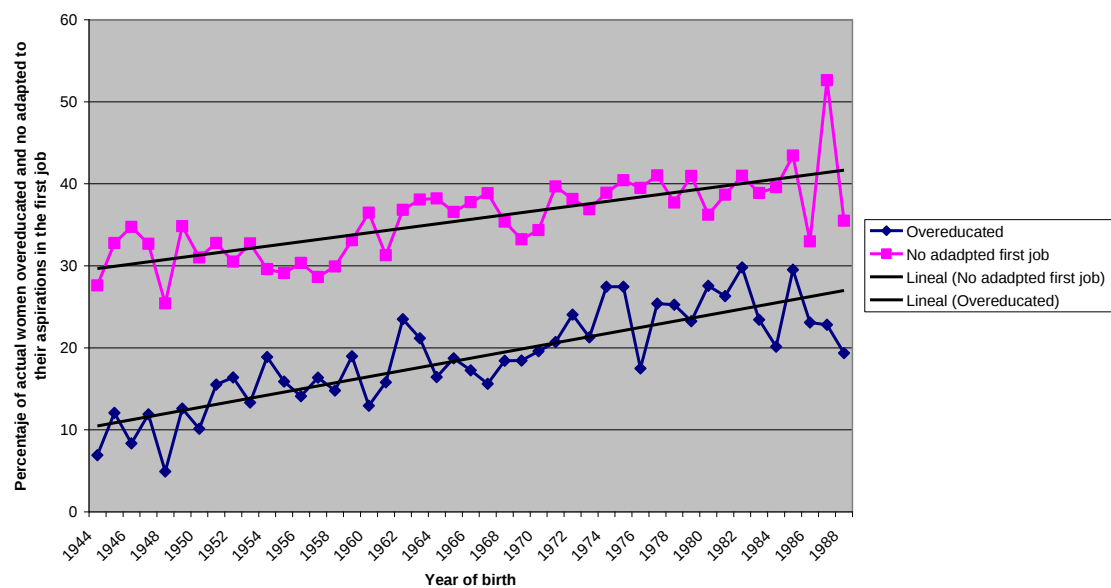
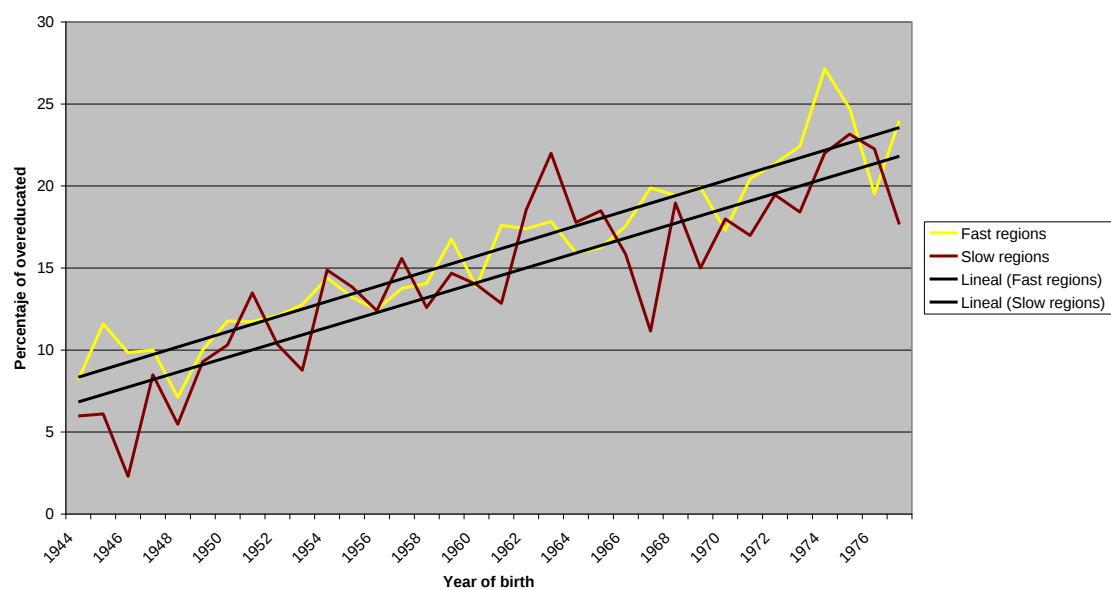


Figure 2
Overeducation in the fast and slow regions



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