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ORIGINAL ARTICLE

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Mapping the (mis)match of university degrees in the graduate labor market

Manuel Salas-Velasco*

Abstract

This paper contributes to the scarce literature on the topic of horizontal education-job mismatch in the labor market for graduates of universities. Field-of-study mismatch or horizontal mismatch occurs when university graduates, trained in a particular field, work in another field at their formal qualification level. The data used in the analysis come from the first nationally representative survey of labor insertion of recent university graduates in Spain. By estimating a multinomial logistic regression, we are able to identify the match status 4 years after graduation based on self-assessments. We find a higher likelihood of horizontal mismatch among graduates of Chemistry, Mathematics, Physics, Pharmacy, and Languages and Literature. Only graduates in Medicine increase the probability of being adequately matched in their jobs. It may be hypothesized that horizontal mismatch is more likely among those graduates in degree fields that provide more general skills and less likely among those from degree fields providing more occupation-specific skills. Other degrees such as Business Studies, and Management and Economics Studies increase the probability of being vertically mismatched (over-educated). Vertical mismatch preserves at least some of the specific human capital gained through formal educational qualifications. However, some workers with degrees in Labor Relations and Social Work are in non-graduate positions and study areas unrelated to their studies. The paper also shows that graduates in the fields of health sciences and engineering/architecture increase the probability of achieving an education-job match after external job mobility.

Keywords: Education-job mismatch, Higher education, Horizontal mismatch, Job turnover, Multinomial logistic regression, Spanish university degrees

JEL Classification: J24, J63, I21, C50

1 Introduction

In most economies, there is a connection between the educational attainment of the labor force and the jobs performed by the workers. In general, job titles are defined in terms of educational requirements that coincide with the levels of formal education. Of particular interest is to analyze whether the tasks assigned to different positions can be performed effectively with the qualifications provided by the education system or, on the contrary, there is no connection between the contents of the educational curriculum and the contents of the jobs.[1] The (mis)match between the level of formal education and the level required for the job has been, indeed, the focus of substantial research in the labor and education economics literature since the appearance of Freeman's (1976) book *The overeducated American.* See, for surveys of the literature, Leuven and Oosterbeek (2011), McGuinnes (2006), and Sloane (2003); for a meta-analysis, Groot and Maassen van den Brink (2000).

In this article, we focus on the labor market for university graduates. The paper contributes to the understanding of the mismatch between professional (academic) degrees and labor market positions. Most theoretical

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[1] In any case, it is not an easy duty to define which education is appropriate for each job since the educational requirements of the positions differ among companies and change over time.

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and empirical studies of education-job mismatch have focused predominantly on graduate over-education (e.g., Dolton and Vignoles 2000). Over-education (or vertical mismatch) appears when graduates work in non-graduate jobs. However, this article focuses on another type of education-job mismatch that has received less attention in the literature: the unrelatedness of a worker's field of study to his or her occupation at their formal qualification level, also referred to as horizontal mismatch. Relative to vertical mismatch, there are much fewer published studies of horizontal mismatch—see Somers et al. (2019) for a recent systematic literature review. In the latter paper, it is evidenced that, unlike vertical mismatch, there are still no theoretical models that explain the phenomenon. Nonetheless, the empirical evidence suggests that the likelihood of horizontal mismatch is among other things determined by the extent to which employees possess general skills as opposed to occupation-specific skills (Somers et al. 2019). In the labor market for university graduates, the issue of horizontal mismatch is considerably less studied than vertical mismatch (or over-education) mainly due to the lack of relevant data on fields of studies of university graduates. Horizontal mismatch (or field-of-study mismatch) occurs when graduates, trained in a particular field, work in another field at their formal qualification level. For example, a person earning a degree in Mathematics working as a computer-aided design technician. Robst (2007) was one of the first papers devoted to the horizontal mismatch. In this study, some of the majors with the highest prevalence rates of mismatch between work and degree fields included English and foreign languages, social sciences, and liberal arts. "Typically, these majors provide more general skills than occupation specific skills" (Robst 2007, p. 402). On the contrary, computer science, health professions, and engineering had low prevalence rates. "Most of these majors focus on skills that apply to relatively specific occupations" (Robst 2007, p. 402). The specific human capital cannot be easily transferred to other sectors, and graduates in these fields are less likely to search for a job in other sectors. They are more likely to work in a job that is directly related to their field of study in order to use specific human capital, which was accumulated during university studies. Graduates of these fields are therefore less likely to be horizontally mismatched.

Because the number of empirical studies on horizontal mismatch among university graduates is limited, this paper contributes thus to the scarce existing literature on the topic by providing the taxonomy of educational mismatch in the labor market for university graduates and investigating its incidence among Spanish higher education graduates based on self-assessments. In addition, the map of degrees done in this article according to the education-job (mis)match is important for the educational policy given that higher education is highly subsidized in Spain. The article is also novel in the sense that it incorporates methodological improvements that we comment below. Two well-cited papers by Robst (2007) and Nordin et al. (2010), published in the same journal, already addressed the mismatch between the individual's field of education and his/her occupation (horizontal mismatch). Robst's (2007) match/mismatch measure was based on subjective answers to the question of whether the job the college graduate held was closely related, not related, or somewhat related to his/her highest degree field. In Nordin et al. (2010), the authors crossed 34 occupations with 29 different fields of education in a table and made the same classification. Nonetheless, both papers present drawbacks. In Robst (2007), the author used an ordered logit model which indicated whether a major had a higher or lower likelihood of being horizontally mismatched, but the author did not distinguish whether the undergraduates were occupying college-level occupations or they were filling typical high school graduate positions.[2] The implications for educational policy and the labor market are different. In the case of Nordin et al. (2010), the authors only presented a table with the fields of education and the shares of matched, weakly matched, and mismatched individuals (there is no econometric model). In their percentages, they did not distinguish either whether the graduates were in positions typical of graduates or lower-level positions. Some results were striking. For example, 80% of men and 75% of women with a degree in Biology were mismatched. In this last classification, among other occupations, the authors included teachers of upper secondary education. However, according to the proposal we make in this paper, they would be well-matched because they are occupying university positions in a related field, i.e., teaching Biology. Our paper contributes thus to improving the deficiencies of those publications by focusing on the Spanish labor market for recent university graduates. In particular, the article aimed to determine which degree fields (narrow fields of education) were associated with being horizontally mismatched in the labor market for higher education graduates in Spain: when graduates are employed in a graduate job that is not related to their field of study. By estimating the likelihood of being horizontally mismatched (field-of-study mismatch), we also simultaneously estimate the probability of being vertically mismatched (over-education), and full job mismatched (i.e., field-of-study mismatch and

[2] For example, in 2010, only 62 percent of U.S. college graduates had a job that required a college degree (Abel and Deitz 2015).

over-education). The taxonomy that we propose allows us to better identify situations of educational mismatch in the graduate labor market. Besides, the multinomial logit model of the probability of education-employment matching that we suggest allowed us to draw a map of university degrees according to the type of (mis)match. This is also a novelty. Additionally, our article aimed to study external labor mobility that takes place in the early stages of graduates' working lives. A good match between graduates' degrees and their jobs will likely happen after job turnover.

For the analysis carried out in this paper, we used individual-level data from the first survey of labor insertion of university graduates in Spain. The *Encuesta de Inserción Laboral de titulados Universitarios* (EILU 2014) is a nationally representative random sample of Spanish universities and university graduates. A total of 30,379 graduates from the class of 2010 were surveyed 4 years after graduation.[3] The survey asked workers directly whether their particular qualification was appropriate for the work that they did. Many Spanish university graduates were employed in jobs that neither required a degree nor made use of expert knowledge learned at the university. The degree of fit between the qualifications obtained by graduates and their job characteristics can be considered one important performance indicator in higher education. This latter is an expensive investment—it is highly subsidized in Spain—and the highest return for society is obtained when individuals are well-matched to employers such that the knowledge and skills that were acquired through higher education are optimally utilized on the labor market. Therefore, research on the study of the labor market for graduates and their educational (mis) match is justified. In the discussion section of this article, the reader will find more arguments.

The rest of the paper is organized as follows. Section 2 outlines the empirical framework behind the measurement of vertical and horizontal education-job mismatch in the graduate labor market. In Sect. 3, we describe the data set drawn from the National Statistics Institute of Spain. We also identify four types of education-job mismatch according to the most appropriate level of formal education and study area to perform a job, and we provide summary statistics on the incidence of mismatch among Spanish higher education graduates. In Sect. 4, we introduce the econometric models of the probability of being (mis)matched in the first and current job, on the one hand, and the probability of being well-matched after external job turnover, on the other hand. Section 5 shows the results of the econometric analysis. Section 6 provides a discussion and some policy implications. Section 7 concludes the paper.

2 Empirical measurement

Job mismatch can be defined as the discrepancy between the qualifications that individuals possess and those that are wanted by the labor market. But when we talk about qualifications, we can refer either to the formal qualification (formal education) or to skills or competencies (European Centre for the Development of Vocational Training, 2014). In the first case, formal qualification is "the formal outcome (certificate, diploma or title) of an assessment process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards and/or possesses the necessary competence to do a job in a specific area of work" (European Centre for the Development of Vocational Training, 2014, p. 202).[4] In the second case, the term qualification refers to "knowledge, aptitudes, and skills required to perform specific tasks attached to a particular work position" (European Centre for the Development of Vocational Training, 2014, p. 202). Skill mismatch arises when workers have higher or lower skills proficiency than those required by their job. If their skills proficiency is higher than that required by their job, workers are classified as over-skilled; if the opposite is true, they are classified as under-skilled (Pellizzari and Fichen 2013). Likewise, educational mismatch arises when workers' levels of formal education are higher or lower than the required levels of education of their employment. This mismatch is also known as a vertical mismatch. Over-education (or over-qualification) and under-education (or under-qualification) are the two types of vertical mismatch.[5] Over-education exists when a worker is employed in a job that requires a lower level of education than that possessed by the worker. Under-education exists when a worker has a lower level of education than required for the job (e.g., Chevalier 2003; Duncan and Hoffman 1981; Hartog 2000; Leuven and Oosterbeek 2011; Mavromaras et al. 2013; Park 2018; Sicherman 1991). In this regard, it should be noted that educational mismatch can imply skill mismatch, but skill mismatch does not imply necessarily educational mismatch (Allen and Van der Velden 2001). For example, when working

[3] The sample in the EILU2014 was restricted to ISCED-97 5A level (Bachelors and Masters or equivalent) graduates. ISCED stands for International Standard Classification of Education.

[4] Although education is often used as a proxy for skills, the two terms have different meanings (International Labour Organization 2014).

[5] In practice, the terms over-qualification and over-education are used interchangeably. The same for under-education and under-qualification.

in a position below one's level of study, skills learned in formal education may not be fully used; over-education would be synonymous with being over-skilled.[6] Let's think of a medical graduate working as a dental assistant. But, if this medical doctor works in a hospital as a surgeon but s/he says that would perform the job better if s/he possessed additional skills, s/he would have a skills deficit, but s/he would not be under-educated.

Nonetheless, vertical mismatch of education (mismatch of the level of education and job) is not the only form of educational mismatch. In this article, we suggested two other educational mismatches. On the one hand, the horizontal educational mismatch, when the own level of education matches the requirements of the job but the type of education is not appropriate for the job. For example, an economics major working as an engineer might be considered to be working in a job unrelated to the degree field (Robst 2007; Tao and Hung 2014). On the other hand, vertical and horizontal educational mismatch, when the highest level of education held by a worker does not match the required level of education for his or her job, and also the type/field of education is inappropriate for the job. However, the study of skill mismatches is beyond the scope of this paper and our database, unlike surveys such as REFLEX, does not contain detailed information on skills acquired and required by jobs.

2.1 Measuring vertical education-job mismatch[7]

Over-education can be assessed subjectively by asking the respondent to give information on the minimum educational requirements of the job and then comparing this with the individual's acquired education or by simply asking the respondent whether or not they are over-educated (McGuinness, 2006). Dolton and Vignoles (2000) used data from the National Survey of 1980 Graduates and Diplomates to measure the incidence of over-education in the UK graduate labor market. They concluded that a significant proportion of British graduates were over-educated in the 1980s. The question used to measure over-education was: *What was the minimum formal qualification required for (entering) this job?* A graduate in a job requiring sub-degree level qualifications (or no qualifications at all) was defined as over-educated. Results showed that 38 percent of all graduates surveyed were over-educated in their first job. This proportion fell to 30 percent by the end of the survey period, 6 years later (Dolton and Vignoles 2000). Over-educated graduates earned significantly less than peers in graduate jobs (Dolton and Vignoles 2000).

More recently, in the 2012 and 2015 Survey of Adult Skills (PIAAC), employed workers aged 25–64 reported their level of educational attainment (formal qualification) and the level needed for the job. In the first case, the survey question was: *Which of the qualifications* (ISCED-97) *is the highest you have obtained* (education that has been completed)? To identify vertical mismatches, the answers given to this question are compared with the responses to the question: *Talking about your current job. If applying today, what would be the usual qualifications* (ISCED-97)*, if any, that someone would need to GET this type of job?* Among workers with a university qualification (ISCED 5A or 6), 75 percent (OECD average) reported being in a well-matched situation. However, over 34 percent of workers in England (UK), Korea, Estonia, and Japan reported being over-qualified for their job (which means having qualification of ISCED 5A or 6 while working in a job needing ISCED 5B or below). In the case of Spain, 24 percent of university graduates reported being in the latter situation (Organisation for Economic Co-operation and Development 2018).

An alternative approach to analyzing the mismatch between education and jobs consists of determining the educational requirements of the occupations from some objective measurement. In particular, over-education can be assessed based on information either about the average or modal education level within the occupation of the worker (realized matches/statistical approach) or about educational requirements coming from an a priori assumed correspondence between education and occupations such as ISCO or DOT classifications (job analysis/normative approach) (Kupets 2016).[8] For example, Rumberger (1987) obtained an objective measure of the degree of educational mismatch once he converted the educational requirements of each occupational category of the DOT into equivalent years of schooling and compared the result with the years of schooling that workers actually had in those occupations.[9] Regarding the

[6] Over-educated or over-qualified: an individual has completed more years of formal education than the current job requires. Over-skilled: an individual is unable to fully use acquired skills and abilities in the current job. See Quintini (2011).

[7] When the measurement is limited to university graduates, the group with the highest level of education, under-education is not possible and vertical mismatch has the same meaning as over-education. However, in our analysis carried out in this paper, vertical mismatch (over-education) is a more restrictive concept in the sense that it includes university graduates whose work does not require a university degree but is related to their field of study.

[8] ISCO stands for International Standard Classification of Occupations (International Labour Office), and DOT stands for Dictionary of Occupational Titles (U.S. Department of Labor).

[9] The author was discussing the United States. The DOT was last updated in 1991, and it is rarely used. Today, occupations are classified using the Standard Occupational Classification (SOC) system—a United States government system of classifying occupations—and data are provided through the Occupational Information Network, known as O*NET.

mode-based statistical approach, if an employee's educational attainment is higher (lower) than the modal education level of individuals working in the same occupation, he/she is classified as over-educated (under-educated) (e.g., Kampelmann and Rycx 2012; Kiker et al. 1997). As to the mean-based statistical approach, over-educated workers are those whose educational attainments are greater than one standard deviation above the mean within their specific occupation; workers whose educational attainments are more than one standard deviation below the mean are defined as under-educated (e.g., Groot 1993; Verdugo and Verdugo 1989).[10] All of these studies were based on the total employed workforce. Focusing more recently on workers who had completed tertiary education, Rossen et al. (2019) employed a variant of the realized matches approach coding a person as being over-educated if his/her highest educational attainment level was higher than the benchmark education level of his/her occupation group at the two-digit ISCO level. As a benchmark, they applied in their main analyses the 80th percentile of the levels of education within each occupational group. They made use of the 2016 wave of the European Labour Force Survey (EU-LFS) for 21 EU countries. Furthermore, the sample was restricted to respondents aged 20–34 years. Over-education as a vertical inadequacy was about 28% in total. The highest rates were measured for France, Austria, Italy, and Greece where more than 35% of workers were over-educated, whereas the lowest rates were observed for Estonia, Belgium, and Latvia with rates below 20%.

2.2 Measuring horizontal education-job mismatch

Horizontal mismatch measures the extent to which workers, typically graduates, are employed in an occupation that is unrelated to their principal field of study (McGuinness et al. 2018). In the subjective self-assessment method, respondents are asked how closely their educational field is related to the work they do.

In one of the first studies on horizontal mismatch, Robst (2007) studied the relationship between college majors and occupations in the United States. Using data from the 1993 National Survey of College Graduates, the following question was used to examine the education-job match: *To what extent was your work on your principal job related to your highest degree field? Was it closely related, somewhat related, or not related?* Fifty-five percent of individuals reported that their work and field of study were closely related, but 20 percent of the sample reported their field of study and work were not related (completely mismatched). College-educated workers in jobs unrelated to their field of study earned less than their well-matched peers (Robst 2007). However, a limitation of Robst's work is that the author did not exclude from the analysis undergraduates working in positions that only require a high school or less education. For example, PIAAC data revealed that 22 percent of U.S. workers with a university qualification (ISCED 5A or 6) would be holding a position requiring less formal qualification (Organisation for Economic Co-operation and Development 2018). Surely, the wage effects of mismatch by degree field found by Robst (2007) would be different.

In Europe, using representative samples of European university graduates graduating in 2000 (REFLEX survey) and 2003 (HEGESCO survey), Verhaest et al. (2017) determined the match status 5 years after graduation based on self-assessments. The vertical educational mismatch was based on the survey question: *What type of education do you feel was most appropriate for this work?* A graduate is considered to be over-educated if his/her educational level exceeds the appropriate level. The horizontal educational mismatch was based on the survey question: *What field of study do you feel was most appropriate for this work?* Possible answers were: (1) exclusively own field, (2) own or related field, (3) a completely different field, or (4) no particular field. They considered horizontal mismatch if they answered (3) or (4). By combining the two types of mismatches, they got four categories: pure match, mere vertical mismatch, mere horizontal mismatch, and pure mismatch. On average, 74.2 percent of graduates were well-matched 5 years after graduation. The average incidence of horizontal mismatch was just over 10 percent but close to 16 percent in Poland and Estonia, and above 18 percent in the UK. In Spain, the incidence of horizontal mismatch was 4.5 percent.

2.3 Limitations

The different measures proposed in the literature to estimate the required education for a job—based on worker self-assessment, realized matches, and job analysis—often give different results of the incidence of the over-education.[11] Self-assessment methods may be biased because they rely on the objectivity of respondents. But an objective approach is also surrounded by controversy. Since the objective measure reflects an average requirement associated with all jobs in a particular occupation, it may not reflect the requirement associated with the particular job held by the respondent. Also, the statistical mode-based method suffers from the misclassification problem:

[10] Although the main advantage of this method resides in the fact that it requires little information, since it is enough to know the educational level of the workers, nevertheless the boundary of a standard deviation is quite arbitrary.

[11] The statistical method usually yields significantly lower estimates of over-education (e.g., Leuven and Oosterbeek 2011).

over-educated workers may be classified wrongly as well-matched if the number of higher educated workers in a given occupational group increased significantly and pushed the modal level of education up even in the absence of changing job tasks/requirements. In the standard deviation-based measure of over-education, the boundary of a standard deviation is quite arbitrary. For a broad discussion of the advantages and disadvantages, see for example Hartog (2000), Leuven and Oosterbeek (2011), and Verhaest and Omey (2006), among others.[12]

Even though the normative/statistical approach has its limitations, it is more or less feasible to measure the vertical mismatch. But an objective approach would be too complex to measure the horizontal mismatch, that is, the discrepancy between the graduate's field of study and that most appropriate for the job.[13] Despite the potential disadvantage that employees' perceptions of the horizontal (mis)match are by definition subject to self-report bias (Banerjee et al. 2019), a potential advantage of this approach is that graduates' field of study is directly compared with the content of their jobs. "The individual assessments, while perhaps subjective, are expected to provide important information" (Robst 2007, p. 401). This will be the approach taken in this paper.

3 Description of data and matching procedure

3.1 EILU2014 graduate survey

In Spain, universities follow a career system, which means that students begin their studies with their major already selected and take courses that are pre-assigned for their entire major, with only a few electives available each year. In the educational curriculum prior to the Bologna reform of 2010, there were two basic types of university programs: short-cycle programs called *diplomaturas*, which were more vocationally oriented and lasted 3 years (e.g., Nursing); and long-cycle programs called *licenciaturas*, which lasted 4, 5, or 6 years (e.g., Economics, Law, and Medicine, respectively). Also, other degrees awarded were engineering degrees and Architecture (5 years on average) and technical engineering degrees and Technical Architecture (3 years on average).[14] A nationally representative sample of university graduates of these degrees was surveyed between September 2014 and February 2015 by the Spanish National Institute of Statistics (INE). Using a combined method of obtaining information—direct interviews (Web and telephone) and use of administrative data, approximately 30,000 university graduates of the 2009/2010 academic year were interviewed. Specifically, 30,379 university graduates from Spanish universities were interviewed in the *Encuesta de Inserción Laboral de titulados Universitarios* (EILU2014): 86% had studied at a public university and 14% at a private university. By gender, 40.3% of the graduates were men, and 59.7% were women. Table 1 shows the description of the sample according to wide groups of university degrees and Table 2 displays the description of the sample according to broad branches of knowledge.[15]

Table 1 Description of the sample by broad groups of university degrees (ISCED 5A programmes)

	Freq	Percent
Diplomatura	9,339	30.74
Technical Engineering and Technical Architecture	3,700	12.18
Licenciatura		46.26
Engineering and Architecture	14,053 2,352	7.74
Grado	880	2.90
Other university degrees before Bologna	55	0.18
Total	30,379	100.00

Source: author's calculations from EILU2014

Table 2 Description of the sample according to broad branches of knowledge

	Freq	Percent
Arts and Humanities	3,231	10.64
Hard Sciences	2,955	9.73
Social and Legal Sciences	13,458	44.3
Engineering and Architecture [a]	6,793	22.36
Health Sciences	3,942	12.98
Total	30,379	100.00

Source: author's calculations from EILU2014

[a] Including *grados* in Building and Computer Engineering

3.2 The taxonomy of educational mismatch in the labor market for Spanish higher education graduates

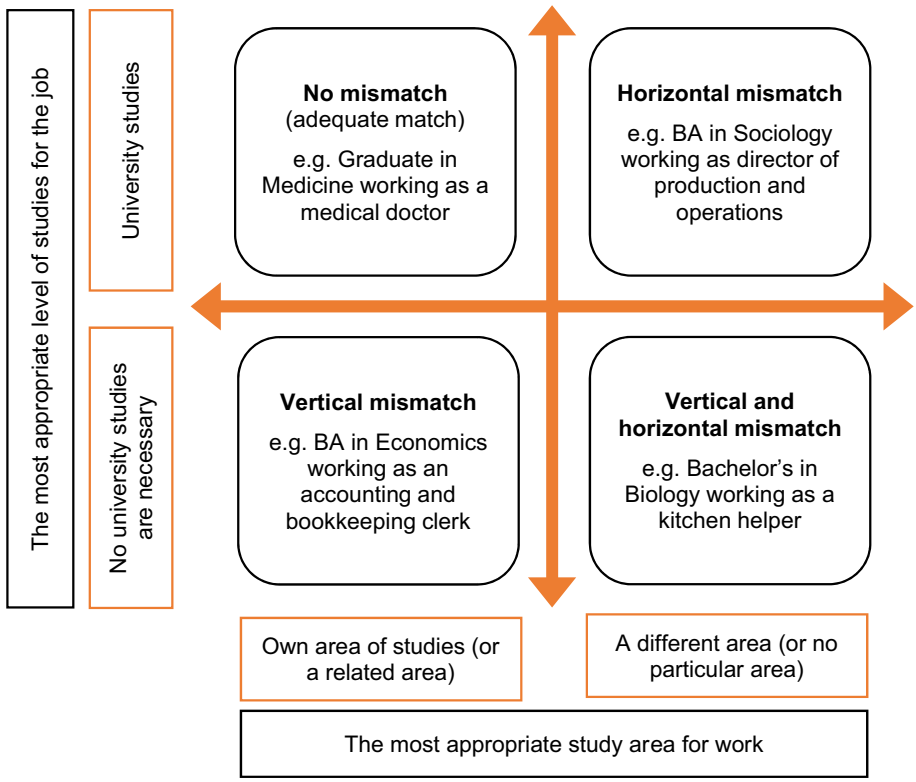
Let us focus on the study of educational mismatches in the employment of the university graduates surveyed.

[12] In practice, researchers use one method or another depending on the available data.

[13] Nordin et al. (2010) built 29 different fields of education and created 34 different occupations. They "subjectively" constructed a matrix of fields of education-occupations matching.

[14] *Licenciaturas* and engineering degrees/Architecture were equivalent to the Master's degree in the American system of higher education. With the reform of Bologna, all the degrees (called *grados*) have a duration of four years, equivalent somehow to the American Bachelor's degree. Some exceptions are Architecture (5 years) and Medicine (6 years).

[15] The database contains 30,379 responses from graduates interviewed only once (a single cross-sectional dataset). This figure is the total number of observations in the raw data.



Source: author's elaboration

Fig. 1 Higher education graduates' degrees and their jobs: the education-job match

The EILU2014 questionnaire contained an employee self-assessment of the level and type of education most appropriate for the first job after graduation[16] and the current job, that is, the job at the time of being surveyed (around 4 years after finishing the university studies).[17] We developed two measures of job matching among university graduates. For our first measure, we used the following question to determine whether or not an occupation required a degree: *Q1. What is, or was, the most appropriate level of education to carry out this work?* Respondents could select from the following education levels: *A1. A university degree. A2. Tertiary vocational education. A3. High school. A4. Middle-high school.*

Our second measure of matching assessed the quality of the education-job match by determining whether or not the field of study of the individual's degree was related to the job that the interviewee was performing. Subjects were asked to indicate: *Q2. What do you think is, or was, the most appropriate study area for this work?* They had several options: *B1. Exclusively the area of studies of my degree. B2. Some related area. B3. A totally different area. B4. No particular area.*

Following Verhaest et al. (2017), we cross-tabulated the answers to the first question about whether employers requested a university credential vs. a sub-degree level qualification for the job, and the answers to the second question about whether graduates hold positions of their area of specialization vs. unrelated to their field of study. We identified four situations of educational mismatch in Fig. 1: adequate match (no mismatch), horizontal mismatch, vertical mismatch, and vertical and horizontal mismatch (double mismatch).[18] First, graduates were considered well-matched (no mismatch) if they responded *A1,* and *B1* or *B2*. Second, we identified the horizontal educational mismatch when the type of university education was not appropriate for the job, but the level of formal

[16] The interviewees were asked to exclude occasional/sporadic employment.

[17] The appropriate level is preferable to the often-used alternative of the required level. The latter may partly measure formal selection requirements whereas the former is more likely to refer to actual job content (Allen and Van der Velden 2001).

[18] Figure 1 is a simplification to illustrate educational mismatch. We took real examples referring to the current occupation of Spanish university graduates four years after graduation.

Table 3 Distribution of educational (mis)match in the labor market for university graduates in Spain

	First job		Current job	
	Freq	Percent	Freq	Percent
Educational (mis)match				
No mismatch	13,899	57.16	12,387	66.38
Horizontal mismatch	1,422	5.85	1,379	7.39
Vertical mismatch	3,166	13.02	1,725	9.24
Vertical and horizontal mismatch	5,827	23.97	3,169	16.98
Total	24,314	100.00	18,660	100.00

The sub-samples analyzed include only wage-earners workers. See footnote 19 for further details

Source: author's calculations from EILU2014

education matched the requirements of the job (if they responded *A1,* and *B3* or *B4*). Third, the educational mismatch was measured as vertical when the acquired level of education was higher than the level of education more suitable to perform the job, although the area of studies was related to the university degree (if they responded *A2 or A3* or *A4,* and *B1* or *B2*. Finally, the vertical and horizontal mismatch was considered when the attained level of education was lower than the appropriate, and the type/field of education was inappropriate for the job (if they responded *A2 or A3* or *A4,* and *B3* or *B4*).

To provide a better sense of our matching classification, Table 3 shows these measures of educational mismatch. We found that about 57–66% of graduates were adequately matched in their jobs in terms of formal (and type of) university education. Around 6–7% were horizontally mismatched. But a considerable percentage of graduates (37% and 26%, first and current jobs, respectively) worked in jobs that didn't require a university degree.[19]

Examination of the data in Table 3 revealed that educational mismatch is a significant phenomenon in the labor market for higher education graduates in Spain. University graduates accept jobs that do not require a university degree and/or do not match their specialties.[20] As a result, qualified human resources in Spain are severely misallocated. Although the survey data (EILU2014) appeared to indicate that there was a slight reallocation of university degrees in the labor market 4 years after leaving university, the reality is that the percentage of mismatched graduates in the labor market remains high and does not seem to have changed in the last 10 years (Fig. 2). This goes to point out that the educational mismatch is a structural problem in the Spanish labor market, with an ever-increasing number of graduates that is not able to absorb an economy with a high rate of youth unemployment and a business environment characterized by small firms where graduates cannot make full use of their university knowledge. However, the problem of educational mismatch not only affects the Spanish case. It is also relevant in countries such as Estonia and the United Kingdom (Fig. 2). Some explanations: (i) supply of educated labor exceeds demand (McGuinness 2006); or (ii) imbalances in composition (individuals studying in fields where there is little demand) (Ortiz and Kucel 2008).

Nonetheless, an in-depth analysis of the reasons for education imbalances in the Spanish labor market was outside the scope of this paper. Our objective was to identify, in the first and current jobs, which university degrees were more likely to fall in each of the four squares in Fig. 1. Since all possible states are covered, which are disjoint and at this level of analysis their order is irrelevant, an appropriate estimation method is offered by the multinomial logit model.

4 Methodology

4.1 A multinomial logit model of job matching

A multinomial logit model (MLM hereafter), also known as multinomial logistic regression, is suitable for our analysis of the educational (mis)match across Spanish university degrees. Our response variable had four categorical outcomes that did not have an ordered structure: appropriate match (no mismatch), horizontal mismatch, vertical mismatch, and vertical and horizontal mismatch ($j = 1,2,3,4$, respectively).

The MLM considers the probability of a certain event j as (McFadden 1974)[21]

$$prob(Y = j) = exp\left(x'\beta_j\right) / \sum_{k=1}^{4} exp\left(x'\beta_k\right) \quad (1)$$

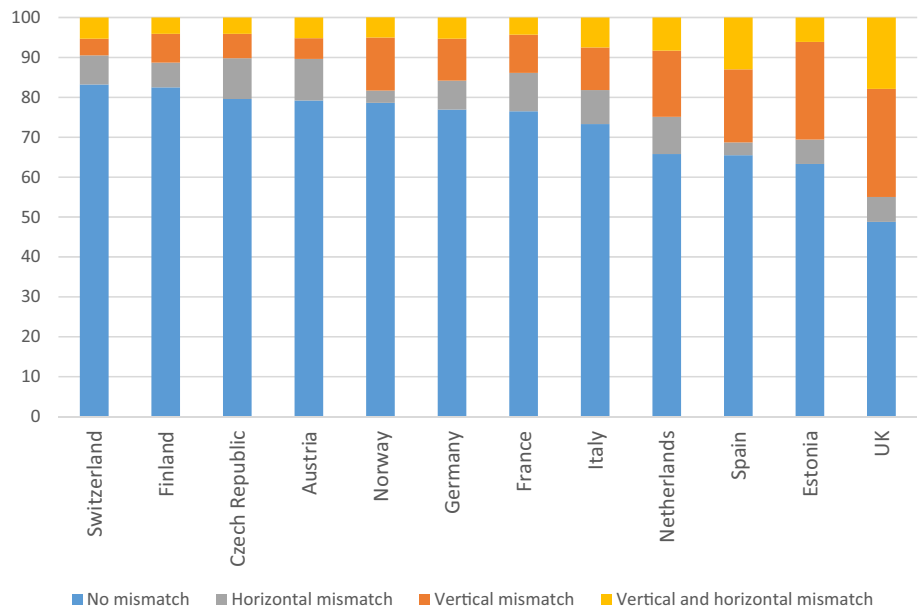
This model provides the probability that an individual with specific characteristics x is in group j. In this paper, the predictor variables used were university degrees (narrow fields of education).[22] Several control variables were also included in the regressions.

[19] The sub-samples in Table 3 included only wage-earners workers. From the total sample of 30,379 graduates, self-employed workers were excluded (around 7% in the first job and about 10% in the current job). The important reduction in the number of observations in the current job was mainly due to the fact that around 22% of graduates were still in their first job at the time of being surveyed and they were not asked questions Q1 and Q2. The rest of the cases not considered was due to missing values (around 7% in the first job and about 4% in the current job), and individuals who were not asked questions Q1 and Q2 because they basically never had worked (around 6% in the first job and about 3% in the current job).

[20] In Table 3, to the question of what was the most appropriate study area for the job, the majority of horizontally mismatched graduates (77.6%/80.0%) stated "a totally different area" and 22.4%/20.0% "no particular area" (first job/current job).

[21] The multinomial logit model is also described in Greene (2012).

[22] They would be our explanatory variables of interest.



Source: Eurostat and author's elaboration

Fig. 2 Educational (mis)match in Spain and Europe in 2005, 5 years after graduation. Eurostat (Reflex project). Percentages

The natural normalization in our case was $\beta_4 = 0$, with the probability to j^{th} outcome be defined as[23]

$$prob(Y = j) = \frac{exp\left(x'\beta_j\right)}{1 + \sum_{k=1}^{3} exp\left(x'\beta_k\right)}, if\ j = 1, 2, 3 \tag{2}$$

And for the baseline category (vertical and horizontal mismatch), we would have

$$prob(Y = 4) = \frac{1}{1 + \sum_{k=1}^{3} exp\left(x'\beta_k\right)}, if\ j = 4 \tag{3}$$

However, if we wish to draw valid conclusions about the direction and magnitude of the relationship between an independent and dependent variable in an MLM, we should calculate marginal effects (Bowen and Wiersema 2004). The marginal effects are defined as the slope of the prediction function at a given value of the explanatory variable and thus inform us about the change in predicted probabilities due to a change in a particular predictor.

In this article, we used as the dependent variable in the MLM the four categories of educational mismatch already shown in Table 3, both in the first job (a variable that we labeled as *mismatchfirstjob*) and in the current employment (labeled as *mismatchcurrentjob*). As predictor variables, we introduced university degrees. In the survey, there were up to 123 different degrees, which were grouped into 27 categories (narrow fields of education) in the regressions. Besides, we considered gender and internship while studying as control variables for the first job; for the current position, gender, having a Master's degree, and age.[24] Table 7 (Appendix) showed the descriptive statistics.

4.2 A binomial logit model of external labor mobility

As we have anticipated in the introduction, this article also aimed to study the empirical relationship between educational mismatch and job mobility. According to the "job matching theory," mismatched employees might try to improve their fit by changing jobs until an optimal match is reached (Jovanovic 1979). Jovanovic's (1979) search-and-matching model of the labor market suggested that employees change jobs more often at the beginning of their careers. The number of jobs (measuring the number of times the individual has changed employer) is an indicator of job mobility in general, either voluntary or involuntary. The EILU2014 dataset contains data on job turnover. We were able to identify whether or not graduates who were mismatched to their jobs

[23] The probability of mismatch is compared to the probability of mismatch in the reference category.

[24] Age was referred to December 31, 2014, and it was already in intervals in the database. In relation to the Master's degree, we do not know when it was awarded, so we have chosen to use this information only in the current job.

after graduation achieved an education-job match after moving to other positions in other companies (external mobility).[25]

To examine the factors that explained the job matching, we estimated a binomial logit model (or binary logistic regression). The reduced form for this model would be (McFadden 1974)

$$prob[Y_i = 1] = \frac{e^{x_i^{'}\beta}}{1 + e^{x_i^{'}\beta}}$$

where Y is the dependent (dichotomous) variable; the x row vector contains the independent or explanatory variables (including a constant); and β is the vector of parameters to be estimated. Furthermore, it is assumed that the non-observed ε's follow a distribution of logistic probability.

Our dependent variable was *gotmatching* which took a value of 1 if the graduate was mismatched in his/her first job and, after moving to another job (employer), s/he achieved the matching. It took the value of 0 otherwise, that is, if the graduate was mismatched in the first job and after moving to another company was still mismatched.[26] We restricted the analysis to wage-earners—in both, first job and current job. In relation to the explanatory variables, and given that the sample for the analysis was reduced considerably, we included university degrees according to broad fields of knowledge and types of degrees. Our explanatory variable of interest was the number of different employers for whom the university graduate had worked during his/her "short" working life. In addition, gender was included as a control variable.

5 Results

5.1 Education-job mismatch among Spanish university graduates

This section shows the results of the estimation of the MLM.[27] Two types of analysis have been carried out. The first one corresponds to graduates' initial job after leaving university. The second analysis corresponds to the educational mismatch in their employment at the moment of being surveyed. However, the sign of the estimated model coefficients does not determine the direction of the relationship between an independent variable and the probability of choosing a specific alternative (Bowen and Wiersema 2004). "If we are interested in inferring the true nature of the relationship between a predictor and the dependent variable in an MLM, we must acknowledge that coefficients […] are potentially misleading" (Wulff 2015, p. 316). Instead, to be able to draw valid conclusions about relationships, scholars must rely on other interpretational devices such as predicted probabilities and marginal effects (Wulff 2015).[28] In this respect, Tables 8 and 9 (Appendix) show the estimated marginal effects in the first job and current employment, respectively.[29] And Tables 4 and 5 show the predicted probabilities for some selected degrees.

Let's focus first on the educational mismatch in the first job. Table 8 shows the estimated marginal effects. A clear advantage of marginal effects is that they provide us with rich and intuitively meaningful information not available through the interpretation of coefficients. However, in order not to tire the reader with the interpretation of all marginal effects, Fig. 3 shows in the four quadrangles of education-job mismatch the university degrees for which the estimated marginal effects in Table 8 are positive and show statistical significance at 5%. The results reveal that occupations requiring more specific human capital exhibit a lower probability of educational mismatch. Thus, we have three degrees that have the highest likelihood of obtaining an education-job match: Medicine, Nursing, and Veterinary (Fig. 3). For example, having finished Medical Studies increases the average probability of being well-matched in the first job by 0.5364; or having finished Nursing Studies is associated with an increase of 0.1850 in the average probability of being well-matched in the first job after graduation (Table 8).[30] These results are in line with published works focusing on horizontal mismatch among university graduates (e.g., Nordin et al. 2010; Robst 2007). In contrast, a horizontal mismatch may find it harder to preserve any specific human capital that is encompassed within a type of qualification, though general human capital may have a role to play here. We find that graduates in History and Philosophy, and Political Science and Sociology, increase the probability of being horizontally mismatched (Fig. 3).

However, as seen in Fig. 3, the vast majority of graduates occupy positions for which, according to them, a university degree was not necessary. On the one hand, we find that graduates with some degrees such as

[25] The data collected did not allow us to distinguish between voluntary and involuntary separations. Internal labor mobility (intra-firm mobility) is outside the scope of this paper given the limitations of the database.

[26] A permanent job separation involves a change of employers for the worker (Jovanovic 1979).

[27] The estimates were made using the statistical program Stata/SE 15.1.

[28] The marginal effects in our research were calculated using the average marginal effects (AME) approach, which relies on actual values of the independent variables (the covariates were all dichotomous).

[29] For the global contrast of the estimated models, the Chi-square test was used. The null hypothesis is that all the coefficients of the equation, except the constant, are null. In the first job: Wald chi2(84) = 3228.82; in the current job: Wald chi2(90) = 36,479.40. In both cases, the associated p-value was very low (less than 0.001). The result of this test allows us to reject the null hypothesis accepting both models as good.

[30] In comparison with the reference category.

Table 4 Predicted probabilities of educational mismatch in the first job for selected degrees

	No mismatch		**Horizontal**
Individual of reference	67%	Individual of reference	7%
Veterinary	82%	Political Sc. and Sociology	17%
Nursing	83%	History and Philosophy	27%
Medicine	96%		
	Vertical		**Vertical and horizontal**
Individual of reference	6%	Individual of reference	20%
Labor Relations	16%	Journalism	33%
Business	27%	Biology	33%
		Tourism	35%
		Fine Arts	45%

The individual of reference is a man who did not do an internship during his studies and got a different qualification than those analyzed. The sum of the probabilities in the four situations is equal to 1 (100%)

Source: author's calculations

Table 5 Predicted probabilities of educational mismatch in the current job for selected degrees

	No mismatch		**Horizontal**
Individual of reference	78%	Individual of reference	2%
Medicine	99%	Journalism	14%
		Political Science and Sociology	15%
		History and Philosophy	25%
	Vertical		**Vertical and horizontal**
Individual of reference	6%	Individual of reference	14%
Management and Economics Studies	19%	Labor Relations	40%
Business Studies	28%	Social Work	45%

The individual of reference is a 30–34 years old man with no Master's degree. The sum of the probabilities in the four situations is equal to 1 (100%)

The odds practically do not change when considering women graduates

Source: author's calculations

Engineering, and Management and Economics Studies, increase the probability of being vertical mismatched. On the other hand, other university degrees such as Biology, Fine Arts, Journalism, or Social Work increase the probability of being vertical and horizontally mismatched (Fig. 3). For example, having finished Fine Arts is associated with an increase of 0.2007 in the average probability of being doubly mismatched (Table 8). Nevertheless, an important distinction between the two types of mismatch is that a vertical mismatch can preserve some of the specific human capital that is encompassed within a type of academic qualification. The engineering or economics fields impart certain job-specific skills that are clearly understood in the job market. But in the case of the full job mismatch (i.e., over-education and field-of-study mismatch), graduates end up in non-graduate positions which contents are not related to their field of study.

Table 4 shows the predicted probabilities of being (mis)matched in the first job after graduation for some selected degrees of Fig. 3.[31] For example, the probability that a Spanish graduate is adequately educated in his or her first job is 67%, but that it increases to 83% for Nursing Studies and up to 96% for Medicine. The probability of being horizontally mismatched is 7%, but it rises to 27% for History and Philosophy. The probability of being vertically mismatched is 6%, but it increases to 27% for Business Studies. Finally, the probability of being vertical

[31] These probabilities have been calculated using the command *margins* in Stata/SE 15.1.

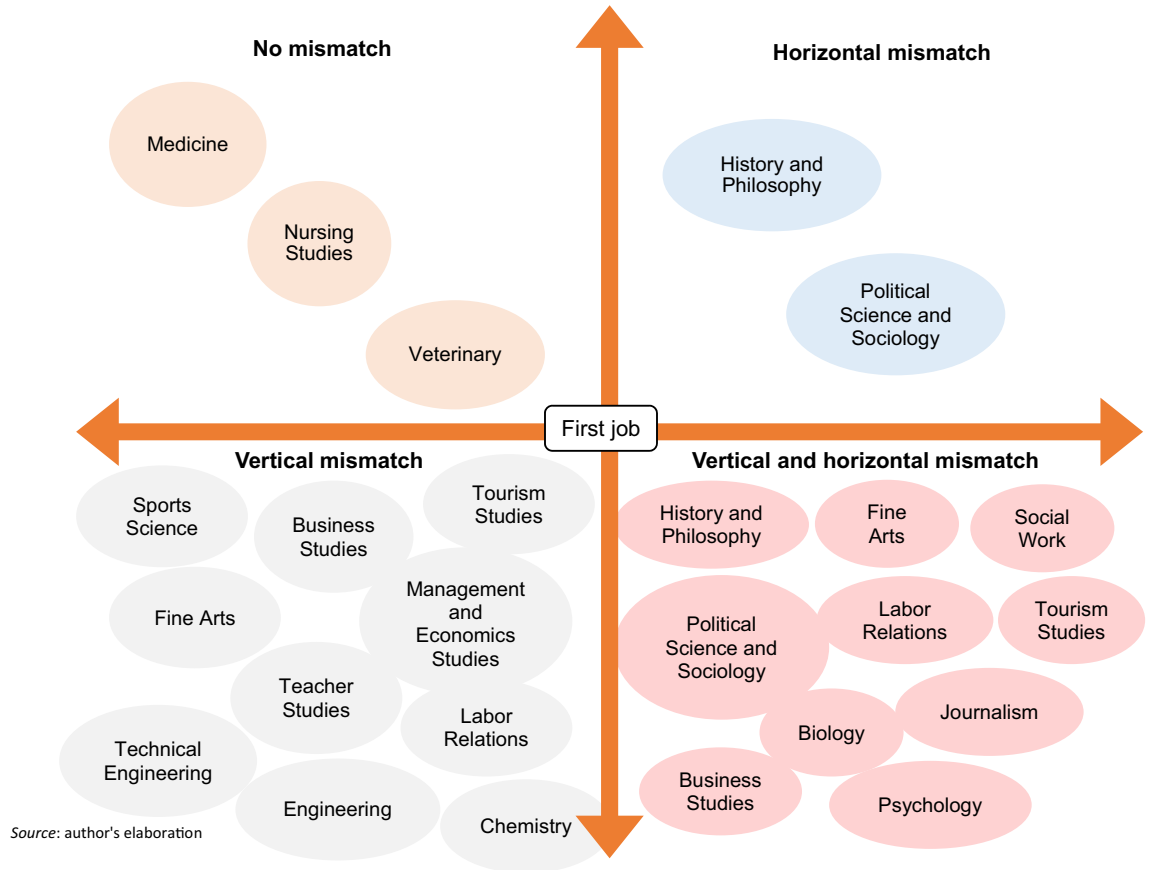


Fig. 3 Mapping the (mis)match of university degrees for higher education graduates in Spain in their first job

and horizontally mismatched is 20%, but it rises to 45% for Fine Arts.[32]

Let's focus now on the current job. As we said, the correct way to interpret the effect of the explanatory variables on the probability of the different situations of job matching is to obtain the marginal effects of the regressors which are shown in Table 9. Figure 4 shows the map of degrees according to their educational (mis)match. It shows only degrees for which the estimated marginal effects in Table 9 are positive and show statistical significance at 5%. Finally, Table 5 shows, for the current job, the probability of being well-matched (78%), horizontally mismatched (2%), vertically mismatched (6%), and vertically and horizontally mismatched (14%).[33] It is remarkable the important increase in the probability of being well-matched and how the double mismatch has also been significantly reduced.[34]

First, workers with a degree in Medicine increase, again, the probability of being well-matched in their current jobs. The predicted probability of a perfect match is 99% (Table 5). It is also noteworthy that engineers and technical engineers, who were vertically mismatched in their first job (over-educated), are no longer in their current job. As discussed below, they increase the probability of achieving an educational match after job turnover. One likely mechanism behind the results is the type of human capital individuals acquired during their university education. Medical doctors and engineers have highly specialized skills which are to a large extent occupation-specific and their transferability across jobs is limited. Although specialized majors earn a premium on average—specific majors' graduates earn the most at almost every age (Leighton and Speer

[32] The probabilities estimated in Table 4 practically did not change when considering women. Gender was not statistically significant in the estimates of the first job.

[33] In parentheses, probabilities for the individual of reference. These probabilities change according to the degree (see Table 5).

[34] As two reviewers point out, one of the limitations of self-assessment-based educational mismatch measurement is that matches could improve over time because people convince themselves that the match is better.

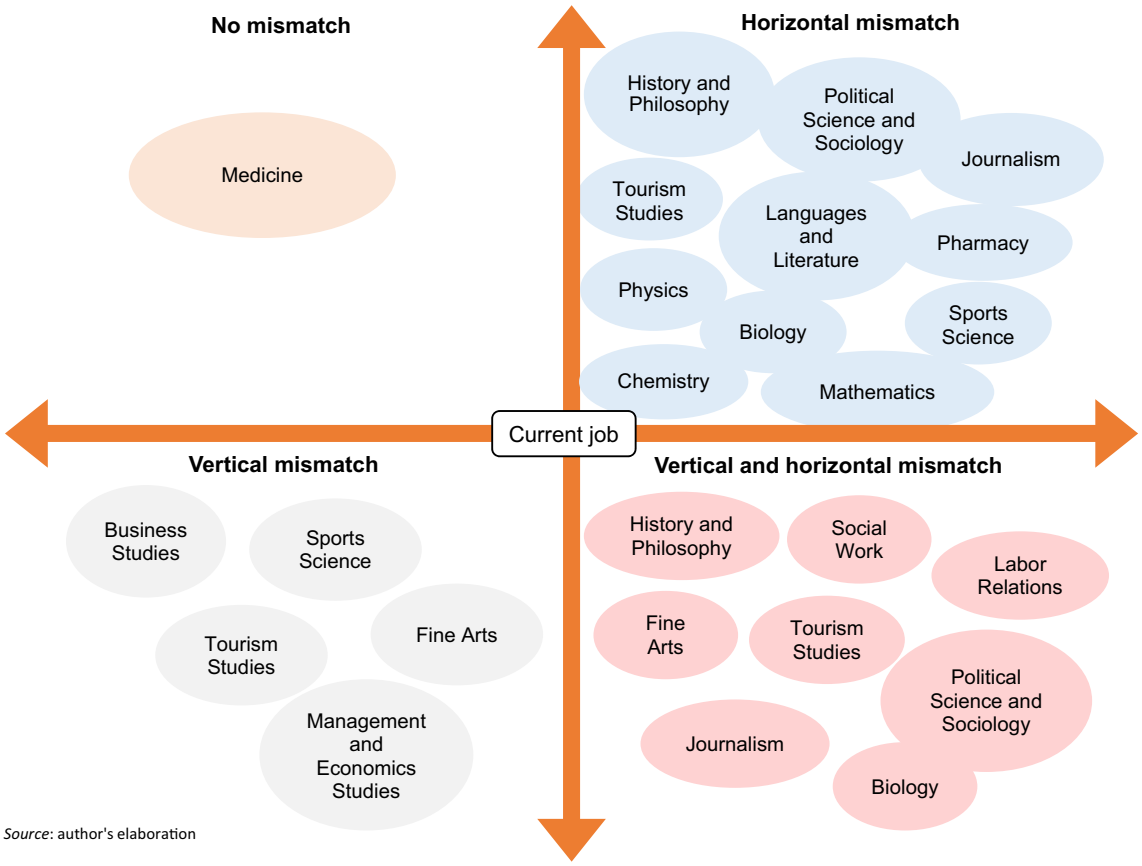


Fig. 4 Mapping the (mis)match of university degrees for higher education graduates in Spain in their current job

2020), a natural concern is that they may be riskier than general fields. Skills that are valuable but not transferable may leave a worker vulnerable to sector-specific shocks or economic downturns and may reduce his/her probability of finding employment (Leighton and Speer 2020).

Second, several degrees have gone from being cataloged as vertically mismatched to be cataloged as horizontally mismatched. There is still a resource misallocation of the human capital in terms of formal qualifications; however, graduates are now carrying out jobs which demand a degree, although without requiring specific university specialties. Typically, as Robst (2007) suggested, those degrees provide more general skills than occupation-specific skills. This would be the case of History and Philosophy, Journalism, Languages and Literature, Political Science and Sociology, Mathematics, Pharmacy, Chemistry, or Physics (Fig. 4). For example, the predicted probability of horizontal mismatch in the current job is 25% for History and Philosophy, 15% for Political Science and Sociology, and 14% for Journalism (Table 5). Some of those degrees, usually considered "specific," actually produce graduates with highly versatile skills. For instance, a Bachelor of Mathematics aims to increase the student's ability in analytical thinking, quantitative reasoning, and problem-solving that is necessary for work in mathematically oriented careers (e.g., actuarial analyst, data analyst, game designer, or investment analyst).[35] In fact, according to the REFLEX survey, the most required competencies in the Spanish graduate labor market are mainly transferable skills, "in other words, skills learned in one context that are useful in another" (Salas-Velasco 2014, p. 509).

Third, Table 9 and Fig. 4 show that there are workers in jobs not requiring a degree that remain mismatched 4 years after graduation. There are university graduates who are still over-educated; this is the case, for example, of Business Studies (28%), and Management and Economics Studies (19%). In the case of Social Work (45%) or Labor Relations (40%), graduates are still vertical and horizontally mismatched. The probability of being mismatched is shown in parentheses (see Table 5). An

[35] https://www.prospects.ac.uk/

interesting result of our study is that some degrees that are often thought of as "broad," entailing general human capital that can be used in different occupations, actually produce skills that are quite specialized (e.g., Bachelor of Economics).

Regardless of how much graduates and employers invest in job search, the initial match is unlikely to be perfect (Allen and Van der Velden 2005). As a result, the adjustment mechanisms employed by agents are of great importance. One way of adjusting to initial mismatches is by learning new and/or specific skills. In our study, the probability of getting an education-job match increases if a master's degree was completed (Table 9). Also, the probability of being (mis)matched relates to graduates' age. Being under 30 years old is associated with an increase of 0.0502 in the average probability of being well-matched in the current job (Table 9). On the contrary, the probability of being horizontally mismatched relates to graduates 35 years of age or older. Therefore, the mismatch is increasing in age. This is a result also found in the literature (Somers et al. 2019). In general, it seems that the lowest rates of mismatch do happen at young ages (Bender and Heywood 2011). Younger Spanish graduates are most likely to make the transition from a state of mismatch to a state of a match in the early stages of their careers.

Lastly, we would like to point out that the role that ability and other unobserved individual characteristics play in the matching process remained to be tested. "Controlling for unobserved heterogeneity might be important if the probability of educational mismatch is correlated with innate ability" (Bauer 2002, p. 222). We know that some degrees such as Medicine and STEM degrees (college programs in science, technology, engineering, and mathematics) attract students with higher average ability and the dispersion around the mean is lower. Therefore, as was predictable, they are occupying typical graduate positions (high-skilled jobs) 4 years after graduation; and the well-match vs. horizontal mismatch will depend on the relative specificity of college majors and the transferability of skills across occupations. However, there are many other degrees where the heterogeneity of the students admitted by universities is much higher, and some of our results could be a result of ability differences between individuals. For example, in Fig. 4, a degree in Sports Science increases the probability of being both horizontally and vertically mismatched; a degree in Political Science and Sociology increases the probability of being both horizontally and completely mismatched, and a degree in Tourism Studies increases the probability of being in the three boxes of educational mismatch. However, we could not investigate this issue in-depth due to the limitations of the database; it does not even have the average grade of the academic record that could approximate the ability. In addition, as one of the reviewers very well points out, it is unclear a priori whether the educational mismatch is a "good" or a "bad" thing for workers. To resolve this question, one should look at whether educational mismatch causes a wage penalty or increases the risk of unemployment. However, these last two aspects are outside the scope of this paper. We hope to give an answer in future research, as long as there is information that allows it.[36]

5.2 Analysis of educational mismatch and external labor mobility

Many university graduates have likely changed jobs since graduation, and labor mobility has allowed them to get an education-job match. Thus, turnover patterns can be informative on the nature of the matching of workers to jobs. A binomial logit model of external labor mobility was presented in Sect. 4.2. The estimated marginal effects are shown in Table 6.[37] The results indicate that keeping everything else constant, the greater the number of employers for whom a graduate has worked, the higher the probability of achieving a job match. The coefficients associated with gender do not show statistical significance in both regressions (Models I and II). However, in comparison with hard science degrees, graduates in the fields of health sciences and engineering/architecture increase the probability of achieving an education-job match after job turnover. Conversely, individuals graduating with arts and humanities degrees—also social and legal sciences degrees—reduce the likelihood of achieving the job match after job mobility (Table 6, Model I). In particular, having a university degree in the field of health sciences represents an increase of almost 18 percentage points in the probability of achieving an education-job match after external labor mobility. This probability also increases appreciably if the individual is an engineer/architect (4.3 percentage points). On the other hand, the probability of obtaining a good fit is significantly reduced if the worker obtained a degree in the field of arts and humanities (decreases almost 15 percentage points), and if he/she obtained a degree in the field of social and legal sciences (decreases by about 5 percentage points). If we focus on the typology of university studies, we see in Table 6 (Model II) that engineering degrees and Architecture, also technical engineering degrees and Technical

[36] In any case, the questionnaire asked the salary (in wide intervals) only for the first job. But this information is not available in the database made public.

[37] For the global contrast of the estimated models, the Chi-square test was used. The null hypothesis is that all the coefficients of the equation, except the constant, are null. In Model I: Wald chi2(6) = 393.15; in Model II: Wald chi2(7) = 265.35. In both cases, the associated p-value was very low (less than 0.001). The result of this test allows us to reject the null hypothesis accepting both models as good.

Table 6 Logistic regression of the likelihood of achieving an education-job match after external labor mobility

Average marginal effects				
	Model I		**Model II**	
	dy/dx	**Std. Err**	**dy/dx**	**Std. Err**
Number of different employers since graduation	0.0426**	0.0028	0.0435**	0.0028
Female (= 1)	0.0086	0.0111	0.0128	0.0112
Arts and Humanities	− 0.1483**	0.0243		
Hard Sciences	reference			
Social and Legal Sciences	− 0.0458**	0.0185		
Engineering and Architecture	0.0426**	0.0206		
Health Sciences	0.1768**	0.0272		
Diplomatura			0.0138	0.0119
Technical Engineering and Technical Architecture			0.0692**	0.0164
Licenciatura			reference	
Engineering and Architecture			0.1454**	0.0207
Grado			0.0389	0.0427
Other degrees before Bologna			− 0.0760	0.1288

Delta-method to compute the standard errors

Model VCE: Robust

Dependent variable: *gotmatching* [= 1 (30%); = 0 (70%)]

Number of obs. = 7,471

Wage-earners both in the first job and in the current job

** *p*-value < 0.05

Source: author's estimates

Architecture (surveyors), increase the probability of achieving a job match after job turnover, compared to a *licenciatura*.

The results in Table 6 suggest that the relative specificity of college majors is associated with a lower probability of being mismatched after job turnover. But the question that arises is: how many times does a university graduate have to change jobs to get a good match? Using the estimates shown in Table 6, Tables 10, 11 (Appendix) show the probability of achieving the job match according to the number of times the graduate changes employer. For example, in Table 10, the likelihood of obtaining a job match if the individual changes only one time is 23.4%. But it would be necessary to "buy" ten jobs to have a high probability (68.4%) of achieving the job matching (result based on model predictions).[38] The latter may be possible in an economy such as the United States where the labor market is characterized by significant flexibility and mobility, but not in Europe, and less in Spain. It is unlikely that an average Spanish university graduate can change employer ten times in four years. Among other things, because employment opportunities are limited and labor mobility is relatively low in the Spanish labor market. In fact, in the sample used in Table 6, the average job turnover was 2.85.[39] Therefore, educational mismatch likely becomes a permanent phenomenon in the job market for Spanish graduates.

6 Discussion

The mismatch between the educational requirements for various occupations and the amount of education obtained by workers is large and growing significantly over time (Vedder et al. 2013). Countries that have a relative over-supply of highly skilled workers show higher levels of over-education for graduates (Verhaest and Van der Velden 2012). This mismatch between education and employment has been the focus of substantial research (e.g., Groot and Maassen van den Brink 2000; McGuinness 2006). More attention has been paid recently to the so-called horizontal mismatch as well, that is, the mismatch between a worker's field of study and the content of his/her job (e.g., Robst 2007; Verhaest et al. 2017).

[38] "Job shopping refers to the period of experimentation with jobs and accompanying high rates of mobility, which typically occurs at the beginning of the working life" (Johnson 1978, p. 261). According to the "theory of job shopping," workers search for a high-quality match (e.g., Anderson et al. 1994). In connection with this idea, McGuiness and Wooden (2009), using Australian longitudinal data, identified mismatched workers (over-skilled in their study) as moving rapidly between jobs but also relatively unconfident of finding an improved job match.

[39] The average number of different employers since graduation was 3.53 among those workers who got a good education-job fit.

Education-job mismatches are almost inevitable in the early years of the career of university graduates. New graduates rarely have the exact skills employers require. This is not (necessarily) a reflection on the shortcomings of higher education. Some skills are best learned on the job, and higher education is expected to do more than providing a narrowly described set of directly utilizable competencies (Allen and Van der Velden 2005). Moreover, individuals having attended different undergraduate programs have different stocks of human capital that can be differentially valued by employers resulting in an initial mismatch for some university degrees. Also, the lack of work experience of recent graduates stops them from occupying positions of their educational level. It is then likely that many fresh college students accept a position below their educational level because they can obtain practical skills and experience that can be used in different higher-level positions or jobs. The "theory of career mobility" already predicted that "it will be rational for some individuals to spend a portion of their working careers in occupations that require a lower level of schooling than they have acquired" because "more educated individuals are more likely to move to a higher-level occupation" (Sicherman and Galor 1990, pp. 177–178). Thus, (vertical) mismatch would be a temporary phenomenon, which would greatly reduce the need for policy intervention.

In the case of Spain, according to the EILU2014 graduate survey, around 13 percent of university graduates were in non-graduate jobs just after leaving the higher education institutions (HEIs), and just over 9 percent remained in mismatched jobs four years after graduation. They were indeed carrying out jobs related to their studies (over-educated but matched in the field of study). But, why offer subsidized university degrees if these jobs can be carried out with, for example, higher-level vocational training (post-upper secondary school level)? Surrounding countries such as Switzerland, with a lower offer of university degrees and an excellent dual system of vocational education and training (VET), have a lower incidence of educational mismatch among their university graduates (see Fig. 2).[40] According to the European Commission, the phenomenon of over-qualification in Spain coexists with the need for more qualified workers mainly with a VET background (European Centre for the Development of Vocational Training 2015). Nonetheless, the Spanish secondary education system remains academic and university-oriented. There have been attempts to reform the formal VET system, but it is still less popular (lower social recognition) than the Baccalaureate; and it attracts, although not always, students with lower academic ability.

The situations that perhaps should concern us the most are those of complete educational mismatch. Almost 17 percent of Spanish graduates were in non-graduate positions unrelated to their studies four years after graduation. From the point of view of educational production, these situations constitute a clear (external) inefficiency because their studies have been useless: "external efficiency implies that the results of educational processes are desirable for society (social utility)" (Salas-Velasco 2020, p. 163). These degrees may have a high component of education consumption and/or are being demanded by students with less academic ability. In these cases, perhaps better school guidance would be desirable for them to pursue vocational training studies instead of university degrees that are more costly to society. Also, because they are in low-wage occupations, they will not be able to return to society via taxes that society gave them. There is perhaps a "matching problem" here in the individual's choice of alternative educational paths.

We cannot give magic recipes to improve the matching of fresh graduates with their jobs in the Spanish labor market. In the first years of their professional careers, the educational mismatch may be due to the fact that they earned a degree but lack the skills or competencies that are needed to perform high-skilled jobs. Using information from the REFLEX survey for Spanish higher education graduates, Salas-Velasco (2014) showed that non-cognitive skills are more demanded in job positions than cognitive skills. However, our graduate survey does not contain information on competencies, unlike the REFLEX survey, so this aspect cannot be analyzed. The mismatch may also be related to the search activity of recent graduates. University graduates with higher ability are, in general, more ambitious and involved individuals, and search more or more efficiently. Getting a good education-job match would thus be related to greater ability. But our survey also does not contain information on the ability of recent graduates, so we have not been able to explore this hypothesis either.

The optimal transition from university to employment, in terms of speed and quality, is also influenced by variables as important as the structure of the labor market, the productive model of the economy, and the business cycle. In this regard, it is necessary to highlight the business dimension of Spanish firms. In small and medium-sized enterprises (SMEs) and family businesses, an education-occupation match can hardly be achieved even four years after obtaining a university degree when workers have already gained skills from the labor market and/or have learned to do a better job search. Medium and large companies are those that offer highly qualified jobs,

[40] Although it is also true that youth unemployment is much higher in Spain.

and also possibilities for promotion through well-defined career ladders. Therefore, if the average business size in Spain does not increase in the following decades, situations of educational mismatch will continue to exist for many university degrees. In the case of physicians and nurses, their good educational match is due not only to the fact that they have specific human capital (highly specialized skills which are to a large extent occupation-specific and their transferability across occupations/sectors is limited) but also because their "only" employer is a very large company: the public sector. Thus, we hypothesize that the education-job match is more likely in monopsonistic labor markets; when there is only one employer of a certain type of work and the human capital demanded is specific for the positions offered by the monopsonist—together with a regulation for the access and exercise of the profession. On the other hand, the business cycle is also important. The unemployment of tertiary education graduates in Spain was 24 percent in 2014, the year in which the graduates of our survey were interviewed.[41] This should be noted in interpreting the importance of the mismatch. In all likelihood, graduates surveyed had no choice but to accept non-graduate jobs and/or disconnected from their fields of education. Hence, the mismatch is involuntary. Future graduate surveys should be used to check if a more favorable labor market in terms of employability improves the education-employment adjustment among graduates.

The map of degrees done in this article according to the education-job (mis)match is important also for the educational policy given that higher education is highly subsidized in Spain. We can raise some questions that can be answered in future research. Should we change the map of university degrees offering only those that really allow a good education-job fit? Is there a rationale for policies promoting access to higher education even in the presence of a mismatch? Should vocational education be enhanced by guiding students properly about their educational choices after completing compulsory education? Is the horizontal mismatch acceptable? After all, graduates are occupying highly qualified positions although, in principle, they do not use the specialized knowledge gained in college. The answers will depend on the value that society places on higher education and its willingness to pay for it. Some studies have found that there are significant non-monetary benefits from higher education that accrue even to mismatched graduates, including better self-reported health, and external benefits for the rest of society (e.g., Green and Henseke 2016). However, the questions that remain are whether those non-monetary benefits outweigh the monetary returns and whether society is willing to subsidize investments in higher education from which a lower tax collection is expected—as graduates work in lower-skilled and lower-paying jobs—as well as a reduction in the GDP growth through the waste of human capital and the implied reduction in productivity (Organisation for Economic Co-operation and Development 2016).[42]

7 Conclusion

This paper examines the education-job (mis)match in the labor market for university graduates. The topic is relevant and pertinent given the amount of resources that both individuals and society allocate to the production of highly qualified workers. As the main novelty, this article studies the horizontal mismatch which has been less studied in the literature, that is, when university graduates hold jobs at their formal qualification level but not related to their field of study. The paper contributes to the existing literature on this topic by providing the taxonomy of educational mismatch in the labor market for university graduates and investigating its incidence among Spanish higher education graduates based on self-assessments. In addition, the map of degrees done in this article according to the education-job (mis)match is important for the educational policy given that higher education is highly subsidized in Spain. The article is also novel in the sense that it incorporates methodological improvements on some already published papers.

In this work, we use a subjective self-evaluation of a sample of 30,379 Spanish university graduates from the class of 2010, surveyed four years after graduation. Graduates inform us, on the one hand, whether or not their current (initial) positions need (needed) a university degree and, on the other hand, what is (was) the most appropriate study area or field of education for these positions. Tabulating the answers to both questions, we identify four situations of educational mismatch: appropriate match, horizontal mismatch, vertical mismatch, and vertical and horizontal mismatch. By estimating a multinomial logistic regression, we categorize university degrees in each of these four categories. Some results were expected. University degrees that entail specific human capital (e.g., Medicine, Nursing, Veterinary, and engineering/architecture degrees) are more likely to match education-occupation. Other degrees that involve a general human capital that has value across various occupations (e.g., hard science degrees such as Mathematics, Physics, or Chemistry, and liberal arts degrees such as

[41] According to Eurostat (https://ec.europa.eu/eurostat), unemployment rates in 2014 (second quarter) of tertiary education graduates (ISCED-97 levels 5 and 6) aged 25 to 29 years old were 37%, 24%, and 10% in Greece, Spain, and the EU-28, respectively.

[42] "For the economy as a whole, total output then depends on how workers are assigned to jobs" (Sattinger 1993, p. 831).

History, Literature, or Sociology) increase the probability of being horizontally mismatched. In this case, we do not believe there is a severe misallocation of human resources since workers are occupying graduate positions. It is almost impossible to establish a one-to-one relationship between the field of study and occupation for those graduates whose degrees allow more flexibility in terms of their careers. Other results are more worrying in terms of the "waste" of university educational output. Some degrees (e.g., Business, and Management and Economics) increase the probability of being vertically mismatched (over-educated) in the first and current jobs. The excessive production of graduates in business and economics at Spanish universities reflects this education-work mismatch. In these situations, workers use in some way the human capital acquired during their university education. We should ask ourselves whether it would not be better to promote vocational education and training in many of these cases. It is cheaper to produce vocational skills, and individuals are more likely to be well-matched in their jobs. The situation is even worse for workers in non-graduate positions and study areas unrelated to their studies (e.g., Social Work). In these cases, it would be necessary to consider whether we really should produce this type of degree at the university.

The paper also shows that many university graduates change jobs and job turnover allows them to get a better match between their degrees and their jobs. Thus, turnover patterns can be informative on the nature of the matching of workers to jobs. The estimation of a binary logistic regression has allowed us to investigate this question. The results indicate that an important percentage of graduates (30%) who were mismatched in their first job become well-matched in their current employment after moving to a different firm. But the results also show that a recent graduate needs “to buy” several jobs to achieve an education-job match.

An important question that arises in this paper is that if workers with a Bachelor’s degree are over-qualified for their jobs and people with non-college education have the same earnings as those with BAs in an occupation, it is hard to justify the time and costs of going to college. But we should recognize that formal education, although important, is only one aspect of job matching. Moreover, going to college has non-monetary benefits for individuals in terms of better health, habits of life, open-mindedness, etc. that should also be taken into account in this type of studies.

Appendix

See Tables 7, 8, 9, 10, 11.

Table 7 Descriptive statistics of the explanatory variables included in the multinomial logistic regression

	First job		Current job	
	Frequency	**Percent**	**Frequency**	**Percent**
Architecture	176	0.72	120	0.6
Biology	813	3.34	537	2.9
Business Studies	748	3.08	588	3.2
Chemistry	635	2.61	503	2.7
Engineering	1761	7.24	1523	8.2
Fine Arts	221	0.91	128	0.7
History and Philosophy	1178	4.84	841	4.5
Journalism	1253	5.15	867	4.6
Labor Relations	384	1.58	297	1.6
Languages and Literature	932	3.83	701	3.8
Law Studies	870	3.58	668	3.6
Management and Economics Studies	1511	6.21	1220	6.5
Mathematics	356	1.46	295	1.6
Medicine	708	2.91	696	3.7
Nursing Studies	2085	8.58	1506	8.1
Pharmacy	532	2.19	422	2.3
Physics	348	1.43	265	1.4
Political Science and Sociology	306	1.26	229	1.2
Psychology	928	3.82	710	3.8
Quantity Surveyors (Technical Architecture)	567	2.33	402	2.2
Social Work	676	2.78	491	2.6
Sports Science	465	1.91	356	1.9
Teacher Studies	3054	12.56	2377	12.7
Technical Engineering	2727	11.22	2151	11.5
Tourism Studies	670	2.76	465	2.5
Veterinary	291	1.20	217	1.2
Other university degrees	119	0.49	85	0.5
Female (= 1)	14,817	60.94	11,275	60.4
Internship (= 1 yes)	15,852	65.20		
Master's degree (= 1 yes)			6271	33.6
Age (under 30 years old)			11,040	59.2
Age (from 30 to 34 years old)			4588	24.6
Age (35 years old or older)			3032	16.2
Observations	24,314		18,660	

Source: author's elaboration from EILU2014

Table 8 Educational mismatches in the first job after graduation. Only wage-earners workers (excluding self-employment). Average marginal effects

	No mismatch		Horizontal mismatch		Vertical mismatch		Vertical and horizontal mismatch	
	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err
University degrees (narrow fields of education)								
Architecture	0.0377	0.0583	−0.0582	0.0382	0.0410	0.0490	−0.0206	0.0530
Biology	−0.1630	0.0468	0.0030	0.0239	0.0509	0.0416	***0.1091***	0.0418
Business Studies	−0.2663	0.0472	−0.0247	0.0251	***0.1848***	0.0407	***0.1062***	0.0421
Chemistry	−0.0607	0.0477	0.0044	0.0244	***0.0828***	0.0416	−0.0265	0.0435
Engineering	0.0629	0.0460	0.0114	0.0231	***0.1008***	0.0404	−0.1752	0.0424
Fine Arts	−0.3210	0.0549	−0.0349	0.0313	***0.1552***	0.0438	***0.2007***	0.0464
History and Philosophy	−0.2702	0.0469	***0.0910***	0.0227	−0.0323	0.0428	***0.2116***	0.0412
Journalism	−0.2000	0.0459	0.0328	0.0231	0.0606	0.0408	***0.1065***	0.0411
Labor Relations	−0.2700	0.0497	0.0146	0.0250	***0.1144***	0.0424	***0.1411***	0.0437
Languages and Literature	−0.0202	0.0473	0.0197	0.0234	−0.0615	0.0437	0.0620	0.0420
Law Studies	−0.0794	0.0467	−0.0010	0.0239	0.0386	0.0416	0.0419	0.0420
Management and Economics Studies	−0.1397	0.0456	0.0030	0.0233	***0.1259***	0.0403	0.0107	0.0412
Mathematics	0.0185	0.0516	0.0322	0.0245	−0.0231	0.0472	−0.0276	0.0467
Medicine	***0.5364***	0.0623	−0.0686	0.0351	−0.1667	0.0602	−0.3012	0.0598
Nursing Studies	***0.1850***	0.0462	−0.0349	0.0244	−0.0052	0.0412	−0.1449	0.0422
Pharmacy	−0.0633	0.0486	*0.0422*	0.0240	*0.0777*	0.0422	−0.0566	0.0447
Physics	*0.0872*	0.0527	0.0159	0.0254	−0.0456	0.0490	−0.0575	0.0481
Political Science and Sociology	−0.2732	0.0515	***0.0533***	0.0241	0.0647	0.0445	***0.1551***	0.0447
Psychology	−0.1524	0.0467	0.0333	0.0236	0.0199	0.0418	***0.0992***	0.0417
Quantity Surveyors	−0.0108	0.0487	−0.0372	0.0261	−0.0048	0.0438	0.0528	0.0434
Social Work	−0.2353	0.0477	0.0085	0.0247	0.0475	0.0421	***0.1793***	0.0420
Sports Science	−0.2351	0.0492	0.0041	0.0256	***0.1905***	0.0412	0.0404	0.0443
Teacher Studies	−0.1937	0.0450	0.0075	0.0230	***0.1209***	0.0401	0.0652	0.0405
Technical Engineering	−0.1030	0.0450	−0.0037	0.0229	***0.1026***	0.0401	0.0042	0.0407
Tourism Studies	−0.3350	0.0477	0.0325	0.0240	***0.1671***	0.0409	***0.1354***	0.0423
Veterinary	***0.1734***	0.0570	−0.0619	0.0382	−0.0361	0.0505	−0.0753	0.0519
Other university degrees	Reference		Reference		Reference		Reference	
Control variables								
Female (=1)	−0.0024	0.0068	−0.0108	0.0033	0.0043	0.0047	0.0088	0.0060
Internship (=1 yes)	***0.0200***	0.0073	−0.0266	0.0036	***0.0134***	0.0052	-0.0069	0.0065

Dependent variable: *mismatchfirstjob*

In bold italics, marginal effects that have a positive and statistically significant contribution to the probability of being well-matched or mismatched in the first job at a significance level of 0.05 (5%). In italics, for a significance level of 10%

Standard errors for average marginal effects are computed by the Stata *margins* command using the Delta-method

Model VCE: Robust

Number of obs. = 24,314

Except for rounding errors, the sum of the marginal effects for the four categories must be 0

Source: author's estimates

Table 9 Educational mismatches in the current job. Only wage-earners workers (excluding self-employment). Average marginal effects

	No mismatch		Horizontal mismatch		Vertical mismatch		Vertical and horizontal mismatch	
	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err
University degrees (narrow fields of education)								
Architecture	−0.0046	0.0811	−0.0624	0.0801	0.0140	0.0524	0.0530	0.0576
Biology	−0.2496	0.0610	***0.0971***	0.0480	0.0478	0.0435	***0.1047***	0.0472
Business Studies	−0.2766	0.0609	0.0549	0.0485	***0.1419***	0.0424	*0.0798*	0.0472
Chemistry	−0.1004	0.0620	***0.0963***	0.0482	0.0582	0.0434	−0.0541	0.0497
Engineering	0.0248	0.0603	0.0741	0.0475	0.0458	0.0423	−0.1448	0.0481
Fine Arts	−0.3855	0.0690	0.0815	0.0527	***0.1329***	0.0455	***0.1711***	0.0516
History and Philosophy	−0.3392	0.0610	***0.1822***	0.0472	−0.0401	0.0454	***0.1971***	0.0463
Journalism	−0.2792	0.0600	***0.1283***	0.0474	0.0429	0.0428	***0.1081***	0.0464
Labor Relations	−0.3321	0.0631	*0.0848*	0.0488	*0.0757*	0.0442	***0.1717***	0.0479
Languages and Literature	−0.1297	0.0614	***0.1083***	0.0477	−0.0433	0.0455	0.0648	0.0472
Law Studies	−0.1508	0.0606	0.0584	0.0481	0.0524	0.0430	0.0401	0.0472
Management and Economics Studies	−0.1568	0.0598	0.0752	0.0476	***0.0991***	0.0421	−0.0175	0.0468
Mathematics	−0.1036	0.0645	***0.0959***	0.0490	−0.0028	0.0471	0.0105	0.0506
Medicine	***2.0203***	0.0841	0.1181	0.0801	0.1033	0.0632	−2.2417	0.0590
Nursing Studies	0.0964	0.0606	0.0080	0.0485	−0.0101	0.0431	−0.0943	0.0476
Pharmacy	−0.0907	0.0628	***0.1044***	0.0483	0.0452	0.0440	−0.0589	0.0503
Physics	−0.0195	0.0667	***0.0975***	0.0494	−0.0075	0.0485	−0.0704	0.0547
Political Science and Sociology	−0.3081	0.0642	***0.1314***	0.0483	0.0477	0.0458	***0.1290***	0.0492
Psychology	−0.1891	0.0606	*0.0893*	0.0477	0.0092	0.0436	*0.0905*	0.0468
Quantity Surveyors	−0.1492	0.0625	0.0528	0.0489	0.0058	0.0450	*0.0907*	0.0479
Social Work	−0.2775	0.0617	0.0504	0.0489	0.0339	0.0441	***0.1932***	0.0468
Sports Science	−0.2613	0.0627	***0.0964***	0.0487	***0.1369***	0.0429	0.0280	0.0496
Teacher Studies	−0.1665	0.0591	0.0540	0.0473	*0.0699*	0.0420	0.0426	0.0459
Technical Engineering	−0.1423	0.0593	0.0758	0.0473	0.0605	0.0420	0.0060	0.0462
Tourism Studies	−0.3774	0.0613	***0.1129***	0.0480	***0.1261***	0.0428	***0.1385***	0.0472
Veterinary	0.1795	0.0769	0.0179	0.0574	−0.0707	0.0585	−0.1268	0.0630
Other university degrees	Reference		Reference		Reference		Reference	
Control variables								
Female (=1)	−0.0114	0.0074	−0.0073	0.0043	0.0021	0.0046	***0.0166***	0.0061
Master's degree (=1 yes)	***0.0620***	0.0075	−0.0006	0.0043	−0.0232	0.0050	−0.0381	0.0061
Age (under 30 years old)	***0.0502***	0.0080	−0.0124	0.0049	−0.0159	0.0049	−0.0219	0.0065
Age (from 30 to 34 years old)	Reference		Reference		Reference		Reference	
Age (35 years old or older)	−0.0147	0.0105	***0.0439***	0.0052	−0.0107	0.0067	−0.0186	0.0085

Dependent variable: *mismatchcurrentjob*

In bold italics, marginal effects that have a positive and statistically significant contribution to the probability of being well-matched or mismatched in the current job at a significance level of 0.05 (5%). In italics, for a significance level of 10%

Standard errors for average marginal effects are computed by the Stata *margins* command using the Delta-method

Model VCE: Robust

Number of obs. = 18,660

Except for rounding errors, the sum of the marginal effects for the four categories must be 0

Source: author's estimates

Table 10 Probability of getting an education-job match according to the number of company changes (Model I) (*)

	Margin	Std. Err	p-value
Number of different employers since graduation			
1	0.2339	0.0174	$p<0.001$
2	0.2752	0.0189	$p<0.001$
3	0.3206	0.0208	$p<0.001$
4	0.3697	0.0228	$p<0.001$
5	0.4217	0.0251	$p<0.001$
6	0.4755	0.0273	$p<0.001$
7	0.5298	0.0293	$p<0.001$
8	0.5835	0.0309	$p<0.001$
9	0.6352	0.0318	$p<0.001$
10	0.6840	0.0321	$p<0.001$

(*) In comparison with the individual of reference: a man who studied a hard science degree

Number of obs. 7471

Adjusted predictions. Delta-method to compute the standard errors

Model VCE: Robust

Wage-earners both in the first job and in the current job

Source: author's estimates

Table 11 Probability of getting an education-job match according to the number of company changes (Model II)

	Margin	Std. Err	p-value
Number of different employers since graduation			
1	0.1928	0.0090	$p<0.001$
2	0.2290	0.0095	$p<0.001$
3	0.2698	0.0106	$p<0.001$
4	0.3149	0.0124	$p<0.001$
5	0.3638	0.0150	$p<0.001$
6	0.4157	0.0180	$p<0.001$
7	0.4695	0.0212	$p<0.001$
8	0.5240	0.0243	$p<0.001$
9	0.5780	0.0268	$p<0.001$
10	0.6301	0.0287	$p<0.001$

In comparison with the individual of reference: a man who studied a *licenciatura*

Number of obs. 7471

Adjusted predictions. Delta-method to compute the standard errors

Model VCE: Robust

Wage-earners both in the first job and in the current job

Source: author's estimates

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Authors' contributions
As a sole author, I prepared and wrote the entire article. The author read and approved the final manuscript.

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The data used for the analysis are available at the *Instituto Nacional de Estadística* repository: https://www.ine.es/dynt3/inebase/es/index.htm?padre=2785&capsel=2876

Declarations

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