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Examining the Alignment and Mismatch of University Degrees in the Graduate Job Market

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Abstract

This study addresses the limited research on horizontal education-job mismatch among university graduates, which occurs when individuals work in a field different from their university training while holding a corresponding formal qualification. The analysis utilizes data from Spain's first nationally representative survey on the labor market integration of recent university graduates. Using multinomial logistic regression, we examine graduates' self-assessed match status four years after graduation. Our results indicate that graduates in Chemistry, Mathematics, Physics, Pharmacy, and Languages and Literature face a higher risk of horizontal mismatch, whereas those in Medicine are more likely to secure jobs aligned with their qualifications. This suggests that horizontal mismatch is more common in degree programs emphasizing general skills and less common in those offering highly occupation-specific skills. Degrees in Business Studies, Management, and Economics, on the other hand, are associated with a higher likelihood of vertical mismatch (over-education), which still allows graduates to retain some of the specific human capital acquired through their studies. Conversely, graduates in Labor Relations and Social Work often occupy non-graduate roles unrelated to their fields of study. Additionally, the findings reveal that graduates in health sciences and engineering/architecture are more likely to achieve a better education-job fit after experiencing external job mobility.

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

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Introduction

In most economies, the educational qualifications of the workforce are closely linked to the jobs that individuals hold, with job requirements typically defined by formal education levels. A key question is whether the qualifications provided by the education system equip workers to perform the tasks required in their positions, or whether there is a disconnect between educational curricula and job content. The alignment or misalignment between formal education and job requirements has been a major topic in labor and education economics since Freeman's [1] The Overeducated American, with comprehensive surveys provided by Leuven and Oosterbeek [2], McGuinness [3], and Sloane [4], and a meta-analysis by Groot and Maassen van den Brink [5].

This paper focuses on the labor market for university graduates and contributes to understanding the mismatch between academic degrees and employment outcomes. While most prior research has concentrated on graduate over-education (vertical mismatch), which occurs when graduates occupy non-graduate jobs (e.g., Dolton and Vignoles [6]), this study examines horizontal mismatch, a less-studied phenomenon where graduates work in occupations unrelated to their field of study but at

a level consistent with their qualifications. Compared to vertical mismatch, horizontal mismatch has been the subject of relatively few studies, with Somers *et al.* [7] providing a recent systematic review highlighting the absence of theoretical models and suggesting that the likelihood of horizontal mismatch is influenced by the degree to which a graduate's skills are general rather than occupation-specific.

Horizontal mismatch arises when graduates trained in one field take jobs in another field. For example, a Mathematics graduate working as a computer-aided design technician illustrates this phenomenon. Robst [8] was among the first to analyze horizontal mismatch, finding high mismatch prevalence in majors such as English, foreign languages, social sciences, and liberal arts, which tend to provide general skills, whereas fields like computer science, health professions, and engineering, which focus on occupation-specific skills, show low prevalence. Graduates from these fields are less likely to seek employment in unrelated sectors because their specific human capital is not easily transferable, leading to a higher likelihood of alignment between education and job.

Given the limited empirical research on horizontal mismatch among university graduates, this study addresses this gap by providing a detailed taxonomy of educational mismatch in Spain and examining its prevalence based on graduates' self-assessments. Mapping the alignment and misalignment of degrees is particularly relevant for educational policy in Spain, where higher education is heavily subsidized. This study also introduces methodological improvements. Earlier studies by Robst [8] and Nordin *et al.* [9] analyzed horizontal mismatch using either subjective survey responses or cross-tabulations of occupations and fields of study, but each had limitations. Robst's use of an ordered logit model identified majors with higher or lower mismatch likelihood but did not distinguish between graduate-level and lower-level positions, which has important policy implications. Nordin *et al.* presented only descriptive tables of matched and mismatched graduates without modeling, and their classification sometimes misidentified graduates teaching in related fields as mismatched.

This paper advances previous research by focusing on Spain's labor market for recent university graduates, identifying which specific fields of study are associated with horizontal mismatch—defined as graduates working in graduate-level jobs outside their field. By estimating the probabilities of horizontal mismatch, vertical mismatch (over-education), and full mismatch (combining both), the proposed taxonomy allows a more precise identification of educational mismatches. The use of a multinomial logistic regression to model education-employment match probabilities also enables the construction of a degree-level map of (mis)match, representing a novel contribution. Furthermore, this study examines the role of early-career external labor mobility, recognizing that alignment between degrees and jobs may improve following job transitions.

For the analysis in this paper, we used individual-level data from Spain's first survey on the labor market integration of university graduates. The Encuesta de Inserción Laboral de Titulados Universitarios (EILU 2014) provides a nationally representative random sample of Spanish universities and graduates, covering 30,379 individuals from the 2010 graduating cohort, surveyed four years after completing their degrees. The survey asked respondents whether their qualifications were appropriate for their current work. Many Spanish graduates held jobs that neither required a university degree nor utilized specialized knowledge gained at university. The alignment between graduates' qualifications and their job tasks can thus be considered an important indicator of higher education performance. Given the high public investment in higher education in Spain, the greatest societal return is achieved when graduates are well-matched to positions where their acquired knowledge and skills are fully applied, justifying research on graduates' labor market outcomes and educational (mis)match. Further arguments are discussed in the article's discussion section.

The remainder of the paper is structured as follows: Section 2 presents the empirical framework for measuring vertical and horizontal education-job mismatch among graduates. Section 3 describes the dataset obtained from the National Statistics Institute of Spain, identifies four types of education-job mismatch based on the required level and field of education, and provides summary statistics on mismatch prevalence among Spanish graduates. Section 4 introduces econometric models estimating the probability of being (mis)matched in first and current jobs, as well as the likelihood of achieving a good match after external job turnover. Section 5 reports the results of these analyses, Section 6 discusses the findings and policy implications, and Section 7 concludes.

Empirical Measurement

Job mismatch refers to the gap between an individual's qualifications and those required by the labor market. Qualifications can denote either formal education or skills/competencies [10]. Formal qualifications are defined as "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" (p. 202). Skills-based qualifications refer to "knowledge, aptitudes, and skills required to perform specific tasks attached to a particular work position" (p. 202).

Skill mismatch occurs when workers' proficiency exceeds or falls short of job requirements: over-skilled if their proficiency is higher, under-skilled if lower [11]. Educational mismatch arises when a worker's formal education level is higher or lower than that required by the job—also called vertical mismatch. Over-education (over-qualification) occurs when a worker's

education level exceeds job requirements, whereas under-education (under-qualification) occurs when education falls short of job requirements [2, 12-17]. Educational mismatch can imply skill mismatch, but the reverse is not always true [18]. For instance, a medical graduate working as a dental assistant is over-educated and over-skilled, whereas a surgeon lacking certain competencies may have a skills deficit without being under-educated.

Vertical mismatch is not the only form of educational misalignment. This paper distinguishes two additional types. Horizontal mismatch occurs when a graduate's education level is appropriate for a job but their field of study does not align—for example, an economics graduate employed as an engineer [8, 19]. The second type combines vertical and horizontal mismatch, where both the level and field of education are inconsistent with job requirements. The study of skill mismatches falls outside the scope of this paper, and the dataset does not include detailed information on skills as some other surveys, such as REFLEX, do.

Measuring Vertical Education-Job Mismatch

Vertical mismatch, or over-education, can be measured subjectively by asking workers about the minimum educational requirements of their jobs and comparing this to their actual qualifications, or simply by asking if they consider themselves over-educated [3]. Dolton and Vignoles [6], using the UK National Survey of 1980 Graduates and Diplomates, found that a substantial share of British graduates in the 1980s were over-educated. Respondents were asked about the minimum formal qualification required for their job, and graduates in positions requiring lower than degree-level qualifications (or none at all) were classified as over-educated. They reported that 38% of graduates were over-educated in their first job, declining to 30% six years later, and that over-educated graduates earned less than their peers in matched positions.

More recent data from the 2012 and 2015 Survey of Adult Skills (PIAAC) asked employed individuals aged 25–64 about their highest completed qualification (ISCED-97) and the usual qualifications required for their job. Among university graduates (ISCED 5A or 6), the OECD average showed 75% were well-matched, but over 34% of workers in England, Korea, Estonia, and Japan were over-qualified, and in Spain, 24% of graduates were in this situation [20].

Objective approaches can also be used, either by comparing an individual's education to the average or modal education within their occupation (realized matches/statistical approach) or by using a normative correspondence between occupations and education, such as ISCO or DOT classifications (job analysis/normative approach) [21]. For example, Rumberger [22] converted DOT occupational requirements into years of schooling and compared them with workers' actual education. In the mode-based statistical approach, employees whose education exceeds (or falls below) the modal level in their occupation are classified as over-educated (under-educated) [23, 24]. In the mean-based approach, over-educated workers have education more than one standard deviation above the occupational mean, and under-educated workers more than one standard deviation below [25, 26]. Rossen *et al.* [27] applied a variant of the realized matches approach to tertiary-educated workers aged 20–34 in the 2016 European Labour Force Survey for 21 EU countries, coding individuals as over-educated if their education exceeded the 80th percentile of their occupational group, finding an overall over-education rate of 28%, with highest rates in France, Austria, Italy, and Greece (>35%) and lowest in Estonia, Belgium, and Latvia (<20%).

Measuring Horizontal Education-Job Mismatch

Horizontal mismatch refers to the extent to which graduates work in occupations unrelated to their primary field of study [28]. The subjective method asks respondents how closely their field of study relates to their current job.

Robst [8] examined horizontal mismatch in the U.S. using the 1993 National Survey of College Graduates, asking whether a respondent's work was closely related, somewhat related, or not related to their highest degree field. Fifty-five percent reported a close match, while 20% indicated a complete mismatch. Workers in unrelated occupations earned less than well-matched peers. However, Robst did not exclude graduates in jobs requiring only high school or lower education, which could affect wage impact estimates. PIAAC data suggest that 22% of U.S. workers with a university qualification (ISCED 5A or 6) are in positions requiring less formal education.

In Europe, Verhaest *et al.* [29] used the REFLEX (2000 graduates) and HEGESCO (2003 graduates) surveys to determine match status five years post-graduation based on self-assessments. Vertical mismatch was assessed by asking respondents which education level was most appropriate for their work; horizontal mismatch was based on whether the field of study was most appropriate, with responses categorized as exclusively own field, own or related field, a completely different field, or no particular field. Horizontal mismatch was defined as responses indicating a completely different field or no particular field. By combining both types, four categories were created: pure match, vertical mismatch only, horizontal mismatch only, and pure mismatch. On average, 74.2% of graduates were well-matched five years after graduation, horizontal mismatch averaged just over 10%, but was higher in Poland and Estonia (~16%) and the UK (>18%), while Spain reported a 4.5% incidence of horizontal mismatch.

Limitations

The literature offers several methods to estimate the educational requirements of jobs—namely self-assessment, realized matches, and job analysis approaches—but these methods often produce different estimates of over-education. Self-reported measures may be affected by respondents' subjective judgments. Objective approaches, meanwhile, also have shortcomings: since they typically reflect average educational levels for an occupation, they may not capture the requirements of a specific job. The mode-based statistical approach can misclassify employees as well-matched when the proportion of highly educated workers in an occupation increases, raising the modal education level even if job tasks remain unchanged. Likewise, using standard deviations to define over- or under-education is somewhat arbitrary. For an in-depth discussion of these issues, see Hartog [14], Leuven and Oosterbeek [2], and Verhaest and Omey [30].

While statistical or normative methods work reasonably well for assessing vertical mismatch, they are less applicable to horizontal mismatch, which occurs when a graduate's field of study does not align with the demands of their job. Although self-reported measures are inherently subjective [31], they allow a direct comparison between the graduate's field and job content. As Robst [8] emphasizes, "individual assessments, while perhaps subjective, are expected to provide important information." For this reason, our analysis relies on graduates' self-evaluations to capture horizontal mismatch.

Data and Matching Methodology

EILU2014 graduate survey

Spanish higher education operates under a career-track system, meaning students select a major at enrollment and follow a largely predetermined curriculum, with limited elective courses. Before the 2010 Bologna reform, Spanish universities offered mainly two types of programs: short-cycle diplomaturas (typically three years, more vocational, e.g., Nursing) and long-cycle licenciaturas (four to six years, e.g., Economics, Law, Medicine). Other programs included Engineering and Architecture degrees (around five years) and technical variants of these programs (three years on average).

The Spanish National Institute of Statistics (INE) conducted a nationwide survey of graduates from these programs between September 2014 and February 2015, combining web and telephone interviews with administrative records. The Encuesta de Inserción Laboral de Titulados Universitarios (EILU2014) collected responses from 30,379 graduates of the 2009/2010 academic year. Of these, 86% attended public universities and 14% attended private institutions, while the sample was 40.3% male and 59.7% female. **Table 1** summarizes the sample by broad degree categories, and **Table 2** presents the distribution by major fields of study.

Table 1. Sample distribution by broad categories of university degrees (ISCED 5A programs)

Degree Category	Percentage (%)	Frequency
Diplomatura	30.7	9,339
Technical Engineering & Technical Architecture	12.2	3,700
Licenciatura	46.3	14,053
Engineering & Architecture	7.7	2,352
Grado	2.9	880
Other pre-Bologna degrees	0.2	55
Total	100.0	30,379

Source: author's calculations from EILU2014

Table 2. Sample distribution by broad fields of study

Field of Study	Percentage (%)	Frequency
Arts & Humanities	10.6	3,231
Natural and Exact Sciences	9.7	2,955
Social & Legal Sciences	44.3	13,458
Engineering & Architecture[1]	22.4	6,793
Health Sciences	13.0	3,942
Total	100.0	30,379

Source: Author's calculations based on EILU2014 data

[1] Includes *Grado* programs in Building and Computer Engineering

Taxonomy of Educational Mismatch in the Spanish Graduate Labor Market

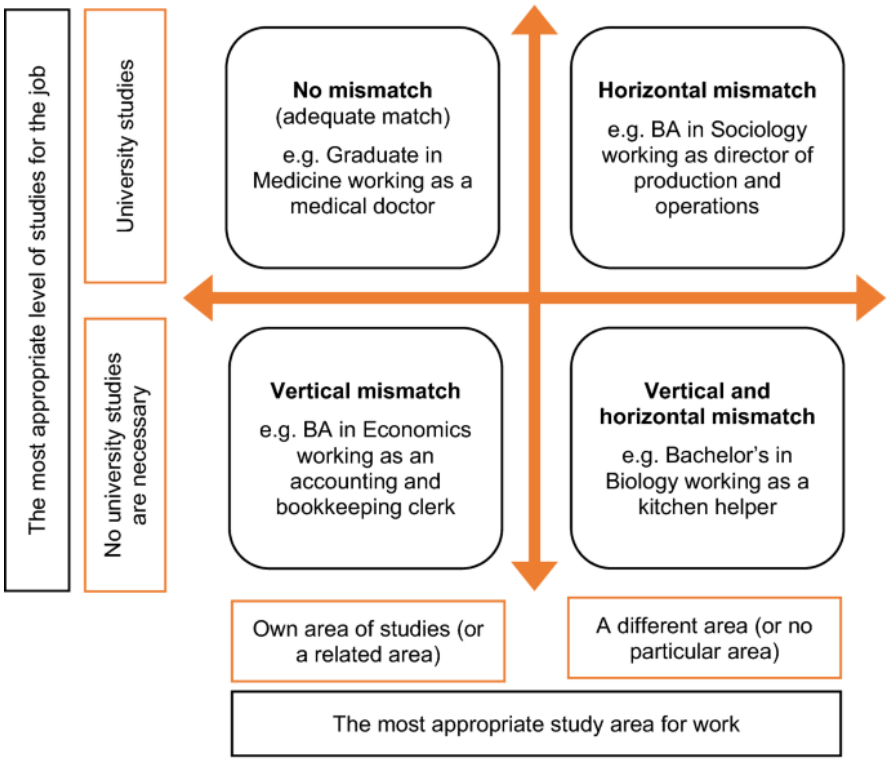
This section examines the occurrence of educational mismatches among the university graduates surveyed. The EILU2014 questionnaire included self-assessments by graduates regarding both the level and the field of education most suitable for their first job after graduation and for their current job, approximately four years later.

We constructed two measures of education-job matching. The first measure evaluated whether a position required a university degree by asking: "What is, or was, the most appropriate level of education to carry out this work?" Respondents could choose

from the following options: (A1) university degree, (A2) tertiary vocational education, (A3) high school, or (A4) middle-high school.

The second measure assessed the alignment between a graduate's field of study and the job performed. Respondents were asked: "What do you think is, or was, the most appropriate study area for this work?" The options were: (B1) exclusively the graduate's field of study, (B2) a related field, (B3) a completely different field, or (B4) no specific field.

Following the approach of Verhaest *et al.* [29], we combined responses to both questions to classify educational mismatches into four categories **(Figure 1)**: well-matched (no mismatch), horizontal mismatch, vertical mismatch, and both vertical and horizontal mismatch. Graduates were classified as well-matched if they reported A1 for education level and B1 or B2 for field alignment. Horizontal mismatch was defined as having the correct level of education (A1) but an unrelated field (B3 or B4). Vertical mismatch occurred when the level of education exceeded that required for the job (A2, A3, or A4) but the field was relevant (B1 or B2). Finally, combined vertical and horizontal mismatch applied when both the education level was below that required and the field of study was inappropriate (A2, A3, or A4 combined with B3 or B4).



Source: author's elaboration

Figure 1. Education-Job Alignment among University Graduates

To illustrate our classification of matches, **Table 3** presents the corresponding measures of educational mismatch. The results indicate that roughly 57–66% of graduates held positions well-aligned with both the level and field of their university education. Approximately 6–7% of graduates experienced horizontal mismatch. However, a substantial share of graduates—37% in their first job and 26% in their current position—were employed in roles that did not require a university degree.

Table 3. Distribution of Educational (Mis) Match among University Graduates in the Spanish Labor Market

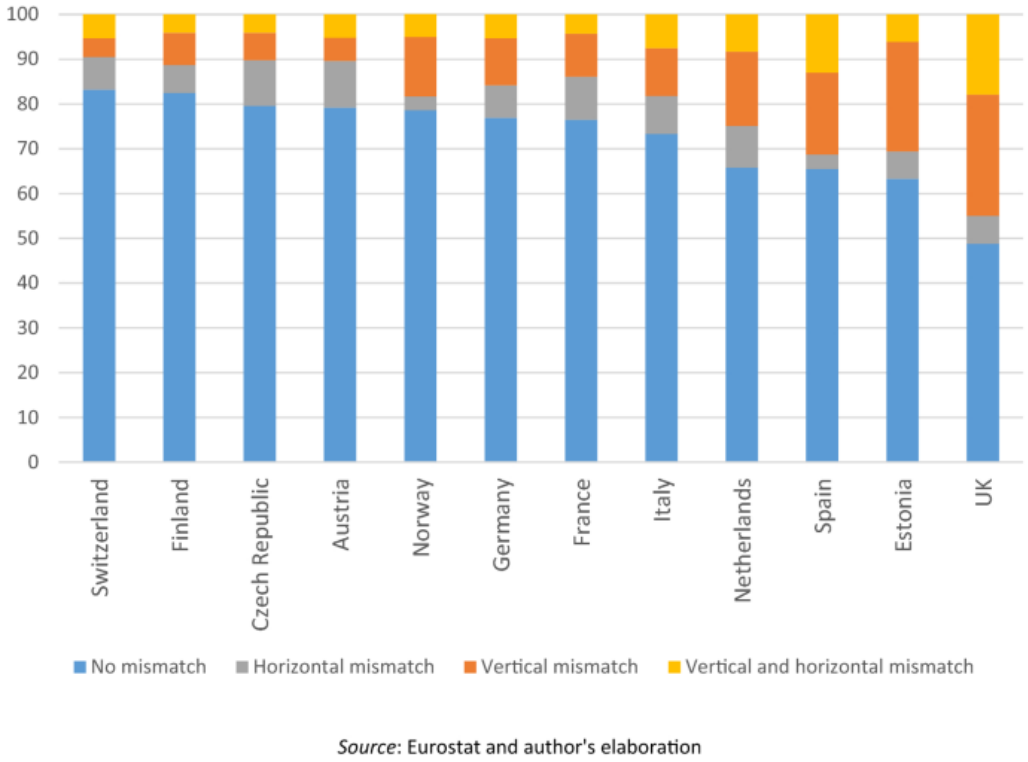
Educational (mis)match	Current Job		First Job	
	Freq	Percent	Freq	Percent
No mismatch	12,387	66.38%	13,899	57.16%
Horizontal mismatch	1,379	7.39%	1,422	5.85%
Vertical mismatch	1,725	9.24%	3,166	13.02%
Both vertical and horizontal mismatch	3,169	16.98%	5,827	23.97%
Total	18,660	100.00%	24,314	100.00%

Note: The analyzed sub-samples comprise only wage-earning employees

Source: Author's calculations based on EILU2014.

Analysis of the figures presented in **Table 3** indicates that educational mismatch is a notable issue in Spain's labor market for university graduates. Many graduates occupy positions that neither require a university degree nor align with their field of study. Consequently, Spain experiences a considerable misallocation of skilled human capital. Although the EILU2014 survey suggests a modest adjustment of graduates' employment four years after graduation, the proportion of mismatched workers

remains substantial and appears largely unchanged over the past decade **(Figure 2)**. This underscores that educational mismatch is a structural challenge in the Spanish labor market, exacerbated by the increasing number of graduates, a persistently high youth unemployment rate, and a business landscape dominated by small enterprises where graduates cannot fully apply their academic training. Moreover, educational mismatch is not unique to Spain but is also observed in countries such as Estonia and the United Kingdom **(Figure 2)**. Possible explanations include: (i) an oversupply of educated labor relative to labor market demand [3], and (ii) a mismatch between fields of study and labor market needs [32].



Source: Eurostat and author's elaboration

Figure 2. Educational (mis)alignment in Spain and Europe in 2005, five years post-graduation. Source: Eurostat (Reflex project). Percentages

This study does not aim to explore the root causes of educational mismatches in Spain's labor market. Instead, the focus is on identifying which university degrees are most likely to correspond to each of the four categories shown in **Figure 1** for both first and current employment. Since the categories are exhaustive, mutually exclusive, and their sequence is irrelevant at this analytical level, the multinomial logit model represents a suitable method for estimation.

Methodology

Multinomial logit model for job matching

To analyze the distribution of educational (mis)match among Spanish graduates, we employ a multinomial logit model (MLM), also known as multinomial logistic regression. The outcome variable comprises four distinct, unordered categories: correctly matched (no mismatch), horizontal mismatch, vertical mismatch, and simultaneous vertical and horizontal mismatch (j = 1, 2, 3, 4). The MLM framework estimates the likelihood of each category occurring, following the formulation proposed by McFadden [33].

$$\text{prob}(Y = j) = \exp(x'\beta_J) / \sum_{K=1}^{4} \exp(x'\beta_K) \quad (1)$$

This model estimates the probability that an individual with particular characteristics x belongs to group j. In this study, the predictor variables were university degrees (specific fields of study), and several control variables were also included in the regressions.

In our case, the natural normalization was applied, with the probability of the jth outcome defined as follows.

$$\text{prob}(Y = j) = \frac{\exp(x'\beta_J)}{1 + \sum_{K=1}^{3} \exp(x'\beta_K)} =, \text{if } j = 1, 2, 3 \quad (2)$$

For the baseline category (vertical and horizontal mismatch), the expression would be:

$$\text{prob}(Y = 4) = \frac{1}{1 + \sum_{K=1}^{3} \exp(x'\beta_K)} =, \text{if } j = 4 \quad (3)$$

To determine the influence and strength of the relationship between independent and dependent variables in a multinomial logit model (MLM), it is essential to compute marginal effects [34]. These effects represent the slope of the predicted probability function at a specific value of an explanatory variable, showing how the likelihood of a particular outcome changes in response to variations in that predictor.

In this analysis, the MLM's dependent variable consisted of the four categories of educational mismatch reported in **Table 3**, assessed both for graduates' first jobs (mismatchfirstjob) and their current positions (mismatchcurrentjob). University degrees were included as the primary predictors. Although the survey collected information on 123 different degrees, these were grouped into 27 narrow fields of education for the regression models. In addition, gender and internship experience during studies were incorporated as control variables for the first job analysis, whereas gender, possession of a Master's degree, and age were used as controls for the current job. Descriptive statistics for these variables are presented in **Table 7**.

Binomial logit model for external labor mobility

A further objective of this study was to examine how educational mismatch relates to job mobility. According to job matching theory, employees whose skills do not match their job requirements may seek new positions to achieve a better fit [35]. Jovanovic's search-and-matching framework also suggests that job changes tend to be more frequent early in workers' careers. Here, the total number of job changes serves as a measure of general mobility, capturing both voluntary and involuntary transitions.

Using data from the EILU2014 survey, we tracked whether graduates initially mismatched to their first jobs were able to secure positions in which their education matched the job requirements through moves to other companies (external mobility). To investigate the determinants of achieving an education-job match, we estimated a binomial logit model (binary logistic regression), following the reduced-form specification described by McFadden [33].

$$\text{prob}\,[Y_i = 1] = \frac{e_i^{x'\beta}}{1 + e_i^{x'\beta}} \quad (4)$$

In this model, Y represents the dependent variable, which is dichotomous, while x is a row vector containing the explanatory variables, including a constant term, and β denotes the vector of parameters to be estimated. It is further assumed that the unobserved error term ε follows a logistic probability distribution.

For this study, the dependent variable gotmatching was defined as 1 if a graduate who was initially mismatched in their first job subsequently achieved a match after moving to a different employer. It was coded as 0 if the graduate remained mismatched after changing companies. The analysis was restricted to wage-earning graduates for both their first and current jobs. Due to the reduced sample size, explanatory variables included university degrees classified according to broad fields of knowledge and degree types. The primary variable of interest was the number of different employers a graduate had worked for during their early career. Gender was also incorporated as a control variable.

Results

Education-job mismatch among Spanish university graduates

This section presents the results from the multinomial logit model (MLM) estimation. Two analyses were performed: the first focused on graduates' initial post-university employment, while the second examined educational mismatch in their current positions at the time of the survey.

It is important to note that the signs of the estimated coefficients do not directly indicate the direction of the relationship between an independent variable and the probability of selecting a specific category [34]. As Wulff [36] points out, "coefficients […] can be potentially misleading" when interpreting the true effect of predictors in an MLM. To draw accurate conclusions, alternative interpretive tools such as predicted probabilities and marginal effects should be used. **Tables 4 and 5** report predicted probabilities for selected degree categories.

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 reference individual is a male graduate who did not complete an internship and holds a qualification different from the degrees listed. The probabilities across the four categories sum 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 reference individual is a man aged 30–34 without a Master's degree. The probabilities across all four categories add up to 1 (100 percent). The results remain largely unchanged when female graduates are considered.

Source: Author's calculations

The analysis of mismatch in the first job relies primarily on the marginal effects. These effects are especially valuable because they translate the model's results into clear, probability-based insights that are much easier to grasp than the underlying coefficients. To keep the discussion concise, **Figure 3** uses a four-quadrant layout to highlight only those degrees where the marginal effect is both positive and statistically significant at the 5% level.

A key pattern emerges: fields that require highly specialized skills show markedly lower rates of education–job mismatch. The three programs most likely to place graduates in well-matched positions right after completion are Medicine, Nursing, and Veterinary Medicine. Holding a Medical degree, for example, boosts the probability of a good match by 53.6 percentage points, while a Nursing degree raises it by 18.5 percentage point. These findings echo earlier studies on horizontal (field-of-study) mismatch (e.g., Robst [8]; Nordin *et al.* [9]).

Conversely, when the link between degree content and job requirements is looser, any field-specific skills are harder to apply, even if broader competencies remain useful. Graduates from History and Philosophy or from Political Science and Sociology stand out as facing the highest risk of ending up in jobs that do not correspond to their area of training **(Figure 3)**.

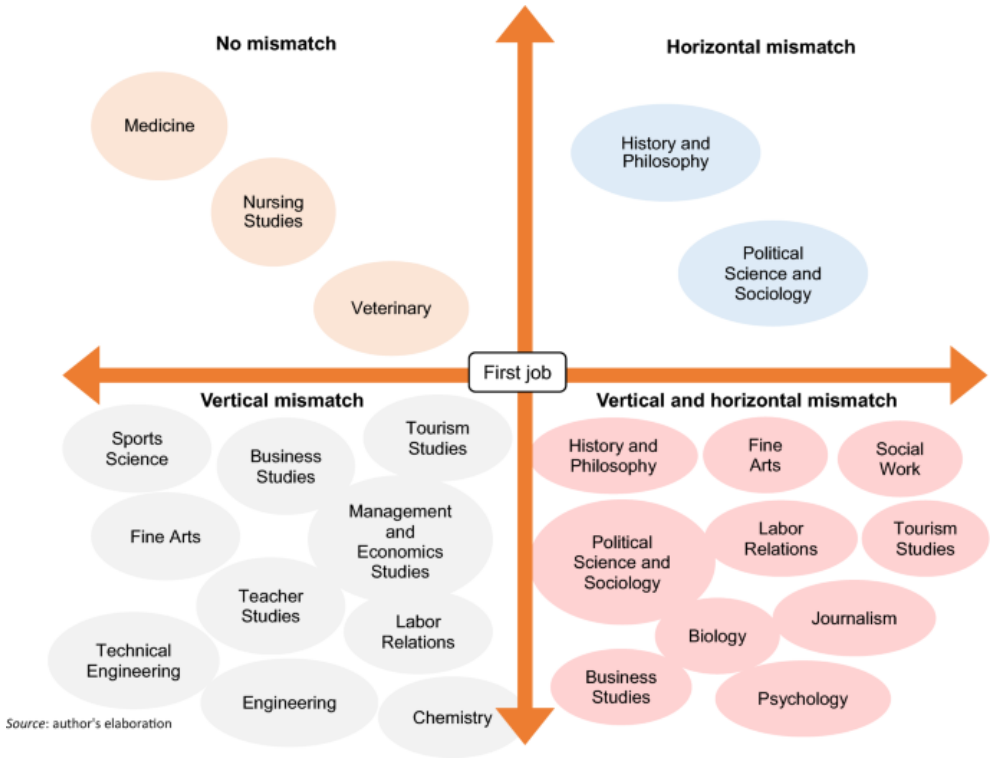


Figure 3. Mapping the educational (mis)match of university graduates in Spain in their first job

As shown in **Figure 3**, the majority of graduates hold positions that, in their own view, do not require a university degree. Graduates with degrees in fields such as Engineering or Management and Economics tend to experience vertical mismatch more frequently. Conversely, degrees like Biology, Fine Arts, Journalism, or Social Work are linked to higher probabilities

of both vertical and horizontal mismatch. For example, Fine Arts graduates have an average increase of 0.2007 in the likelihood of being doubly mismatched. A crucial difference is that vertical mismatch can still allow graduates to apply some of the specialized skills from their degree, as fields like engineering or economics provide job-specific expertise that is recognized in the labor market. In cases of full mismatch, which combines over-education with field-of-study mismatch, graduates often end up in roles unrelated to their academic training.

Table 4 presents the predicted probabilities of various types of educational (mis)match in the first job for selected degrees. On average, 67% of Spanish graduates are well-matched in their first job, with this probability rising to 83% for Nursing and 96% for Medicine. Horizontal mismatch occurs for 7% of graduates, but reaches 27% for History and Philosophy. Vertical mismatch affects 6% overall, increasing to 27% among Business graduates. The probability of both vertical and horizontal mismatch is 20%, but climbs to 45% for Fine Arts graduates.

Regarding the current job, the impact of explanatory variables on the probability of different types of job matching is interpreted through the marginal effects of the regressors. **Figure 4** maps the distribution of degrees according to educational (mis)match, displaying only those with positive and statistically significant effects at the 5% level. **Table 5** shows that for current jobs, the probabilities are as follows: well-matched (78%), horizontally mismatched (2%), vertically mismatched (6%), and both vertically and horizontally mismatched (14%). There is a notable increase in the likelihood of being well-matched, accompanied by a significant decrease in double mismatch.

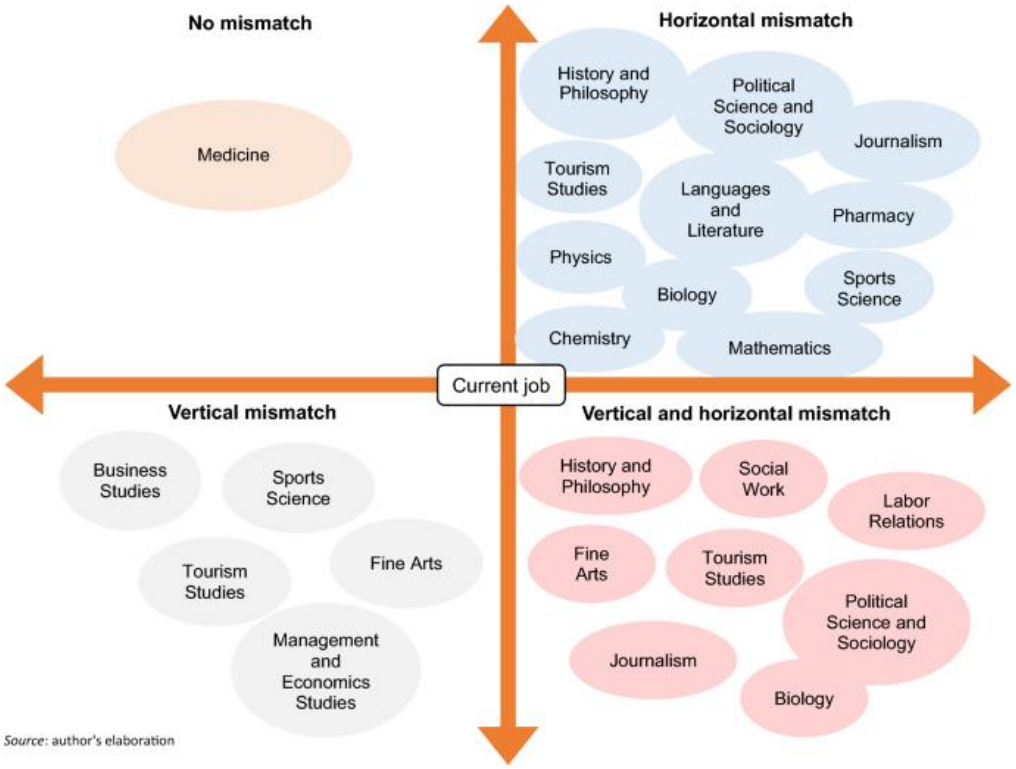


Figure 4. Educational (mis)match of university graduates in Spain in their current employment

Medical graduates remain the group most likely to occupy positions well-aligned with their qualifications, with a predicted probability of a perfect match reaching 99% **(Table 5)**. Interestingly, engineers and technical engineers, who often experienced vertical mismatch in their first jobs, appear to have corrected this by their current employment, suggesting that changing jobs helps align graduates with positions better suited to their skills. This outcome is likely linked to the type of human capital obtained during university studies: professions like medicine and engineering equip students with highly specialized, occupation-specific abilities that are less transferable to other fields. While these specialized skills tend to command higher wages at nearly every career stage [37], they can also make workers more susceptible to sector-specific shocks or economic downturns, potentially lowering their employment prospects [37].

Several degrees have shifted from primarily vertical mismatch to horizontal mismatch. While these graduates still face some inefficiencies in the allocation of human capital, they are now employed in roles that require a degree, even if the specific major is not essential for the job. According to Robst [8], such degrees generally foster broader, transferable skills rather than highly specialized competencies. Examples include History and Philosophy, Journalism, Languages and Literature, Political Science and Sociology, Mathematics, Pharmacy, Chemistry, and Physics **(Figure 4)**. Horizontal mismatch probabilities in the current job are 25% for History and Philosophy, 15% for Political Science and Sociology, and 14% for Journalism **(Table 5)**. Some programs considered specialized—like Mathematics—produce graduates with highly adaptable abilities, including analytical thinking, quantitative reasoning, and problem-solving, applicable to careers ranging from actuarial analysis and

data analytics to game design and investment analysis. The REFLEX survey confirms that Spanish employers highly value transferable skills, defined as "skills learned in one context that are useful in another" [38].

Nonetheless, some graduates remain mismatched even four years after completing their degrees. Vertical mismatch persists among Business Studies (28%) and Management and Economics (19%), while Social Work (45%) and Labor Relations (40%) continue to experience both vertical and horizontal mismatch. Interestingly, certain programs often assumed to produce generalist skills, such as Economics, can in practice cultivate specialized competencies.

Initial job allocation rarely results in a perfect fit [39], making adjustment mechanisms critical. Graduates can improve alignment through further education, such as completing a master's degree, which increases the likelihood of a proper education-job match. Age also influences outcomes: graduates under 30 years old see a 0.0502 increase in the probability of being well-matched, whereas horizontal mismatch becomes more common among those aged 35 or older. Consistent with prior findings, younger graduates exhibit the greatest ability to transition from mismatch to well-matched employment early in their careers [7, 40].

The influence of ability and unobserved individual characteristics remains an important consideration. "Controlling for unobserved heterogeneity might be important if the probability of educational mismatch is correlated with innate ability" [41]. Degrees such as Medicine and STEM fields attract students with higher average ability and lower variability, which explains why these graduates typically occupy high-skilled positions four years post-graduation. In contrast, fields with more heterogeneous student populations may show mismatch patterns partly due to individual differences in ability. For instance, Sports Science increases the likelihood of both vertical and horizontal mismatch, Political Science and Sociology increases horizontal and full mismatch, and Tourism Studies increases the probability of mismatch across all categories. Limitations in the database, such as the absence of average academic grades, prevent deeper analysis. Whether educational mismatch is ultimately beneficial or harmful in terms of wages or unemployment remains beyond the scope of this study.

Educational mismatch and external labor mobility

Job changes since graduation provide graduates with opportunities to achieve a better fit between education and employment. A binomial logit model of external mobility (Sect. 4.2) indicates that the probability of achieving a match rises with the number of employers a graduate has worked for. Gender does not appear significant in either regression model. Compared with hard sciences, graduates in health sciences and engineering/architecture have a higher probability of achieving a match after job turnover, while those in arts, humanities, and social/legal sciences have a lower likelihood (**Table 6**, Model I). Health sciences graduates see an almost 18-percentage-point increase in the probability of achieving a match, engineers and architects see a 4.3-point increase, whereas arts and humanities graduates experience a 15-point reduction, and social/legal sciences graduates a 5-point reduction.

Looking at university typologies, **Table 6** (Model II) demonstrates that engineering, architecture, technical engineering, and technical architecture (surveyors) degrees increase the likelihood of achieving a match after job turnover compared with traditional licenciatura degrees.

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

Average marginal effects				
	Model II		**Model I**	
	dy/dx	**Std. Err**	**dy/dx**	**Std. Err**
Number of different employers since graduation	0.0435**	0.0028	0.0426**	0.0028
Female (= 1)	0.0128	0.0112	0.0086	0.0111
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		

Standard errors were calculated using the delta method. The model employed robust variance-covariance estimation (VCE). The dependent variable, gotmatching, equals 1 for 30% of observations and 0 for 70%. The analysis is based on 7,471 wage-earners who have data for both their first and current jobs. Statistical significance is indicated at **p < 0.05.

Source: author's estimates

The findings presented in **Table 6** indicate that the degree to which a college major is specialized correlates with a lower likelihood of being mismatched after changing jobs. This raises a key question: how many job changes are typically required for a graduate to achieve a well-matched position? Using the estimates in **Table 6**, illustrate the probability of securing a suitable job depending on the number of employer changes. For instance, a single job change yields a 23.4% chance of obtaining a match. Achieving a high probability of alignment, such as 68.4%, would require approximately ten job changes according to model predictions. Such frequent mobility may be feasible in highly flexible labor markets like that of the United States, but it is far less realistic in Europe, particularly in Spain, where labor mobility is limited. Indeed, the sample used in **Table 6** shows an average job turnover of only 2.85. Consequently, educational mismatch may persist as a long-term feature of the Spanish labor market.

Discussion

The gap between the educational requirements of occupations and the qualifications held by workers is substantial and has been expanding over time [42]. Nations with a relative oversupply of highly educated workers tend to experience higher levels of over-education among graduates [43]. This mismatch has been extensively studied in the literature (e.g., Groot and Maassen van den Brink [5]; McGuinness [3]), with recent attention increasingly directed at horizontal mismatch, which occurs when a worker's field of study does not correspond to the content of their job (e.g., Robst [8]; Verhaest *et al.* [29]).

Educational mismatches are nearly unavoidable in the early career stages of university graduates. Newly graduated individuals rarely possess all the skills that employers seek, which does not necessarily reflect deficiencies in higher education. Many competencies are most effectively developed on the job, and higher education is expected to provide more than narrowly defined, immediately applicable skills [39]. Furthermore, graduates from different undergraduate programs accumulate varying human capital, which employers may value differently, producing initial mismatches for some degrees. The lack of work experience among recent graduates also limits their ability to secure positions corresponding to their educational level. As a result, many accept roles below their qualification level to gain practical skills and experience that can later facilitate entry into higher-level positions. The "theory of career mobility" predicts 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" [44]. Thus, vertical mismatch is often a temporary phenomenon, reducing the necessity for policy intervention.

In Spain, the EILU2014 graduate survey shows that roughly 13% of graduates held non-graduate positions immediately after leaving higher education institutions, with just over 9% remaining in mismatched roles four years later. These individuals were performing work related to their field of study, though over-educated. This raises the question of why subsidized university degrees are offered when some of these roles could arguably be filled with post-secondary vocational education. In contrast, countries like Switzerland, with a more limited supply of university degrees and a robust dual vocational education and training (VET) system, show lower levels of educational mismatch among graduates **(Figure 2)**. According to the European Commission, over-qualification in Spain coexists with a shortage of skilled workers, particularly those with a VET background [45]. Nevertheless, the Spanish secondary education system remains primarily academic and university-oriented. Attempts to reform VET exist, but it still attracts fewer students, often with lower academic performance, and is less socially recognized compared with the Baccalaureate.

Complete educational mismatch is particularly concerning. About 17% of Spanish graduates held non-graduate jobs unrelated to their studies four years after graduation. From the perspective of educational production, these cases represent external inefficiency, as the social utility of their studies is minimal: "external efficiency implies that the results of educational processes are desirable for society" [46]. These degrees may primarily reflect consumption of education or may be pursued by students with lower academic ability. In such instances, better career guidance could help students choose vocational paths rather than costly university programs. Additionally, graduates in low-wage occupations are less able to contribute back to society via taxes, creating a broader societal inefficiency and a "matching problem" in educational choice.

There is no simple solution for improving the alignment between graduates and employment in Spain. Early-career mismatches often stem from a gap between degree attainment and the skills or competencies needed for high-skilled jobs. The REFLEX survey shows that non-cognitive skills are more demanded in the labor market than cognitive ones [38]. Our survey lacks data on competencies, preventing direct analysis of this aspect. Mismatches may also reflect differences in graduate search behavior. Higher-ability graduates tend to be more ambitious and efficient in job search, making educational alignment more likely. However, our dataset does not include measures of individual ability, so we are unable to test this hypothesis.

The effectiveness of the transition from university to the labor market, both in terms of speed and quality, is shaped by several structural factors, including the organization of the labor market, the economy's productive model, and the prevailing stage of the business cycle. In the Spanish context, the nature of firms plays a critical role. In small and medium-sized enterprises (SMEs) and family-run businesses, achieving an education-job match is often difficult, even four years after graduation,

despite graduates acquiring work experience or improving their job search strategies. In contrast, medium and large companies tend to offer positions that are highly qualified and provide opportunities for career advancement through structured promotion paths. Therefore, unless the average firm size in Spain grows in the coming decades, educational mismatch is likely to persist across many university programs.

For professions such as physicians and nurses, the high rate of alignment between education and occupation is partly due to the specialized, occupation-specific human capital they acquire, which has limited transferability across sectors. Additionally, these graduates generally have a single employer—the public sector—which operates as a monopsonist in their labor market. This suggests that education-job alignment is more probable in monopsonistic markets, particularly when specific skills are required and professional entry is regulated.

Economic conditions also influence the transition. In 2014, the unemployment rate for tertiary-educated graduates in Spain was 24%, the year in which the surveyed graduates were interviewed. This context likely forced many graduates to accept positions that did not match their qualifications or were unrelated to their field of study, implying that part of the observed mismatch is involuntary. Future surveys could help assess whether more favorable labor market conditions improve education-employment alignment.

The degree-level mismatch map presented in this study has important implications for educational policy, particularly given the substantial public subsidies for higher education in Spain. Several questions emerge for future research: Should the university curriculum be restructured to focus only on programs that ensure a strong education-job fit? Is there justification for policies that promote higher education access despite potential mismatches? Should vocational education be strengthened and career guidance provided at the end of compulsory schooling? Is horizontal mismatch acceptable, considering that graduates may occupy high-skilled positions even without fully applying specialized knowledge from their degrees?

The answers depend on society's valuation of higher education and its willingness to fund it. Research indicates that higher education provides non-monetary benefits to graduates, including improved self-reported health, and external benefits for society as a whole [47]. However, key questions remain regarding whether these non-monetary gains compensate for lower monetary returns, particularly when graduates occupy lower-skilled and lower-paid jobs, potentially reducing tax revenue and GDP growth through underutilized human capital [48].

Conclusion

This study investigates the issue of education-job (mis)match in the labor market among university graduates, a topic of considerable relevance given the substantial investments made by both individuals and society in producing highly skilled workers. A key contribution of this paper is its focus on horizontal mismatch—a less explored phenomenon in the literature—where graduates hold jobs that correspond to their qualification level but not to their field of study. By providing a taxonomy of educational mismatch and examining its prevalence among Spanish higher education graduates through self-assessments, the paper extends current research. Additionally, the mapping of degrees according to the education-job (mis)match has important implications for educational policy, particularly given the high level of public funding for higher education in Spain. Methodologically, the paper also advances previous studies by incorporating several improvements.

The analysis is based on self-reported data from 30,379 Spanish university graduates from the class of 2010, surveyed four years after completing their degrees. Graduates provided information on whether their initial and current positions required a university degree and which field of study was most appropriate for these positions. By cross-tabulating these responses, four types of educational mismatch were identified: appropriate match, horizontal mismatch, vertical mismatch, and combined vertical-horizontal mismatch. Using multinomial logistic regression, university degrees were classified into these categories. Some findings were consistent with expectations: degrees requiring specific human capital, such as Medicine, Nursing, Veterinary studies, and Engineering/Architecture, tend to align well with occupational requirements. Conversely, degrees conferring more general human capital, including hard sciences (Mathematics, Physics, Chemistry) and liberal arts (History, Literature, Sociology), are more prone to horizontal mismatch. In these cases, the mismatch does not necessarily imply a waste of human resources, as graduates still occupy positions appropriate for their qualification, and their degrees allow for greater career flexibility.

More concerning are degrees where vertical mismatch occurs. For example, Business, Management, and Economics degrees increase the likelihood of over-qualification in both initial and current jobs, highlighting an oversupply of graduates in these fields at Spanish universities. In such cases, it may be more efficient to promote vocational education and training, which is less costly to produce and more likely to result in well-matched employment. The situation is particularly problematic for graduates in non-graduate positions unrelated to their field of study, such as Social Work, prompting a reconsideration of whether such degrees should be offered at the university level.

The study also shows that job mobility can improve education-job matching. Binary logistic regression analysis reveals that around 30% of graduates who were mismatched in their first job achieve a better match in subsequent employment by changing firms, although several job transitions may be necessary for a good match.

Finally, the findings raise broader questions about the value of a Bachelor's degree when over-qualification is prevalent and non-college-educated workers earn similar wages in the same occupations. Nevertheless, formal education offers benefits beyond monetary returns, including improved health, life habits, and open-mindedness, which should also be considered when evaluating the outcomes of higher education.

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