Analysis of the factors determining educational mismatches: evidence from the Catalonian employment insertion surveys

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Abstract

Purpose – The existence of mismatches between training and jobs is relatively common and is accentuated in times of crisis where unemployment is growing. The negative effects that this phenomenon can generate on both workers and the economy makes its study relevant. The objective of this research is to analyse whether graduates of the Catalan university system have jobs according to their educational level.

Design/methodology/approach – This paper sees how graduates' own and acquired characteristics influence the probability of a mismatch from the analysis of the microdata of different waves of the employment insertion survey conducted by the Agència per a la Qualitat del Sistema Universitari de Catalunya (AQU).

Findings – The main conclusions focus on confirming that more humanities-oriented degrees tend to have a higher level of mismatch while technology or medicine approach a perfect fit. Therefore, bringing the education and business systems together is important to reduce this gap. Meanwhile, in terms of activities, services such as hospitality and retail have historically been sectors with a poor fit, and what has happened with Catalan graduates has not been an exception.

Originality/value – The main contribution of the research has been to highlight where there is a greater mismatch from the point of view of training, the type of work and its evolution over time, detecting the need to adjust labour supply and demand.

Keywords Training, Working life, Human capital, Educational level, Job market, Educational mismatch, Vertical mismatch, Horizontal mismatch, Graduates

Paper type Research paper

1. Introduction and objectives

Training has become a way of cataloguing workers, acting as an identifier of capacities to achieve high positions (Marqués Perales and Gil-Hernández, 2015). Employers use educational level to discriminate between hires, in a way that encourages workers to train. Arribas (2007) states that education becomes the primary signal for employers when selecting candidates for employment. Petrizzi *et al.* (2015) state that the content of workers' education is less important than the signal it emits about their innate ability.

Thus, training becomes a key factor in the current market, not only because it is vital to adapt to the current job structure, but because the level of training becomes the basic criterion for employers when hiring. But, in turn, an excess of workers with a high qualification level or a deficit of the work structure that is not able to absorb labour can cause mismatches, both vertical (graduations that do not conform to the educational level) and horizontal (workers with an adequate level but different specialty than that required for the tasks to be performed). This can have negative effects for both workers and the economy.

When the active population grows more than jobs, employers tend to hire graduates even if they do not need such highly trained workers. Mayhew and Holmes (2015), for example, explains that as the number of highly skilled workers in the UK increases, jobs that were previously filled by non-graduates are now awarded to graduates, even if their training is not explicitly necessary. In the UK, professional occupations have increased their percentage of graduate versus non-graduate employees from 53% to 78% during the period 1991–2001. Arellano et al. (2019) compare labour in Spain, where growing numbers of workers have either low or high qualifications, and Germany, where mid-level qualifications are increasing. In Spain, 40% of the workforce is highly skilled (college studies or higher), compared to only 29% in Germany. The authors also say that a worker with more training can avoid unemployment by accepting a position with lower training requirements than what they have to offer. Thus, in Spain, with an overall unemployment rate of 15.4% in 2018, the less-qualified workforce has an unemployment rate of 22.3% versus a rate of 15.5% for those with a middle level and 9% for those with a university degree or higher.

The objective of this paper is to analyse the incidence and evolution of educational mismatch (distinguishing between different types of it) in the labour market for graduates from Catalan universities. I decided to focus on the analysis of this collective given the availability of very detailed statistical information offered by the Encuesta de Inserción Laboral (Employment Insertion Survey) of the Agencia de Calidad Universitaria de Catalunya (AQU). The use of statistical and econometric techniques suitable for the analysis of the microdata from this survey will allow different hypotheses to be considered regarding the influence of individual characteristics and the workplace on educational mismatch.

This paper will contrast a total of four working hypotheses. The first refers to the personal characteristics of graduates, assessing whether age or gender influence the probability of mismatch. Different types of degrees affect the second hypothesis, and I anticipate that the mismatch will be greater in degrees related to humanities and less technological subjects. The third and fourth hypotheses assess the activity of the company in which the graduate works (hypothesis 3) and their occupation (hypothesis 4), and through reading the previous research, the less technological and more traditional branches of activity are the ones that will suffer the most mismatch, placing special emphasis on consumer services. The hierarchy or specificity of the occupations inversely affect the probability of mismatch.

The rest of the paper is structured as follows: the next section presents the current situation and literature review. In Section 3 the definitions and different methodologies related with mismatch research are presented. The hypotheses and the data and variables used in the analysis of educational mismatch are presented in Section 4. Then, the results regarding the types of mismatches existing in the Catalan labour market from the analysis of employment insertion surveys of graduates of Catalan University are described. Finally, the paper concludes with some final thoughts and comments.

2. Literature review

The issue of educational mismatch in many European countries (including Spain) has sparked our interest. Authors such as Kalfa and Piracha (2018) or Mayhew and Holmes (2015), among others, have highlighted the fact that training is important but is useless if there is no restructuring of the production system, because that is when mismatches are generated in the labour market due to the excess of supply with a high educational level or the qualified demand deficit. Petrizzi et al. (2015) note that changes in the labour market appear to be too slow to absorb the skilled labour offering.

Educational mismatch/skills mismatch, defined by Petrizzi et al. (2015) as how well (or not) the curricular profiles of workers fit the requirements of the jobs they occupy, is an

endemic problem of the Spanish labour system, which does not appear to have been corrected at present. In this paper I want to study the evolution and typology of both horizontal and vertical mismatch among graduates of the Catalan educational system. We talk about vertical mismatch when the level of training is higher (or lower) than the required in the job, and horizontal when the level is suitable but the skills acquired during training are not necessary to do the work.

2.1 Why is the market unbalanced?

As previously stated, educational mismatch is understood as the difference between the worker's level of training and what is needed to adequately perform the tasks associated with their job. To measure the mismatch, one of the most common approaches in the literature consists of comparing the level of education successfully completed by an individual with the level required for their job (Rumberger, 1981). From this perspective, a worker is over-educated (under-educated) if their level of education is higher (lower) than what their job requires (Nieto and Ramos, 2013; Arribas, 2007; Li *et al.*, 2018).

Adalet McGowan and Andrews (2015) analyse data from the Survey of Adult Skills in the OECD Programme for International Assessment of Adult Competencies (PIAAC) and find that approximately one-third of workers in OECD countries are over- or underqualified for their job, while one-sixth report a mismatch between their skills and those required for their job (OECD, 2013). Morgado (2016) makes it clear that the existence of overeducation in the labour market can call into question the benefits of public financing of higher education. Cabus and Somers (2018) and Mateos-Romero and Salinas-Jiménez (2018) on the 2014 OECD report comment that the expansion of higher education coincided with a significant increase in public investment in education and raises several questions about its implications for the labour market, and affirm that one of the potential consequences of this expansion is related to a mismatch between the supply of skills and the demand for skills in the labour market.

2.2 Where are mismatches detected?

The existing bibliography shows that mismatch is present in all labour markets. This subsection provides a brief review of the literature to identify the main conclusions and statistics regarding the levels of mismatch found by different authors.

Montt (2017) for the year 2012 and considering all OECD countries finds that all countries experience some level of mismatch in the field of study, with the highest levels observed in Korea, the United Kingdom and Italy at around 50% of workers, and the lowest in Austria, Germany and Finland, at less than 30%.

The study of vertical and horizontal mismatch in Europe for 2008 by Morgado *et al.* (2016) comments that there is great diversity in the incidence of vertical mismatches between countries. Switzerland and the United Kingdom tend to have the highest level among Northern and Central European countries, Italy the highest among Southern European countries, and Estonia and Romania the highest among Eastern European countries. Denmark, Portugal and the Slovak Republic tend to have the lowest level of vertical mismatch in their respective groups.

For South America, Espino (2011) examines the imbalances between labour supply and demand for qualifications in the Uruguayan labour market in the period 2000–2009. Although highlighting differences in results depending on the method applied, significant conclusions are reached regarding the influence of variables such as gender, age, occupation, or occupational sector on the probability of mismatch. Herrera-Idárraga *et al.* (2015) investigates the performance of education in the Colombian labour market, relating concepts such as job mismatch, salary and job typology. Finally, Petrizzi *et al.* (2015) studies educational mismatch in certain areas of Argentina, especially for the hotel sector.

Marqués Perales and Gil-Hernández (2015) insists on the difference between the evolution of qualified work and its needs. While in 1992 in the European Union (EU-21) 18% of the workforce aged 16 or over had a higher education degree, in 2009 this same figure had reached 29%.

In Spain it has almost doubled, increasing from 17.6% to 33.8% (ILO, 2001). In fact, overeducation has become a widespread phenomenon since the 1990s in Spain, a country with one of the highest rates of overeducation among OECD members (Blázquez and Alba-Ramírez, 2003; Barone and Ortiz, 2011; OECD, 2007; García, 2011; Obiols-Homs and Sánchez-Marcos, 2018; Acosta-Ballesteros *et al.*, 2018). In Spain, the number of graduates increases proportionally more than the population (in the period 1998–2006 the increase was 4.5% while the population had increased by 1%) but is not enough. The problem, as pointed out by Felgueroso *et al.* (2023), is that on the one hand, the situation has not been reversed in recent years and on the other hand, and this is the most worrying aspect, this overeducation exists despite the fact that the educational levels of its workers are below the EU average. This mismatch makes Spain one of the countries with the highest levels of overeducation. For example, 25% of all workers in 2003–2004 were overeducated, well above the OECD average (Nieto and Ramos, 2013), and recently a 35% of employed people with tertiary educational degrees work in occupational groups associated, *a priori*, with lower level qualifications, Felgueroso *et al.* (2023).

In a study of Spanish graduates by Salas-Velasco (2021), differences in mismatch were detected depending on the degree pursued. A good fit was observed in degrees such as Medicine or Veterinary Medicine, whereas degrees like Biology, Fine Arts, Journalism, or Social Work tended to exhibit vertical and horizontal mismatches.

2.3 Consequences of mismatch

The ideal situation is for people's jobs to be aligned with their training, since mismatches, both above and below, generate problems. Adalet McGowan and Andrews (2015) state that a good mix between the skills required by companies and those acquired in education and at work is important to promote strong and inclusive growth. Undereducated workers earn less than those who are in equilibrium, but more than what would correspond to them according to their training, and therefore have no incentive to change (Groot and Maassen, 2000; Nieto and Ramos, 2013). This creates work inefficiency. Acosta-Ballesteros *et al.* (2018) finds this influences the longevity of the mismatch, stating that workers who enter a company in a job not associated with their training usually do not change their situation.

Overqualification can have negative effects on the entire economy. Workers whose training would allow them to perform tasks superior to those they are doing can degenerate into frustration and a clear lack of motivation, as well as inefficiency (especially in horizontal mismatches, but also vertical). According to Nieto and Ramos (2016), this over-education can provide them with a higher salary than their colleagues, but it is also always lower than what they would earn if they worked in a position according to their educational level. Schweri *et al.* (2020) also emphasizes lower wages in the event of horizontal mismatches, this negative effect being more intensive the more specific the training received. In contrast, Humburg *et al.* (2017) affirms that the more specific the education is, the better it will fit the job. Although some studies find a negative relationship between overeducation and job satisfaction (Tsang, 1987; Hersch, 1991; Espino, 2011; Iriondo and Velázquez, 2015; Petrizzi *et al.*, 2015), others could not demonstrate that overeducated workers report lower job satisfaction compared to their colleagues who occupy jobs consistent with their training (Büchel, 2002). The existence of this frustration and/or lack of motivation can degenerate into depression and a consequent loss of productivity that, in aggregate, is transferred to the entire economic system. Along these lines, Adalet McGowan and Andrews (2015) highlights that a higher qualification and

skill mismatch is associated with lower labour productivity, although the exact channel varies according to the different types of mismatches.

2.4 Where the educational mismatch affects the most?
This section examines the markers and classifications used in the literature to categorize educational mismatch.

Montt (2017) studies the influence of horizontal mismatch on wages and concludes that it is especially affected if there is also a vertical mismatch. Data for this study come from the PIAAC. PIAAC is an international survey (24 countries participated in 2012) that measures adult numeracy, literacy and problem-solving in a technology-rich environment. In addition to the assessment, PIAAC asks respondents about their job characteristics, their education and training, their use of different skills at work and home, and their sociodemographic characteristics.

Morgado *et al.* (2016) explains that there are some sectors with more overeducation than undereducation, such as agriculture, surprisingly information and communication, and the financial and insurance sector, among others. Espino's (2011) extensive study on single-digit occupational mismatch warns that the workers with the greatest skill deficit are mid-level technicians and professionals, followed by agricultural and fishing workers, and mechanical operators. The highest proportion of overqualified workers occurs among scientific and intellectual professionals and among office employees. Regarding the branches of activity, those most affected by underqualification are construction, followed by the agricultural sector and the manufacturing industry, and the branch of activity with the lowest level of underqualification is financial services.

Continuing with Morgado *et al.* (2016), horizontal mismatch tends to be somewhat correlated with vertical mismatch in sectors of economic activity with quite similar levels. When analysed by professions or occupations, the vertical mismatch is greater for agricultural, forestry and fishing workers, elementary occupations, services and sales, technicians and office employees. In contrast, the mismatch is smaller among managers and professionals. The horizontal mismatch tends to be greater for elementary occupations, services and sales and lower for crafts.

Both studies, Morgado *et al.* (2016) and Espino (2011), with similar variables and similar conclusions, serve as a reference to study sectors of activity and occupations, although as we will see the results at the European or American level do not always coincide with those at the Catalan level.

Nieto and Ramos (2013) uses microdata from the Spanish sample of the 2007 Adult Education Survey to see the effect of non-formal training among the overeducated and their salaries. The variables used from the database are related to personal characteristics and employment status. For the personal characteristics variables, they use information related to monthly income, gender, nationality, years of education, occupation, economic activity, potential experience, seniority, the number of people in the home, non-formal education, type of contract, type of working day and number of jobs. For employment status variables, they use data related to company size, regional population density and region of residence.

Subsequently, Nieto and Ramos (2016) with data from the PIAAC and to compare the salaries of the overeducated versus those correctly placed, considers two sets of variables. The first includes variables related to workers' employability. The second comprises other personal, work-related and regional variables that are included in the model as controls. These variables are gender, age, nationality, type of contract (full-time/part-time), term of contract (temporary/permanent), sector (public/private), economic activity (industry, agriculture, construction, services, non-sales services) and 17 regions.

3. Definitions and study methodologies

In line with Nieto and Ramos (2016), Spain is an interesting country for studying overeducation since it is a developed country that shows one of the highest percentages of overeducated workers (OCDE, 2013; Morgado *et al.*, 2016), a characteristic that was also observed before the current economic crisis (OCDE, 2007; Verhaest and van der Velden, 2013; CEDEFOP, 2018).

Nieto and Ramos (2013), Nieto *et al.* (2015), Mayhew and Holmes (2015), Petrizzi *et al.* (2015) and Morgado *et al.* (2016) define the three ways of measuring educational mismatch: objective, subjective and statistical, none of them being better than the others (Hartog, 2000). The objective method or job analysis is defined by the vision of the experts who determine the degree of training necessary to develop the different competencies and work skills.

The subjective, or self-evaluation of the worker, takes into account the perception of the workers as to whether or not their studies fit the work they are doing, either directly (asking the worker) or indirectly, which compares the level of education of workers with the level of education that they identify as optimal to perform that type of work. While it is based on worker perception, I assume that their answer is correct but problems can arise; as Salas-Velasco (2021) explains, self-assessment methods may be biased because they rely on the objectivity of respondents, but the objective approach is also controversial and the statistical mode-based method suffers from the misclassification problem.

As Nieto and Ramos (2013) explains, there is a third method, the statistical method, which is based on the mean or mode. They explain that according to Verdugo and Verdugo (1989) a person is considered overeducated (undereducated) if he or she has a level of education that is higher (lower) by more than one standard deviation than the average level of education of workers in that occupation.

The use of one method or another usually depends on the nature of the data available (Nieto and Ramos, 2013). On the database we have the direct question to the graduates if their job is adequate to their degree, so while assuming that the subjective method can be more biased than the statistical and the objective methods, I also emphasize that it is an opportunity because this information is not always available, and as mentioned, the conclusions drawn from it are equally valid in either case.

4. Methodology and data

The objective of our research is to analyse whether graduates of the Catalan university system have jobs according to their educational level. Also, how the graduates' own and acquired characteristics influence the probability of mismatch. The paper divides this section into two parts. The article continues as follows: a first part to define and to justify the working hypotheses; a second part which covers the methodology; and a final part which addresses the origin and specificity of the data.

4.1 Working hypothesis

Considering the objective of the research, the hypotheses are defined in the following order: a first group referring to individual characteristics and those related to the studies completed, then those related to the job position currently held.

For individual characteristics there are two variables: sex and age. Women need a higher educational level to reach the same professional levels as men. After conducting an exhaustive study where there is some disparity regarding whether the mismatch is greater in men or women, Petrizzi *et al.* (2015) concludes in his study of the Argentine hotel sector that women are more overeducated. Similarly, Espino (2011) specify that in terms of gender, the appropriately educated are at very similar levels, and there is not a definitive conclusion, but

in the mismatches women are more likely to be overeducated, while men are more likely to be undereducated. It is evidence that there is still a large difference between men and women in terms of the occupation of management positions (Vega *et al.*, 2016 or Cacho, 2017) when this difference does not exist, at least to the same magnitude, in education. As for age, since they are graduates, the range is very narrow, but it seems that younger people have more problems finding the job their qualifications would merit.

Based on these statements, the gender level there are no clear conclusions regarding fit, but there are regarding the type of mismatch (under-educated or over-educated). Similarly, if I evaluate age it seems that as workers get older, overeducation mismatches decrease and undereducation increases. This paper deduces the following hypotheses, divided into two.

H1.1. Women are more likely to have an educational mismatch than men, especially a vertical mismatch.

H1.2. Years in the labour market improve the fit of the education level and reduce the incidence of overeducation.

The second hypothesis relates to the probability of mismatch according to the training received. The literature usually defines the training variable at a quantitative level, that is, according to the training level, but in that case, I will focus on the field of study, given that we are dealing with university graduates. Therefore, based on the conclusions of Martínez Morales *et al.* (2017) among others, this paper proposes the following hypothesis.

H2. There is a greater probability of mismatch for graduates in the humanities and social sciences.

The environment, defined as the branch of activity in which the company operates and the characteristics of the work, such as the worker's occupation or the type of contract, affect the probability of mismatches differently. Here, the findings of Espino (2011) and Morgado *et al.* (2016) help us reach certain conclusions regarding both activity and occupation. As already mentioned, both agree on the mismatch in mid-level technicians or similar occupations and in activities such as retail commerce and hospitality, with a high level of overeducation. Iriondo and Velázquez (2015) concludes that graduate jobs (grouping as is usual in the literature the occupations of "Managers", "Professionals" and "Technicians and support professionals") represent the majority of the "matched" (90.0% of the total), unlike the undereducated who are mainly in non-graduate jobs (which include "Administrative" occupations for those with low qualifications).

From the cited literature this paper therefore define the following two hypotheses, the first referring to the sector of activity and the second to the occupation.

H3. Mismatches are more likely in more traditional branches of activity, with less use of technology.

H4. Regarding occupation, hierarchical level, specialization and the use of technology inversely influence the probability of educational mismatch.

4.2 Methodology
The econometric model I use is a logistic regression model, which allows us to analyse the probability of mismatch based on a series of characteristics such as personal attributes, education level, year, branch of activity and job position. This model enables us to estimate the probability of occurrence of a dichotomous qualitative variable (mismatch) using qualitative independent variables.

The utility of discrete choice models lies in their ability to model qualitative variables through techniques specific to discrete variables, predicting choices between different alternatives. In this case, I aim to predict labour mismatch using binary variables.

For the independent variables, this paper uses one of the indicators as a reference (base) to compare each of the other indicators against it. For degrees, the base category is Philosophy and History (with all other degrees compared against this base). For branch of activity, the base is Agriculture, Livestock, Forestry, Hunting, or Raw Materials and Energy Production. For occupation, the base is Elementary Occupations. The results will range from 0 to values greater than 1, where 1 indicates that the indicator has the same probability as the base, and values greater than 1 indicate a higher probability of mismatch compared to the base. A value closer to 0 indicates a higher degree of job-education match.

Finally, Table 4 presents the same model as the previous table, but with activities grouped according to the classification by Corominas *et al.* (2010) for AQU. The occupation model is also a logistic regression model, but with data from 2014, unlike the others which use data from 2005.

4.3 Data
Reviewing the existing literature, and raising the hypotheses, I will examine how educational imbalance has evolved in Catalonia over the last twenty years. I start from the triennial survey carried out by the AQU on graduates of the Catalan university system, asking about their employment situation four years after graduating, the "*Informe tècnic d'inserció laboral*" (*Technical Report on Labour Insertion)*. The study is based on a profile of specific people. Since the question refers to the job they are doing, our sample is made up of graduates who are currently working.

This is a study of the entire Catalan university system, surveying individuals who obtained their degree 4 or 5 years before the survey. The eight editions of the labour insertion study have generated more than 120,000 records, making Catalonia one of the European territories with one of the most extensive, complete and representative databases for this type of analysis.

In this 2023 edition, more than 52% of the population contacted answered the survey.

This paper uses the subjective method since the database allows it. This method is based on the perception of the workers themselves regarding the suitability of their training for the job. Among those who state that their qualifications do not fit their work, I differentiate between jobs requiring a university degree, although not the one they have completed, and jobs where a degree was not needed at all, which allows us to study both the horizontal and the vertical mismatch.

Table 1 shows the number of responses obtained for each year and the percentage they represent with respect to the annual total for each of the categories considered in relation to the situation of educational mismatch. A quick look at the statistics shows that in the period after the 2008 crisis the number of good fits, that is, the percentage of graduates who consider that their work is consistent with their training, fell from 67.1% in 2008, with 8,126 workers claiming a good fit, to about 58% in 2014 and 2017. In 2020 this figure returned to pre-crisis levels (64.19% claiming a good fit), and then decreased again in 2023.

In summary, the fit improves until 2008 and clearly deteriorates from that year on, with those claiming a good fit increasing or remaining the same in absolute numbers (around 9,000 people) but proportionally decreasing by almost 10% points. In times of recovery, the percentage of people in employment grows, but not in a balanced manner, with the mismatch going from 33% in 2008 to 41% in 2017 (both vertically and horizontally).

Finally, the last two editions show a very good level of fit in 2020 (similar to 2008), and in 2023 the effect of the COVID-19 pandemic is seen and an unstable economy with mismatches again at 40%. It will be interesting to study what happens next, but Pizzinelli and Shibata (2023) concludes for the UK and US that the total loss in employment caused by the rise in mismatch was smaller during the COVID-19 crisis than in the aftermath of the Global Financial Crisis.

| | | | Studies required to access the last job | | | |
			The specific degree	Just be a college graduate	No college degree required	Total
Year of publication of the labour insertion study	2001	Count	5,677	1,621	2,093	9,391
		%	60.50	17.30	22.30	100.00
	2005	Count	7,124	1,736	2,274	11,134
		%	64.00	15.60	20.40	100.00
	2008	Count	8,126	1,801	2,184	12,111
		%	67.10	14.90	18.00	100.00
	2011	Count	9,406	2,872	2,777	15,055
		%	62.50	19.10	18.40	100.00
	2014	Count	9,146	2,671	3,816	15,633
		%	58.50	17.10	24.40	100.00
	2017	Count	9,064	2,643	3,716	15,423
		%	58.80	17.10	24.10	100.00
	2020	Count	8,784	2,310	2,590	13,684
		%	64.19	16.88	18.93	100.00
	2023	Count	12,478	4,374	3,749	20,601
		%	60.57	21.23	18.20	100.00
Total		Count	69,625	20,266	23,220	113,111
		%	61.55	17.92	20.53	100.00

Source(s): Own elaboration based on the technical report of the 2023 labour insertion study

Table 1.
Qualifications required for the last job by year of publication of the job placement study

When I create the dichotomous variable between those who have a good fit and those who do not, the results are as shown below in Table 2.

As mentioned above, the horizontal mismatch is identified from the responses of those graduates who state that any university degree is enough to perform their job (mismatched) in relation to those to whose specific degree was required (appropriately matched).

Finally, I can measure the incidence of vertical mismatch from the responses of those graduates who state that their job did not require a university degree (overeducated) in relation to those who state it did (appropriately educated).

Thus, the data allow us to differentiate three groups of graduates in relation to the mismatches considered (a good fit, vertical mismatch and horizontal mismatch).

Having dichotomized the endogenous variable, below the paper describes the variables that will be incorporated as exogenous variables in a binary logistic regression model that will allow us to assess their influence on the probability of educational mismatch.

To resolve the hypothesis H1 regarding personal characteristics, I use the variables Sex and Age. The variable Code AQU expanded sub-scope allows us to respond to the H2 which states that more humanities-oriented subjects and social sciences have a greater probability of mismatch. The survey also tells us the branch of economic activity of the survey which allows us to study the H3 hypothesis. For this I consider it interesting to see the results from a proposal for the reorganization of business activities proposed by Corominas *et al.* (2010) and which we will see in Table 4.

To verify the H4, referring to the type of work, I only have data from 2014, so I will have to study them separately, in a new model, with data only from these two editions.

5. Empirical evidence and results
In the first model this paper studies the following variables specific to the worker and the company in which they work: Sex, Age at the time of the survey, AQU Code extended sub-scope, Branch of economic activity of the company and Year of edition of the job insertion study. And in the second: Typology of Work for the years 2014–2023.

		Frequency	Percentage	Valid percentage	Accumulated percentage
Adjusted versus educationally unadjusted					
Valid	Only be a university graduate or No university degree was required 1	43,486	37.6	38.4	38.4
	The specific degree 0	69,625	60.3	61.6	100
	Total	113,111	98	100	
Missing	System	2,281	2		
Total		115,392	100		
Horizontal mismatch					
Valid	Just have a university degree 1	20,266	17.6	22.5	22.5
	The specific qualification 0	69,625	60.3	22.5	100
	Total	89,891	77.9	100	
Missing	System	25,501	22.1		
Total		115,392	100		
Vertical mismatch					
Valid	No university degree was required 1	23,220	20.1	25	25
	The specific qualification 0	69,625	60.3	75	100
	Total	92,845	80.5	100	
Missing	System	22,547	19.5		
Total		115,392	100		

Source(s): Prepared by the author based on the 2023 labour insertion study technical report

Table 2.
Studies needed to do the job

From the results obtained on Table 3 we can see at a general level a high degree of statistical significance at the usual levels of most of the variables, referring to both global mismatches and vertical or horizontal mismatches.

This paper divides the first hypothesis, referring to personal characteristics, into two: the first referring to sex and in which I considered women to be more likely to suffer from job mismatch, and age, with respect to which I said that the passing of the years in the labour market increases educational fit and reduces the incidence of overeducation. Looking at the results, however, I see that men have a higher level of mismatch than women, especially in terms of vertical mismatch, while the level of horizontal mismatch between men and women is almost equivalent.

The age variable does not have a special incidence in terms of its influence on the probability of mismatch, which is logical since the study values are very close, with over 70% of the sample being people aged 25 to 30.

Thus, in our case, they do not allow us to accept or reject the H1, although it is true that we see some influence of gender on the probability of mismatch, but the opposite to what was expected.

The H2 was based on the training of graduates, stating that those with degrees in the humanities and social sciences have a greater probability of mismatch. In this case, the results confirm the existing literature and are effectively those degrees that are more humanistic and less scientific.

	Variables in the MISMATCH equation		Variables in the vertical MISMATCH equation		Variables in the horizontal MISMATCH equation		
	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	BASE
Sex							Women
Man	1.152	0.000	1.267	0.000	1.051	0.039	
Age at the time of the survey							
Age	1.051	0.000	1.062	0.000	1.038	0.000	
Extended Subscope AQU Code							Philosophy and History
Languages and literature	0.395	0.000	0.352	0.000	0.475	0.000	
Arts and design	0.522	0.000	0.569	0.000	0.355	0.000	
Mixed humanities degrees	0.353	0.000	0.543	0.032	0.173	0.000	
Economics, business and tourism	0.258	0.000	0.193	0.000	0.343	0.000	
Law, labour and politics	0.380	0.000	0.325	0.000	0.453	0.000	
Communication and documentation studies	0.325	0.000	0.279	0.000	0.371	0.000	
Education	0.201	0.000	0.225	0.000	0.184	0.000	
Social intervention	0.200	0.000	0.201	0.000	0.179	0.000	
Biological and earth sciences	0.348	0.000	0.309	0.000	0.387	0.000	
Experimental sciences and mathematics	0.214	0.000	0.145	0.000	0.305	0.000	
Nursing and health studies	0.137	0.000	0.112	0.000	0.159	0.000	
Psychology and therapy	0.307	0.000	0.270	0.000	0.346	0.000	
Medicine and Biomedical Sciences	0.045	0.000	0.023	0.000	0.074	0.000	
Architecture, construction and civil engineering	0.149	0.000	0.106	0.000	0.222	0.000	
industrial technologies	0.177	0.000	0.086	0.000	0.328	0.000	
ICT	0.217	0.000	0.168	0.000	0.274	0.000	
Agriculture, forestry and fisheries	0.179	0.000	0.101	0.000	0.304	0.000	
Branch of economic activity of the company							Agriculture, livestock, forestry, hunting
Fisheries and Pisciculture	0.770	0.532	0.815	0.664	0.773	0.693	
Comb. Radioactive solids, oil, gas and minerals	0.993	0.970	0.756	0.285	1.699	0.042	
Electricity, gas and water. Manufacture of generators, treatment plants . . .	0.947	0.615	0.622	0.000	1.758	0.000	
Extraction and transformation of minerals	0.479	0.024	0.351	0.011	0.754	0.538	
chemical industries	0.837	0.092	0.656	0.001	1.370	0.040	
Pharmaceutical and cosmetic industries	0.813	0.042	0.399	0.000	1.857	0.000	
Metallurgy, electrical and precision materials engineering	0.946	0.561	0.778	0.026	1.469	0.007	
Transportation materials. Manufacture of motor vehicles, bicycles . . .	0.851	0.120	0.590	0.000	1.545	0.004	

Table 3.
Values and
significance of own
and environmental
variables

	Variables in the MISMATCH equation		Variables in the vertical MISMATCH equation		Variables in the horizontal MISMATCH equation		
	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	BASE
Food products, beverages and tobacco	1.214	0.041	0.922	0.464	1.934	0.000	
Textile, leather and clothing industries	1.762	0.000	1.466	0.005	2.369	0.000	
Wood, cork and wooden furniture industries	1.957	0.001	1.888	0.006	1.824	0.047	
Paper and derivative articles. Graphic arts and editing …	1.330	0.026	1.067	0.659	1.794	0.002	
Rubber and plastic. Other manufacturing industries. Recycling…	1.139	0.379	0.910	0.599	1.804	0.003	
Construction	0.626	0.000	0.435	0.000	1.080	0.597	
Trade and repairs	2.343	0.000	2.150	0.000	2.494	0.000	
Restaurants, cafes and hotels	3.225	0.000	3.230	0.000	2.026	0.000	
Transportation and others	1.613	0.000	1.431	0.001	2.092	0.000	
Communication technologies	1.162	0.105	0.778	0.021	2.132	0.000	
Media	0.712	0.001	0.463	0.000	1.278	0.098	
Financial institutions, insurance and real estate	0.975	0.779	0.457	0.000	2.353	0.000	
Business services. Goods rental services	0.626	0.000	0.334	0.000	1.394	0.012	
Public administration, defence and Social Security	1.331	0.001	1.003	0.979	2.129	0.000	
Education, research and cultural services	0.413	0.000	0.163	0.000	1.221	0.131	
Health and social care	0.473	0.000	0.221	0.000	1.310	0.044	
Other services provided to the community	1.383	0.000	1.013	0.904	1.997	0.000	
Others	0.502	0.140	0.244	0.032	1.155	0.803	
Year of edition of the employment insertion study							2001
2005	0.879	0.000	0.882	0.000	0.875	0.001	
2008	0.726	0.000	0.696	0.000	0.766	0.000	
2011	0.914	0.001	0.775	0.000	1.092	0.012	
2014	1.097	0.000	1.144	0.000	1.037	0.310	
2017	1.051	0.061	1.095	0.005	0.995	0.894	
2020	0.839	0.000	0.788	0.000	0.905	0.006	
2023	0.979	0.406	0.803	0.000	1.206	0.000	
Constant	0.665	0.000	0.374	0.000	0.291	0.000	

Source(s): Prepared by the author based on the 2023 labour insertion study technical report

Table 3.

I also perceive an intermediate group in which Law, Psychology, Education or Economics and Business are found and which have a certain balance, probably less affected by temporary situations (cyclical crises) but with a more fixed mismatch over time.

Finally, more technological, scientific and especially medical degrees suffer less probability of mismatch. Specifically, 90% less probability of misalignment, especially vertical.

For all these reasons, I cannot reject H2, which states that the degree obtained affects the probability of workers' mismatch, with significant differences between them.

Given the most intrinsic characteristics of the workers, this paper focus on their environment. From the point of view of the company and the branch of activity in which it works, we see results very consistent with both the literature and the predetermined ideas that we had (see, for example, Morgado, 2016), although there is also great disparity between the levels of vertical and horizontal mismatches. In this sense, the probability of being mismatched at the horizontal level is much higher than at the vertical level. The higher level of horizontal than vertical mismatch shows a certain discrepancy in the relationship between training and skills, indicating a gap between what is taught in universities and what companies ask for.

In conclusion, it can be said that the educational mismatches of graduates from the Catalan university system are not so much due to overeducation but in terms of imbalances among graduates. Activity sectors such as agriculture, fishing, extraction and transformation of minerals or construction to a lesser extent, have low levels of both horizontal and vertical mismatch.

It is important to highlight the low probability of mismatch in construction (0.626), both because of its importance in Catalonia and because unlike the others, it has a more significant number of responses.

The industrial sector in general suffers from a larger horizontal than vertical mismatch, which shows us that studying a degree increases the probability of working in industry, but once graduated there is a certain mismatch between the chosen specialties. At the aggregate level, the low levels of vertical mismatch mean that I cannot say that the industry has a high level of mismatch.

About the services, finance and everything related to technology in general, although a certain horizontal mismatch remains, the mismatch is reduced at both the vertical and aggregate levels.

Finally, where there is the greatest probability of mismatch is in commerce (2.34) and in hospitality (3.23), especially retail trade and restaurants, which, as stated by Petrizzi *et al.* (2015) are sectors of entry into the world of work.

	Variables in the DISMATCH equation		Variables in the vertical DISMATCH equation		Variables in the horizontal DISMATCH equation		BASE
	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	
Branch of economic activity. Classification defined by Corominas							Raw materials and energy production
Industry	1.018	0.782	0.902	0.239	1.097	0.241	
Construction	0.602	0.000	0.601	0.000	0.573	0.000	
consumer services	1.555	0.000	1.798	0.000	1.203	0.024	
communication technologies	1.418	0.000	1.410	0.001	1.382	0.000	
Information and communication	0.965	0.676	1.049	0.661	0.815	0.054	
Inst. Financial, insured, immobile	1.184	0.026	0.884	0.232	1.452	0.000	
Company Services	0.931	0.282	0.791	0.009	1.018	0.821	
Public admin	1.146	0.067	1.077	0.446	1.208	0.036	
Education, culture and research	0.725	0.000	0.594	0.000	0.820	0.015	
Health and social assistance	0.675	0.000	0.508	0.000	0.845	0.050	

Note(s): * The table shown is part of the complete model, only changing the aggregation of the different branches of activity according to the proposal of the AQU
Source(s): Prepared by the author based on the 2023 labour insertion study technical report

Table 4.
Values and significance of the Branch of activity according to Corominas' aggregation*

In Table 4, Corominas *et al.* (2010) reorganizes the branches of activity that allow us a more general but clear vision. Once again, the probability of mismatch in construction, business services and healthcare is very low. To this group education, culture and research must be added.

The highest probability of mismatch is in customer services, where mismatches are highly likely in both restaurants and retail: a 1.55 global mismatch compared to the base (raw materials and energy production) and 1.80 vertical mismatch. The public sector also stands out, with a mismatch of 1.15, and again, especially with a high presence of graduates in jobs that do not require degrees of any kind. In this case, the question is whether it is about new contracts or whether workers in Public Administration continue with their training despite already having a job. The result of communication technologies with a high level of mismatch is surprising.

For all these reasons, I do not reject H3: the environment, defined as the branch of activity in which the company operates, affects the probability of mismatches. Certain jobs, especially based on customer service, have a high probability of mismatch, above all in restaurants and shops.

Going deeper into the Corominas classification and in order to conclude this section, there is a notably high probability of mismatches, especially vertical, in occupations related to public administration and especially in customer services, an element that corroborates the type of activity also with the greatest mismatch, commerce and restaurants. These are jobs generally held by young people who work for purely economic purposes and often of a temporary nature and as I have seen in the literature, and now in the results, with a high level of over education.

To assess the hypothesis H4, referring to occupation, which predicted that hierarchical level, specialization and the use of technology inversely influence the probability of educational mismatch, this paper used exclusively data from 2014 to 2023 (Table 5), not having previous information, which is why I assess it separately and last.

Directors, managers, technicians and scientific professionals have the least global and vertical mismatch, although for directors and managers there is a certain degree of horizontal mismatch. It is therefore interesting to conclude that these positions value graduates or those with qualifications in accordance with the importance of the job, even if not exactly relevant to it. As seen above, workers in hospitality services, salespeople, operators of facilities and machinery and assemblers have a huge educational gap, superior, in some cases, to elementary occupations. I can say that the higher the rank, the less likely it is to be mismatched, as the greater complexity of the skills required in these positions increases the need for qualifications to fit the job requirements, and therefore, I cannot reject the hypothesis H4 that says that the higher the hierarchical level of the worker, the lower their probability of mismatch.

6. Conclusions
Educational mismatch is a common and international problem, but the methodology used for its calculation, the different geographical and temporal casuistry and the different characteristics of the databases used for analysis can lead to different conclusions when faced with this same problem. In this context, the objective of this research has been to offer new evidence on the incidence of educational mismatch for Catalonia based on the analysis of microdata from different waves of the labour insertion survey carried out by the AQU. Specifically, the richness of the analysed database has made it possible to contribute to the literature on the subject, offering new evidence on the role of graduates' fields of study, the sectors of activity in which they work, and their type of employment in a context characterized in the short term by economic recession, but with a long-term trend threatened by automation and technological change.

	Variables in the MISMATCH equation		Variables in the vertical MISMATCH equation		Variables in the horizontal MISMATCH equation		
	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	BASE
Type of job. Coding according to CNO Coded corrected (with scopes of work coded, etc.)							elementary occupations
Military occupations	0.178	0.002	0.114	0.000	1.067	0.927	
Directors and managers	0.127	0.000	0.079	0.000	0.796	0.434	
Technical, scientific and intellectual professionals	0.043	0.000	0.017	0.000	0.403	0.001	
Technicians and support professionals	0.115	0.000	0.072	0.000	0.710	0.233	
Accounting, administrative and office employees	0.258	0.000	0.187	0.000	1.251	0.437	
Catering services, personal care, protection and vendors	0.835	0.351	0.802	0.255	1.297	0.378	
Skilled workers in agricultural, livestock, forestry and fishing activities	0.258	0.000	0.244	0.000	0.453	0.046	
Craftspersons and skilled workers in the manufacturing and construction industries	0.192	0.000	0.166	0.000	0.560	0.067	
Plant and machinery operators and assembly workers	0.900	0.709	0.805	0.443	2.240	0.037	
Constant	9.375	0.000	8.750	0.000	0.625	0.099	

Source(s): Prepared by the author based on the 2023 labour insertion study technical report

Table 5.
Typology of work for the years 2014–2023

This paper has achieved the research objective, which aimed to analyse the incidence and evolution of educational mismatch in the labour market of graduates from Catalan universities.

Thus, the analysis allows us to conclude, first, that the influence of gender among graduates of the Catalan university system produces results differing from the main literature, with greater probabilities of mismatches for men than for women. Our results show an inverse trend, rejecting the proposed hypothesis. In our view, the passing of years and the increasing presence of women in higher-ranking positions have likely slowed or even reversed this situation in addition of the need for women to attain more education to aspire to the same job position. It is also possible that parity laws force a situation where women are mismatched both vertically and horizontally.

Regarding gender, I have a question that we should resolve in future research: relating gender to levels of occupation, activity, or training. I will investigate whether being mismatched is due to gender or the type of work they perform or the training they receive.

Secondly, degrees in the humanities or social sciences imply a greater probability of educational mismatch. These results can be interpreted to mean that high levels of unemployment can lead people to train while they are unable to work; training has an anticyclical behaviour. This effect raises the mismatch in two ways; first, because the unemployed are more willing to accept any job, and second, because studies during a period of unemployment do not always have the objective of improving our skills for the previous job, but rather improving as a signal to recover the job or, why not, taking advantage of free time to increase our employability, whether or not it is in line with the future job. The degree profile has an evident influence on a future employment fit or mismatch.

Thirdly, there is an almost complete agreement between the literature and our results regarding the probability of mismatch according to branches of activity, with restaurants and commerce being the most affected. I cannot say the same about some types of services such as financial services, since our results do not denote a high probability of mismatch where some authors, as seen above, had detected it.

An important contribution is that the educational mismatches of graduates from the Catalan university system are not so much due to overeducation but to imbalances between graduates. Sectors of activity such as agriculture, fishing, mineral extraction and processing, or to a lesser extent construction, present low levels of both horizontal and vertical mismatch.

Continuing with the different branches of activity, horizontal mismatch is much greater than vertical, which allows us to conclude that graduates adapt to the level of activity for which they have been trained but not so much to the chosen specialty. In those branches of activity where I have detected more mismatch (services or Public Administrations in the case of the grouping proposed by Corominas, for example), it is very high both horizontally and especially vertically, but in the rest of the activities, horizontal mismatch prevails over vertical. Thus, this paper verifies, as the literature stated, the mismatch in sectors such as trade and hospitality, but these are jobs, especially when there is this mismatch, that will not be long-lasting. For the rest, although the results are not as exaggerated, I want to highlight the greater horizontal than vertical mismatch, confirming that this happen tot only because a situation of overeducation related to the level of qualification but also and specially according to the type of qualification.

Finally, for occupation, as stated above, it is remarkable that the higher the position, the less likely is a mismatch verifying Iriondo and Velázquez (2015) among others, results. The job position related to catering services, personal care, protection and vendors is one of the most mismatched, especially at a vertical level, so I could verify, according to our results, that the profile of women in the service sector has the most potential for mismatch.

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