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Horizontal mismatch in the labor market among university graduates in Chile

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Abstract

Purpose – This study examines the variables associated with the likelihood of horizontal mismatch among Chilean university graduates, focusing on the role of field of study, university prestige and gender.

Design/methodology/approach – A binary logistic regression model was estimated using data from a survey conducted on a representative sample of 951 graduates from 17 universities. The selected universities were requested to provide the academic records of their graduates corresponding to the 2015, 2016 and 2017 cohorts (56,168).

Findings – The results indicate that graduates in fields such as business and management, arts and humanities, social sciences and STEM face a higher risk of horizontal mismatch. Gender and institutional prestige, on the other hand, showed no significant association. These findings suggest that horizontal mismatch is linked not only to individual differences in the type of human capital acquired but also to structural imbalances between educational offerings and labor market demands.

Originality/value – This study provides original insights into horizontal mismatch in an emerging economy, adding to the limited understanding of mismatch drivers in developing countries and offering implications for educational and labor policy design.

Keywords Horizontal mismatch, Field of study, University graduates, Human capital, Labor market

Paper type Research article

1. Introduction

In many countries, the rapid expansion of tertiary graduation rates over the past two decades has not been accompanied by a proportional increase in the availability of jobs requiring high skill levels (Marginson, 2016; OECD, 2024). This imbalance has led to an oversupply of professionals (Quintini, 2018; Verhaest *et al.*, 2017). As a result, a significant number of university graduates have been forced to accept jobs that do not correspond to their educational level or field of specialization (Cortadas-Guasch, 2024; McGuinness *et al.*, 2018; Rudakov *et al.*, 2022). These labor mismatches negatively affect the efficiency of public and private resources allocated to higher education by compromising the expected returns on such investments (Serikbayeva and Abdulla, 2022; Somers *et al.*, 2019).

The two most commonly discussed types of labor mismatches are vertical and horizontal (McGuinness *et al.*, 2018). Vertical mismatches occur when the educational level of university

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graduates does not align with the requirements of their jobs, leading to overeducation or undereducation (Hirao, 2024; Li *et al.*, 2018). Horizontal mismatches emerge when the work performed by graduates does not align with their fields of study (Aytun and Meçik, 2023; Iriondo Múgica, 2022).

This study focuses on the horizontal mismatch that affects university graduates in Chile. This phenomenon primarily arises when there is a gap between the supply of university graduates and employers' demand for human capital in specific fields and occupations (Senkrua, 2022). Thus, it underscores both the labor market's valuation of certain knowledge and skills acquired in higher education, and the tertiary education systems' failure to anticipate and adapt to changes in the labor market (Pholphirul, 2017; Rudakov *et al.*, 2022). While most research on labor mismatches has concentrated on vertical mismatch (Salas-Velasco, 2023; Mahuteau *et al.*, 2015; McGuinness, 2006), horizontal mismatches have recently garnered increasing attention from researchers and policymakers (Aytun and Meçik, 2023; Choi and Ahn, 2024; Verhaest *et al.*, 2017). Part of the literature on horizontal mismatches focuses on assessing its prevalence (Somers *et al.*, 2019). Differences in the incidence of horizontal mismatches have been observed based on the field of study (Robst, 2007; Rodríguez-Esteban *et al.*, 2024; Rudakov *et al.*, 2019, 2022; Salas-Velasco, 2021, 2023) and, to a lesser extent, on variables such as gender (Lalley *et al.*, 2018; Mahuteau *et al.*, 2015; Takeuchi, 2023) and the prestige of the graduating institution (Domadenik *et al.*, 2013; Kucel and Vilalta-Bufí, 2012, 2019; Verhaest *et al.*, 2017).

In Chile, the number of annual graduates has increased by approximately 20% points over the past five years, representing cumulative growth (SIES, 2024a). This has intensified graduates' competition for specialized jobs and has increased the prevalence of labor mismatches (Espinoza *et al.*, 2024; Muñoz *et al.*, 2019; Sevilla *et al.*, 2021). However, knowledge about the groups most prone to experiencing these mismatches is limited. Regarding vertical mismatch, some studies indicate that it is more common for women than for men (Espinoza *et al.*, 2024; Sevilla *et al.*, 2021). On the other hand, Chilean research on horizontal mismatch is virtually nonexistent, with only two studies focused on its negative effects on the salaries and job satisfaction of university graduates (Espinoza *et al.*, 2024; Muñoz *et al.*, 2019). These studies, however, do not explore comprehensively the characteristics that contribute to horizontal mismatch.

Given the adverse effects of horizontal mismatch, both at the individual and the societal levels (Cortadas-Guasch, 2024; Salas-Velasco, 2023), achieving a deeper understanding of its determinants is critical. This study examines the factors that are associated with the likelihood of horizontal mismatches among university graduates in Chile, a country with one of the most privatized and deregulated higher education systems in the world (Rosenzvaig-Hernandez, 2022). By analyzing how horizontal mismatch varies across fields of study, gender, and institutional prestige, this study provides evidence that not only advances our understanding of the Chilean experience but also sheds light on broader challenges faced by developing countries undergoing similar patterns of educational expansion and labor market restructuring. In contrast to the abundant literature on vertical mismatches, research on horizontal mismatches remains limited, particularly in Latin America (Romano, 2023), where such disparities may have long-term implications for economic development and social equity. This study, therefore, seeks to bridge a critical gap in the literature, offering insights that could inform policies aimed at aligning educational systems with labor market needs, both in Chile and in comparable contexts worldwide.

2. Literature review

2.1 Theoretical perspectives on the origin of horizontal mismatches

The existence of horizontal mismatches has been explained through various theories, principally Human Capital Theory (Becker, 1964) and Assignment Theory (Sattinger, 1993). According to the former, the fundamental purpose of education is to develop human capital, that is, knowledge and skills that increase workers' productivity. The labor market, in turn, should allocate educated workers to roles where their competencies are required (Allen and De

Weert, 2007). Horizontal mismatches thus reflect a significant loss of human capital due to the underutilization of available skills (McGuinness, 2006; Somers *et al.*, 2019). According to this theory, these discrepancies arise mainly from labor market imperfections and structural shifts in the economy (Becker, 1964).

Human Capital Theory has also been expanded to include the role of different types of human capital in the emergence of horizontal mismatches (Bourdabat and Chernoff, 2012; Nordin *et al.*, 2010; Robst, 2007). It has been argued that university studies contribute to the accumulation of both general human capital, which is valuable in any sector of the economy, and specific human capital, whose value is maximized when there is alignment between the graduate's education and the job performed. Different fields of study foster to varying degrees the development of these competencies (Robst, 2007; Rudakov *et al.*, 2022; Senkrua, 2022). For example, fields such as Health and Engineering emphasize highly specialized skills, many of which are not transferable to other sectors. In contrast, fields like Social Sciences and Arts and Humanities primarily develop general skills, which can be easily transferred to other occupations (Boudarbat and Chernoff, 2012; Mahuteau *et al.*, 2015; Robst, 2007). The greater transferability of general skills facilitates work flexibility, while also potentially leading to a lower alignment between education and employment (Cortadas-Guasch, 2024; Verhaest *et al.*, 2017).

On the other hand, Assignment Theory is more explicit regarding the relevance of labor market demand in explaining horizontal mismatches (Allen and De Weert, 2007). This approach emphasizes how the allocation of workers to specific jobs may depend on the structure of the labor market. For certain jobs, some graduates have advantages over others due to the general and specific skills acquired in university. The limited availability of these jobs may, however, force graduates to accept positions unrelated to their fields of study (Montt, 2017). The likelihood of achieving a horizontal match is influenced both by the demand for skills related to a particular occupational group and by the supply of workers in the corresponding field (Montt, 2017; Senkrua, 2022).

Recent literature highlights the importance of distinguishing between voluntary and involuntary horizontal mismatches in the labor market, extending beyond the Human Capital and Assignment theories. Involuntary mismatches occur due to demand-side constraints, such as limited job availability or discrimination, which prevent graduates from working in their field of study. On the other hand, voluntary mismatches arise from personal choices, often influenced by new information or changing preferences (Béduwé and Giret, 2011; Nordin *et al.*, 2010; Robst, 2007; Rudakov *et al.*, 2022). The Job Matching Theory (Jovanovich, 1979; Wolbers, 2003) supports this perspective by suggesting that young graduates explore the labor market to find suitable jobs, even if those positions are outside their specific fields of study. Understanding these distinctions is crucial because involuntary mismatches are often associated with negative consequences, such as lower wages and job dissatisfaction, whereas voluntary mismatches may have neutral or even positive effects (Ge *et al.*, 2020; Somers *et al.*, 2019).

2.2 Incidence and factors associated with horizontal mismatches

The incidence of horizontal mismatch shows significant variability across countries (Verhaest *et al.*, 2017). In a review of studies on horizontal mismatch conducted between 1995 and 2015 in North America, Europe, and Asia, Somers *et al.* (2019) identified rates ranging from 7% to 63%. Similarly, McGuinness *et al.* (2018), by systematizing the results of research conducted in 36 countries, estimated a global average of 25.4%. Montt (2017) analyzed horizontal mismatch in the United States, Canada, Japan, South Korea, and several European countries. His study revealed that the prevalence of mismatch varies between 25 and 50%, with an average of 39%. Recent studies in specific contexts also report diverse incidence rates: 50% in Indonesia (Hakim *et al.*, 2024), 32% in Thailand (Senkrua, 2022), and 11% in Spain (Salas-Velasco, 2023).

Differences between countries are due largely to the various methods used to measure horizontal mismatch. On average, different methodologies report incidence rates ranging from 21% to 46% (Somers *et al.*, 2019). The highest rates are reported in studies that used objective

measurements directly comparing fields of study with occupations (e.g. Béduwé and Giret, 2011). In a study conducted in Russia, Rudakov *et al.* (2019) highlighted discrepancies in the results depending on the measurement method: 32% of Russian university graduates experienced horizontal mismatch according to their own evaluation (subjective measurement), while with objective measurements the figure rose to 40%.

The frequency of horizontal mismatches varies with the graduate's field of study. In line with Human Capital Theory, a series of studies conducted in Europe (Domadenik *et al.*, 2013; Rodríguez-Esteban *et al.*, 2024; Salas-Velasco, 2023; Verhaest *et al.*, 2017), Australia (Li *et al.*, 2018), Russia (Rudakov *et al.*, 2022), Thailand (Pholphirul, 2017; Senkrua, 2022), the United States (Robst, 2007), and Canada (Boudarbat and Chernoff, 2012) found a higher prevalence of horizontal mismatches among graduates from fields that mainly provide general skills.

University prestige is another educational factor that can influence the likelihood of horizontal mismatch (Somers *et al.*, 2019). Verhaest *et al.* (2017) demonstrated that lower selectivity and quality of institutions and academic programs increase this likelihood among university graduates in several European countries. These graduates tend to accept jobs that do not align with their education, as they are likely to receive fewer suitable job offers. Similarly, Kucel and Vilalta-Bufí (2012) found that higher institutional prestige reduces the prevalence of horizontal mismatch in Poland, as prestige serves as a signal to employers regarding the quality of graduates. Consistent results were obtained by Domadenik *et al.* (2013) in Slovenia, who observed that graduates in Social Sciences and Business Administration are the most advantaged by graduating from prestigious universities.

Several studies have revealed that horizontal mismatch is more common among women than men (e.g. Addison *et al.*, 2020; Lalley *et al.*, 2018; Mahuteau *et al.*, 2015; Takeuchi, 2023). Gender disparities in the likelihood of experiencing horizontal mismatches may arise both from differences in the preferences of men and women and from the distinct institutional and regulatory constraints they face (Passaretta *et al.*, 2023). According to Wolbers (2003), it is expected that women will experience higher levels of horizontal mismatch as they tend to be more exposed to unemployment and to show lower professional mobility. The field of study can also influence horizontal mismatch, as women are more likely to graduate in less specialized fields (Passaretta *et al.*, 2023).

2.3 Chilean context

One of the most distinctive features of the recent evolution of the higher education system in Chile is its rapid expansion and privatization (Altbach *et al.*, 2017; Gregorutti *et al.*, 2016; Sevilla and Farías, 2019). During the 1980s, the neoliberal reforms implemented under the military dictatorship (1973–1990) deregulated the system, allowing the creation of private institutions and introducing tuition fees paid by students and their families (Espinoza, 2008; Salazar and Leihy, 2017). Financial aid options were diversified and expanded in the following decades, creating a system that currently includes scholarships, loans, and free education. This progress has fostered a remarkable expansion in higher education coverage, integrating students from various social sectors. By 2024, total undergraduate enrollment reached approximately 1.3 million students, with more than half (55.3%) enrolled in universities (SIES, 2024b). Within this group, 73% enrolled in private universities, while only 27% enrolled in public universities (SIES, 2024a).

This expansion process has not been accompanied by a proportional growth in jobs that allow graduates to apply the skills and knowledge acquired during their undergraduate studies (Quintini, 2018; Soto, 2020). The limited supply of highly qualified jobs, combined with strong incentives to pursue tertiary education, has resulted in a low correspondence between the skills developed in the university system and those required by the labor market (Sevilla *et al.*, 2021). Moreover, the state acts as a regulator and guarantor of quality through accreditation processes, but it does not establish relevance criteria for programs based on the state's own needs, the saturation of certain fields of study, or the demands of productive sectors

(Peralta *et al.*, 2020). This has increased the prevalence of labor mismatches (Sevilla *et al.*, 2021; Sevilla and Farías, 2019).

Research on causal factors in horizontal mismatch in Chile is limited, even more than that related to vertical mismatch. In the field of university education, studies by Muñoz *et al.* (2019) and Espinoza *et al.* (2024) report that working in a job unrelated to one's field of study has a negative effect on job satisfaction. In their study conducted in a Chilean public university, Muñoz *et al.* (2019) also note that graduates who experience horizontal mismatch tend to earn lower salaries compared to those whose jobs are aligned with their academic training. The authors further observe that this type of mismatch is more common among graduates from programs focusing on general skills, as opposed to those from fields that offer more specific competencies.

2.4 Hypotheses

Based on the theoretical and empirical background presented, this study proposes the following hypotheses:

H1. Graduates from fields that primarily develop general skills (e.g. Arts, Humanities, Social Sciences) are more likely to experience horizontal mismatches than graduates from fields that foster specialized human capital (e.g. Health, Engineering, Basic Sciences).

H2. Graduates from universities with lower and mid-level prestige are more likely to experience horizontal mismatches than their peers from highly prestigious universities.

H3. Female graduates are more likely to experience horizontal mismatches than male graduates.

3. Methodology

3.1 Data

This research follows a quantitative approach, using data collected through a questionnaire administered to a sample of university graduates. This instrument was subjected to expert validation and a pilot test with a group of graduates to ensure that the questions were correctly formulated and the length was appropriate.

The sampling process was conducted in two phases. The first phase was purposive sampling (Cohen *et al.*, 2017) involving 17 Chilean universities belonging to the University Admission Access system. This system includes the 45 (of the country's 55) universities that have selective admission processes. To ensure adequate representation of the system, the selection of universities was based on three criteria: (1) geographic region (north, center, and south); (2) type of administrative dependency (public, traditional private, and new private); and (3) level of selectivity (low, medium, and high). The selected universities were requested to provide the academic records of their graduates corresponding to the 2015, 2016 and 2017 cohorts (56,168). In the second phase, a random sampling of the total number of graduates was carried out with a margin of error of 3% and a confidence level of 95%.

The survey was administered via email to participants between May and November 2023. A weekly replacement strategy was employed to address non-responses, ensuring that new graduates were selected until the target sample size for each university was achieved. In total, the survey was sent to 13,270 graduates, yielding 1,057 responses, resulting in a response rate of 8%. After excluding respondents who were not employed at the time of the survey (11% of cases), the final sample comprised 951 graduates.

Table 1 presents the representativeness of the sample of graduates used in the analysis (951) compared to the sampling frame (56,168). Overall, no considerable differences are observed between the two datasets, as the discrepancies across all variables of interest are less than 3%. This Table also indicates that graduates from low-prestige universities are moderately overrepresented among non-respondents, whereas those from high-prestige

Table 1. Descriptive statistics for the sampling frame, sample and non-respondents

Variables	Categories	% sampling frame	% sample	% Non-respondents	% Horiz. mismatch (sample)
Hor. mismatch	Total or partial mismatch	–	18.6	–	–
	Complete match	–	81.4	–	–
Gender	Female	57.4	58.8	57.2	16.8
	Male	42.6	41.2	42.8	21.2
Field of study	Bus. and Comm	9.9	8.3	9.8	26.6
	Arts and Hum	6.7	6.1	6.8	25.9
	Education	18.4	18.1	20.2	14.0
	Social Sciences	12.2	15.0	10.6	20.3
	Agriculture	4.2	5.4	3.6	23.5
	STEM	19.7	17.7	14.3	28.6
	Law	4.4	5.8	3.1	9.1
	Health	24.5	23.6	31.6	10.3
Prestige	Low	39.3	40.2	52.4	17.0
	Medium	24.7	26.4	23.5	24.8
	High	36.0	33.4	24.1	15.7
Graduation cohort	2015	32.6	32.1	32.4	14.8
	2016	33.0	33.3	33.9	17.0
	2017	34.4	34.6	33.7	23.7
Parents' educational attainment	Without tertiary education	–	54.6	–	19.7
	With tertiary education	–	45.4	–	17.4
Father's occupation	Non-professional	–	45.0	–	21.7
	Professional	–	51.1	–	15.9
	Managerial	–	4.0	–	17.6
Household income	USD 160–635	–	40.0	–	22.1
	USD 636–1,270	–	35.5	–	18.6
	USD 1,271 or more	–	24.5	–	12.9
School type attended	Public	–	33.9	–	19.6
	Private subsidized	–	51.1	–	18.3
	Private	–	15.0	–	17.5
Employed prior to graduation	Yes	–	21.9	–	14.9
	No	–	78.1	–	19.7
Current occupation	Public sector employee	–	34.6	–	9.1
	Private sector employee	–	49.4	–	22.8
	Employer	–	9.2	–	23.3
	Self-employed	–	6.8	–	28.1
Completed a master's or doctoral degree	Yes	–	17.9	–	11.8
	No	–	82.1	–	20.1
			Mean		*Mean*
Edad	–	–	33.8	–	33.5
N	–	56,168	951	12,213	–

Source(s): Authors' own work

universities are underrepresented, with differences slightly surpassing 10% relative to the sampling frame.

3.2 Variables

The dependent variable in this study is the horizontal mismatch of university graduates in their current employment. The match or mismatch for each graduate was determined through self-

assessment. This subjective method of measuring mismatch has been used in a wide range of studies (e.g. Li *et al.*, 2018; Robst, 2007; Rudakov *et al.*, 2022; Rodríguez-Esteban *et al.*, 2024; Salas-Velasco, 2023; Verhaest *et al.*, 2017). To evaluate the degree of horizontal mismatch, graduates were asked the following question: "In relation to your current job, how closely related is it to the degree you studied?". The possible responses were (1) very low, (2) low, (3) medium, (4) high, and (5) very high. The first three categories were coded as (1) "total or partial mismatch", while the last two were coded as (0) "complete match".

3.2.1 Independent variables. A total of eight fields of study were considered: (1) Business and Management, (2) Arts and Humanities, (3) Education, (4) Social Sciences, (5) Agriculture, (6) Science, Technology, Engineering and Mathematics (STEM), (7) Law, and (8) Health. Prestige was determined based on two criteria: (1) university selectivity (low, medium, and high), established by the standardized test scores required for admission to each institution, and (2) the university's research activity level (low, medium, and high), measured by the number of publications in journals indexed in Web of Science. Based on these criteria, the institutional prestige variable was constructed with three categories: (1) low, (2) medium, and (3) high. Finally, gender includes the categories (0) male and (1) female.

3.2.2 Control variables. The control variables included in the analysis are grouped into four categories: (1) demographic characteristics, including age and graduation cohort (2015, 2016, or 2017); (2) labor market experience and post-graduation trajectory, covering whether the graduate was employed prior to graduation (yes/no), the graduate's current occupation (public sector employee, private sector employee, employer, or self-employed), and completion of a master's or doctoral degree (yes/no); (3) academic achievement, measured by the grade point average (GPA) (measured on a scale from 1 to 7); and (4) socioeconomic background, based on parents' educational attainment (without tertiary education, or with at least one parent having completed tertiary education), the administrative dependence of the secondary school attended (public, private subsidized, or private), the father's occupation at the time of university entry (non-professional, professional, or managerial), and household income at the time of university entry (USD 160–635, USD 636–1,270, or USD 1,271 or more).

To ensure comparability of academic performance across fields with potentially different grading standards, a field-adjusted GPA measure was used. Specifically, each graduate's GPA was standardized by calculating a z-score within their field of study. This transformation captures how each student performed relative to their peers within the same discipline, thereby accounting for variation in grading stringency across academic programs.

Socioeconomic indicators were included to account for potential confounding effects of pre-university background on the relationship between institutional prestige and horizontal mismatch. Socioeconomic status may affect both access to prestigious institutions and subsequent labor market outcomes. Controlling for these factors helps to reduce bias associated with unobserved heterogeneity and to isolate more accurately the independent effect of institutional prestige.

3.3 Analysis

To assess the association between the field of study, institutional prestige, gender and the likelihood of horizontal mismatch, a binary logistic regression model was employed. This method was selected for its suitability in analyzing dichotomous dependent variables, as it provides a robust framework for estimating probabilities without requiring the dependent variable to meet the assumptions of normality or linearity inherent to ordinary least squares (OLS) regression (López-Roldán and Fachelli, 2015). Unlike OLS, which assumes a continuous dependent variable and can produce nonsensical predictions for binary outcomes, logistic regression ensures predicted probabilities remain bounded between 0 and 1. Moreover, in contrast to similar approaches such as discriminant analysis, binary logistic regression does not necessitate assuming a specific distribution for the independent variables, offering greater flexibility in analyzing datasets with diverse characteristics (Tillmanns and Krafft, 2022).

The model estimates the logarithm of the odds ratio (log-odds) of a graduate being in a situation of total or partial horizontal mismatch (code 1) compared to being in a situation of complete match (code 0). The model specification is presented below, where βn represents the regression coefficients associated with each predictor variable of the dependent variable.

$$\text{logit}\left(P\left(Y=1\right)\right)=\beta_0+\beta_1\left(\textit{field of study}\right)+\beta_2\left(\textit{institutional prestige}\right)+\beta_3\left(\textit{gender}\right)+\beta_4\left(\textit{control variables}\right)+\epsilon$$

To mitigate potential selection bias in the choice of field of study, a propensity score adjustment strategy was implemented. An additional binary logistic regression model was used to estimate the probability that a graduate would enroll in a general-skills versus a specific-skills field, based on NEM (high school GPA), PSU Mathematics, and PSU Language scores. These scores are standardized indicators used in the Chilean university admissions process. The resulting propensity scores were divided into quartiles and included in the main model as a single categorical variable with four levels. Specifically, quartile 1 represents graduates with the lowest predicted probability of selecting a specific-skills field (i.e. more likely to choose general-skills fields such as Arts, Humanities, or Social Sciences), while quartile 4 includes those with the highest predicted probability of enrolling in a specific-skills field (such as Health or STEM). This approach, following Rosenbaum and Rubin (1983) and further elaborated by Austin (2011), allows for adjustment of observed ability-related differences that might confound the association between field of study and mismatch. As a robustness check, an alternative specification was estimated in which NEM and PSU scores were included directly in the model. As the results remained consistent in both magnitude and significance, the main text reports the model using propensity score quartiles, while the alternative specification is presented in Appendix 1.

Multicollinearity was assessed across all independent and control variables. The variance inflation factor (VIF) values ranged between 1.044 and 1.559, with tolerance values between 0.641 and 0.958, indicating no problematic collinearity.

All analyses were conducted using SPSS statistical software v.29 and Stata v.18.

4. Findings

Table 1 presents the descriptive statistics of the variables used in the analysis, along with the percentage of graduates experiencing horizontal mismatch across categories of the independent variables. A horizontal mismatch rate of 18.6% is observed in the sample, indicating that nearly one in five graduates is working in a job that is only partially or not at all related to their field of study. When disaggregated by field of study, the highest mismatch rates are found among graduates from the fields of STEM (28.6%), Business and Management (26.6%), and Arts and Humanities (25.9%). In contrast, the lowest rates are observed in Law (9.1%) and Health (10.3%), suggesting stronger alignment between academic training and employment in these areas. Above-average mismatch rates are also observed among men (21.2%), graduates from the 2017 cohort (23.7%), those from medium-prestige universities (24.8%), graduates without postgraduate degrees (20.1%), graduates not employed prior to graduation (19.7%), and across all categories of current occupation except for public sector employees, where the rate is notably lower (9.1%). Elevated mismatch rates are also apparent among graduates from socioeconomically disadvantaged backgrounds. This includes those whose parents did not attain tertiary education (19.7%), whose fathers held non-professional occupations at the time of university entry (21.7%), whose household income at entry ranged from USD 160 to 635 (22.1%), and those who attended public secondary schools (19.6%).

Table 2 presents the results of the binary logistic regression model estimating the probability of horizontal mismatch among university graduates. The model is statistically significant ($p < 0.001$), correctly classifying 81.6% of the cases. The Hosmer-Lemeshow test

Table 2. Binary logistic regression model for horizontal mismatch

Total or partial horizontal mismatch (ref.: Complete match)				
Variable	β (standard error)	Odds ratio (OR)	95% C.I. for OR	Average marginal effects
Field of study (ref.: Health)				
Business and Commerce	1.09* (0.42)	2.96	1.29–6.79	0.14
Arts and Humanities	1.06* (0.46)	2.89	1.18–7.10	0.13
Education	0.06 (0.41)	1.07	0.48–2.37	0.01
Social Sciences	0.88* (0.38)	2.40	1.15–5.04	0.11
Agriculture	0.85 (0.48)	2.34	0.91–5.98	0.10
STEM	1.37*** (0.36)	3.95	1.96–7.98	0.19
Law	0.18 (0.66)	1.19	0.33–4.32	0.02
Prestige (ref.: Low)				
Medium	0.19 (0.25)	1.21	0.73–1.99	0.03
High	−0.17 (0.27)	0.85	0.49–1.45	−0.02
Female (ref.: Male)	−0.09 (0.22)	0.91	0.60–1.39	−0.01
Age	−0.07 (0.04)	0.93	0.87–1.01	−0.01
Graduation cohort (ref.: 2015)				
2016	0.01 (0.27)	1.01	0.60–1.70	0.00
2017	0.25 (0.26)	1.28	0.76–2.15	0.03
Field-adjusted GPA	−0.25* (0.11)	0.78	0.63–0.97	−0.03
Parents with tertiary education (ref.: Without tertiary education)	0.35 (0.25)	1.42	0.87–2.32	0.05
Father's occupation (ref.: non-professional)				
Professional	−0.49* (0.25)	0.61	0.38–1.00	−0.06
Managerial	−0.20 (0.58)	0.82	0.26–2.57	−0.03
Household income (ref.: USD 160–635)				
USD 636–1,270	−0.29 (0.24)	0.75	0.47–1.20	−0.04
USD 1,271 or more	−0.93** (0.35)	0.40	0.20–0.79	−0.12
School type attended (ref.: Public)				
Private subsidized	−0.25 (0.24)	0.78	0.49–1.25	−0.03
Private	0.31 (0.38)	1.36	0.65–2.88	0.05
Employed prior to graduation *(ref.: Not employed)*	−0.29 (0.26)	0.75	0.45–1.25	−0.04
Current occupation (ref.: Public sector employee)				
Private sector employee	1.20*** (0.29)	3.33	1.87–5.93	0.14
Employer	1.47*** (0.39)	4.35	2.03–9.32	0.18
Self-employed	1.69*** (0.44)	5.44	2.32–12.80	0.22
Completed a master's or doctoral degree (ref.: Not completed)	−0.14 (0.30)	0.87	0.48–1.57	−0.02
Propensity score quartiles (ref.: Q4)				
Q1	0.05 (0.33)	1.05	0.55–2.01	0.01
Q2	−0.06 (0.30)	0.94	0.52–1.69	−0.01
Q3	−0.17 (0.29)	0.84	0.48–1.48	−0.02
Number of cases	951			
−2 Log likelihood	627.945			
Nagelkerke's pseudo R^2	0.202			
Sig. Hosmer-Lemeshow	0.461			
% of cases correctly classified	81.6			

Note(s): $p < 0.05$*, $p < 0.01$**, $p < 0.001$***

Source(s): Authors' own work

confirms a good fit of the model ($p > 0.05$), supporting the model's adequacy in representing the observed data.

Contrary to what was anticipated in hypotheses H2 and H3, institutional prestige and gender do not show a significant association with horizontal mismatch. That is, in Chile these variables do not appear to play a decisive role in the alignment between academic training and current employment. In contrast, the field of study shows a consistent association with the likelihood of mismatch. Graduates from the STEM field have, on average, a 19% point higher likelihood of reporting a mismatch compared to those from the Health field. Elevated probabilities are also observed among graduates from Business and Commerce (14 points), Arts and Humanities (13 points), and Social Sciences (11 points). These patterns suggest that graduates from certain fields are more often employed in positions that do not closely align with their academic training.

Among the control variables, the field-adjusted GPA shows a statistically significant relationship with horizontal mismatch. Specifically, graduates with higher GPA scores tend to report slightly lower rates of mismatch, with a one standard deviation increase in GPA associated with an approximate 3% point reduction in probability of mismatch. Similarly, current occupation is related to mismatch likelihood: compared to public sector employees, those working in the private sector show a 14% point higher likelihood of mismatch, while the probability increases by 18 points for employers and 22 points for the self-employed.

Additionally, two socioeconomic indicators at the time of university entry are associated with differences in horizontal mismatch. Graduates whose father held a professional occupation are 6% points less likely to experience mismatch compared to those whose father held a non-professional occupation. Likewise, those from households with a monthly income of USD 1,271 or more show a 12-point lower probability of mismatch relative to graduates from the lowest income category.

5. Discussion

The findings of this study reveal that 18.6% of graduates in Chile experience horizontal mismatches, a proportion that is 6.8% points lower than the 25.4% average estimated by McGuinness *et al.* (2018) in their review of studies analyzing the incidence of this phenomenon across 36 countries. Compared to the results reported by these authors, Chile's rate is similar to countries such as Germany (16.5%), Norway (17.8%), and the United States (19.9%), but significantly higher than nations with rates below 10%, such as Portugal, Slovenia, Switzerland, and Hungary. However, Chile also falls significantly below countries where horizontal mismatch reaches critical levels of 40%–50%, including South Korea, Australia, Russia, Ireland, and Japan.

Graduates from fields such as Business and Management, Arts and Humanities, and Social Sciences exhibit a higher risk of horizontal mismatch. This pattern aligns with the findings previously reported in Chile by Muñoz *et al.* (2019) and with recent international evidence from studies conducted in countries like Spain (Rodríguez-Esteban *et al.*, 2024; Salas-Velasco, 2023), Russia (Rudakov *et al.*, 2022), and Thailand (Senkrua, 2022). This finding supports the argument made by Robst (2007), Nordin *et al.* (2010), and Bourdabat and Chernoff (2012), based on Human Capital Theory, which posits that graduates in fields that predominantly promote the development of general human capital are more exposed to horizontal mismatch compared to those who acquire primarily specific human capital. While general human capital, characterized by its flexibility and transferability, enables graduates to adapt to a variety of labor contexts, this adaptability may also reduce the likelihood of securing jobs closely aligned with their academic training. Thus, the broader and more adaptable nature of the skills acquired in the aforementioned fields may partially explain the higher propensity of these graduates to experience horizontal mismatch, reflecting a trade-off between labor versatility and lower precision in the education-job match.

However, the study's H1 cannot be fully accepted, as a specialized field such as STEM also unexpectedly shows a higher likelihood of horizontal mismatch. This may be due to the fact

that horizontal mismatches do not solely arise from differences in types of human capital, but also from the limited availability of jobs in certain sectors of the economy, as suggested by the Assignment Theory (Sattinger, 1993). Although graduates in this field possess highly specialized technical skills, their ability to find jobs that match their training is likely influenced by an economic structure that does not always demand workers with these specific skills. In this context, the Assignment Theory broadens the perspective of Human Capital Theory by considering that an inefficient distribution of labor opportunities can lead qualified professionals to perform roles that are poorly or entirely misaligned with their training, thereby underutilizing their potential (McGuinness *et al.*, 2018; Rudakov *et al.*, 2022).

Globally, various studies have shown that the expansion of higher education has not always been accompanied by a corresponding evolution in occupational structures (Kracke *et al.*, 2018). In Chile, the economic matrix is primarily focused on the export of natural resources, limiting investment and the adoption of technologies that could increase the demand for highly skilled workers (López *et al.*, 2020). At the same time, Basic Sciences programs (41.5%) ranked among the top five in graduation rates between 2019 and 2023 in the country (SIES, 2024a). Additionally, in 2023, the field of Technology had the highest absolute number of graduates, accounting for 25.5% of all degrees awarded that year. This increase in the supply of graduates, combined with a poorly diversified economic structure, creates an imbalance between labor supply and demand in specialized fields, exacerbating the risk of horizontal mismatch (Quintini, 2018; Sevilla *et al.*, 2021; Verhaest *et al.*, 2017). Consequently, our findings underscore the need to consider both the nature of human capital and the structural constraints of the labor market when studying horizontal mismatches.

Nevertheless, not all horizontal mismatches necessarily reflect structural limitations or labor market failures. Some may result from individual career strategies. Specifically, the transferable skills acquired by STEM graduates may allow them to pursue appealing positions in unrelated sectors, such as finance or technology. In such cases, horizontal mismatch does not necessarily imply a loss of skills or inefficient resource allocation; rather, it may reflect deliberate choices made in a dynamic labor market characterized by imperfect information and evolving demands (Jovanovich, 1979).

Unlike the field of study, neither gender nor institutional prestige show a significant association with horizontal mismatch, refuting hypotheses 2 and 3 of this study. Although previous research has demonstrated that women are more vulnerable to horizontal mismatch due to biases in hiring and role assignment processes (e.g. Addison *et al.*, 2020; Lalley *et al.*, 2018; Takeuchi, 2023), the data analyzed here indicate that variables such as field of study, type of occupation, and employment sector are more strongly associated with the alignment between education and employment in the Chilean context. This lack of influence is not entirely unexpected. As Somers *et al.* (2019) noted in their literature review on horizontal mismatches, the evidence regarding the relationship between gender and this phenomenon is ambiguous, with no clear pattern favoring either men or women. Additionally, recent studies in Europe (e.g. Passaretta *et al.*, 2023; Salas-Velasco, 2023) conclude that gender does not have a significant effect on the likelihood of horizontal mismatch. In Chile, a plausible explanation for this trend is the high concentration of female graduates in the Health field (SIES, 2024a), which has the lowest prevalence of horizontal mismatch among all fields of study according to several studies (e.g. Iriondo Múgica, 2022; Salas-Velasco, 2023). Furthermore, recent advances in reducing gender barriers in the Chilean labor market (OECD, 2021) may be facilitating greater equality of opportunities between men and women to access jobs aligned with their academic training.

Meanwhile, the independence of horizontal mismatch from the prestige of the graduating university contradicts the findings of studies such as those by Verhaest *et al.* (2017), Kucel and Villalta-Bufí (2012, 2019), and Domadenik *et al.* (2013). A possible explanation for this result lies in the differentiated role that institutional prestige may play in the labor market. While this factor appears to be determinant in securing the first job and accessing higher-level positions through its signaling effect (Bühlmann *et al.*, 2022), it does not necessarily guarantee an exact

match between field of study and employment. In labor contexts where precision in the alignment between education and occupation is not a priority or where there is a limited supply of specialized jobs, even graduates from prestigious institutions may be forced to accept positions outside their field of study. This suggests that the capacity for alignment between education and employment may not depend solely on academic credentials, but also on structural conditions and the dynamics of the labor market.

While this study provides valuable insights into the determinants of horizontal mismatch among Chilean university graduates, several limitations should be acknowledged. First, the measure of mismatch relies on graduates' self-assessments, which, although practical for large-scale data and reflective of individual experiences (Li *et al*., 2018; Robst, 2007), may introduce subjectivity and reporting biases (Banerjee *et al*., 2019; Salas-Velasco, 2021). Graduates with similar educational trajectories and occupational roles may interpret the connection between their studies and current job differently (Somers *et al*., 2019). Second, although the analysis includes key observable controls —such as academic performance, socioeconomic background, and a propensity score adjustment for selection into field of study— it is still subject to potential omitted variable bias. In particular, unobserved individual attributes such as motivation, personality traits, or soft skills could influence both academic choices and labor market outcomes. Likewise, the absence of demand-side variables limits the capacity of the model to fully account for structural factors that may contribute to horizontal mismatch. Finally, while the sample used in the analyses is representative of the overall sample frame (see Table 1), there is an overrepresentation of graduates from low-prestige universities and an underrepresentation of graduates from high-prestige universities among non-respondents. Consequently, the external validity of the findings for these universities should be considered with care.

6. Conclusion

This study examined how the field of study, the prestige of the graduating university, and gender are associated with horizontal mismatch among university graduates in Chile. The results indicate that neither institutional prestige nor gender significantly influences the prevalence of this phenomenon. However, the field of study emerges as a key determinant. Consistent with previous literature, graduates from fields offering more general skills face a higher risk of mismatch, likely due to the versatile but less specific nature of their human capital. Interestingly, and contrary to expectations, graduates from highly specialized fields such as STEM also exhibit a higher probability of experiencing horizontal mismatches. These findings suggest that this horizontal mismatch is not solely tied to individual differences in the type of human capital acquired but may also be influenced by structural imbalances between educational supply and labor market demands.

This research carries significant practical implications for the design of educational and labor policies in Chile and other emerging economies that are rapidly expanding their higher education systems. Horizontal mismatches not only reflect a disconnection between academic training and labor market demands but also highlight the deficiencies of tertiary education systems in anticipating and responding to changes in occupational structures. This underscores the urgent need to implement mechanisms that strengthen the linkage between higher education institutions and labor market dynamics, such as labor observatories to monitor market trends and advisory councils involving representatives from the productive sector. In highly deregulated systems like Chile's, stronger regulatory frameworks may also be required to ensure better alignment between undergraduate program offerings and labor market needs. Furthermore, it is essential to provide clear and up-to-date information on labor projections associated with different fields of study. This would assist young people in making informed decisions that better align their educational aspirations with actual market opportunities. Often, they are unaware of labor market demands and the implications of their own career preferences. Expanding the study of horizontal mismatch among university graduates beyond developed countries is a critical task for the international research agenda.

Finally, this study, being the first in Chile to systematically assess the determinants of horizontal mismatch among graduates from various universities and disciplines, opens multiple opportunities for future research. One important direction would be to explore how mismatch evolves over time, assessing whether graduates from fields initially associated with higher mismatch rates experience greater alignment as they accumulate work experience, or whether such mismatches persist throughout their careers. Further research could also examine the specific factors driving horizontal mismatch within individual disciplines, including the possibility of voluntary mismatch, where graduates deliberately pursue employment outside their field for pecuniary or non-pecuniary reasons. In light of the limitations of self-reported data, future studies would benefit from incorporating objective or employer-based measures of mismatch, along with indicators of labor market demand –such as job vacancy rates, projected employment growth, among others. Additionally, addressing the role of unobserved individual attributes —such as soft skills, motivation, or personality traits— would help refine current estimates of mismatch determinants. Special attention should also be paid to the experiences of female graduates, particularly in fields where gender-based occupational segregation may influence mismatch patterns. By addressing these gaps and incorporating more robust methodological strategies —including longitudinal designs and matching techniques— future research can offer a more comprehensive understanding of horizontal mismatch and inform more effective policies to align higher education with labor market needs.

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Appendix

Table A1. Binary logistic regression for horizontal mismatch with direct controls for academic ability (NEM, PSU Language, PSU Mathematics)

Total or partial horizontal mismatch (ref.: Complete match)

Variable	β (standard error)	Odds ratio (OR)	95% C.I. for OR	Average marginal effects
Field of study (ref.: Health)				
Business and Commerce	1.10** (0.42)	3.00	1.31–6.90	0.14
Arts and Humanities	1.11* (0.46)	3.03	1.22–7.51	0.14
Education	0.09 (0.41)	1.10	0.49–2.44	0.01
Social Sciences	0.90* (0.38)	2.47	1.18–5.19	0.11
Agriculture	0.82 (0.48)	2.28	0.89–5.82	0.10
STEM	1.38*** (0.36)	3.99	1.97–8.10	0.19
Law	0.17 (0.66)	1.19	0.33–4.33	0.02
Prestige (ref.: Low)				
Medium	0.20 (0.26)	1.22	0.74–2.02	0.03
High	−0.15 (0.29)	0.86	0.49–1.52	−0.02
Female (ref.: Male)	−0.14 (0.22)	0.87	0.56–1.34	−0.02
Age	−0.07 (0.04)	0.94	0.87–1.01	−0.01
Graduation cohort (ref.: 2015)				
2016	0.03 (0.27)	1.03	0.61–1.73	0.00
2017	0.26 (0.26)	1.30	0.77–2.18	0.04

(*continued*)

Table A1. Continued

Variable	β (standard error)	Odds ratio (OR)	95% C.I. for OR	Average marginal effects
Total or partial horizontal mismatch (ref.: Complete match)				
Field-adjusted GPA	−0.27* (0.11)	0.77	0.61–0.96	−0.04
Parents with tertiary education (ref.: Without tertiary education)	0.36 (0.25)	1.44	0.88–2.36	0.05
Father's occupation (ref.: non-professional)				
Professional	−0.50* (0.25)	0.61	0.38–0.99	−0.07
Managerial	−0.22 (0.59)	0.80	0.26–2.53	−0.03
Household income (ref.: USD 160–635)				
USD 636–1,270	−0.24 (0.24)	0.79	0.49–1.27	−0.03
USD 1,271 or more	−0.86* (0.36)	0.42	0.21–0.86	−0.12
School type attended (ref.: Public)				
Private subsidized	−0.26 (0.24)	0.77	0.48–1.23	−0.03
Private	0.29 (0.38)	1.33	0.63–2.81	0.04
Employed prior to graduation *(ref.: Not employed)*	−0.30 (0.26)	0.74	0.44–1.24	0.04
Current occupation (ref.: Public sector employee)				
Private sector employee	1.23*** (0.30)	3.44	1.93–6.13	0.14
Employer	1.49*** (0.39)	4.46	2.07–9.58	0.18
Self-employed	1.72*** (0.44)	5.56	2.36–13.11	0.22
Completed a master's or doctoral degree (ref.: Not completed)	−0.15 (0.30)	0.86	0.48–1.57	−0.02
NEM	0.25 (0.25)	1.29	0.80–2.09	0.03
PSU Mathematics	−0.00 (0.00)	0.99	0.99–1.00	−0.00
PSU Language	−0.00 (0.00)	0.99	0.99–1.00	−0.00
Number of cases	951			
−2 Log likelihood	627.435			
Nagelkerke's pseudo R^2	0.203			
Sig. Hosmer-Lemeshow	0.314			
% of cases correctly classified	81.6			

Note(s): $p < 0.05$*, $p < 0.01$**, $p < 0.001$***

Source(s): Data processed by the authors

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