

The Extent of Field-of-Study Mismatch in Thailand and its Impact on Earnings

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Abstract: This research investigates the extent of horizontal mismatch or field-of-study mismatch in Thailand and its impacts on earnings using the Thailand Labor Force Survey of 2017. Samples are individuals aged 15 – 60 years with university degree levels: bachelor's *degree*, master's *degree* and doctoral *degree*. The results demonstrate that 32.02% of university graduates in Thailand are horizontally mismatched. In addition, horizontally mismatched graduates earn 6% less than matched graduates. Specifically, graduates with a degree in social science and humanities who are employed in jobs unrelated to their fields of study earn 7% less than horizontally matched graduates. Meanwhile, horizontally mismatched graduates with a degree in physical science earn 2% less than horizontally matched graduates. Essentially, horizontally mismatched workers suffer a wage penalty as a result of human capital underutilization.

Keywords: Field-of-study mismatch, Horizontal mismatch, Job-education mismatch, Vertical mismatch

I. INTRODUCTION

Recent decades have witnessed a growing interest in horizontal mismatch or field-of-study mismatch (Robst, 2007a; Nordin, M., Inga, P. and Dan-Olof, R., 2010). Horizontal mismatch is defined as a mismatch between the type of qualifications acquired by individuals (i.e., field of education) and those required to perform their current jobs (Montt, 2017).

Horizontal mismatch underscores the incompatibility between the supply of graduates and the demand of employers with regard to human capital and skills. Besides, evidence shows that the effects of horizontal mismatch on labor outcomes are more significant than those of vertical mismatch (i.e., education mismatch).

Field-of-study mismatch is conceptually distinct from education mismatch in that an employee may be matched to the job in terms of the years of schooling but not by the field of study. As a result, field-of-study mismatch is a form of horizontal mismatch while education mismatch is a form of vertical mismatch (overeducation) (Heijke et al, 2003; Robst, 2007a).

Vertical mismatch has been extensively researched and results reveal a significant wage penalty for overeducated graduates (Wolbers, 2003; Chevalier, A. and Joanne, L., 2009; Sloane, 2003; McGuinness, 2006; Mavromaras and Seamus, 2012). However, this current research focuses on horizontal mismatch or field-of-study mismatch and its impacts on workers' earnings.

A mismatch between field of education and the job (i.e., horizontal mismatch) has a detrimental effect on the employee and society. The effects of horizontal mismatch on employees include wage penalties and job dissatisfaction (Bender, K.A. and Kristen, R., 2013). The societal impacts of field-of-education mismatch include lower return on public investment in education, reduced tax revenues, and higher unemployment payout (Robst, 2007a; Zhu, 2014).

As a result, this research investigates the extent of horizontal mismatch (i.e., field-of-study mismatch) in Thailand and its impact on earnings. Specifically, this study aims to answer the following questions: (i) What proportion of workers are employed in jobs unrelated to their fields of study; (ii) Which degree fields (i.e., fields of study) experience acute horizontal mismatch; and (iii) What is the effect of horizontal mismatch on workers' earnings?

The organization of this research is as follows: Section I is the introduction. Section 2 deals with the theoretical background and literature review. Section 3 describes the study data and research methodology, and Section 4 discusses the research findings and implications. The conclusions are provided in Section 5.

II. THEORETICAL BACKGROUND AND LITERATURE REVIEW

Theoretical Background

The existence of horizontal mismatch (or field-of-study mismatch) and its impact on earnings can be explained by labor market theories, including human capital theory (Becker, 1964; Mincer, 1974), job competition model (Thurow, 1975), and job assignment theory (Sattinger, 1993).

The human capital theory posits that wage discrepancies are closely linked to differences in human capital, which depend

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on years of schooling, quality of education, innate abilities and other factors. According to the theory, field-of-study mismatch, even though temporarily, often causes inefficiency in the workplace.

The human capital theory classifies field-of-education skills into two categories: general skills (or general human capital) and job-specific skills (or specific human capital). The general human capital is transferrable and valuable regardless of industry of employment, whereas job-specific skills are related to the technical aspects of a job or specific skills required to perform the job. Besides, the proportions of general to specific human capital vary between fields of study.

An individual selects a field of education and invests financial resources and time to acquire relevant skills with the expectation of employment in an occupation related to that field of study. As a result, job-education mismatch (or field-of-study mismatch) is likely to result in wage penalties for workers. Robst (2007a) documented that field-of-study mismatch is more likely among graduates with a degree in humanities, social sciences and liberal arts (i.e., general skills), vis-à-vis those with a degree in medicine, computer science, engineering and technology (job-specific skills).

Meanwhile, the job competition theory postulates that earnings are independent of a worker's skills or productivity, as opposed to the human capital theory. In the job competition theory, the characteristics of the job is the key determinant of workers' earnings and thus the variance in earnings among workers with identical education and work effort. The variance in wages of individuals with identical education largely depends on their position in labor queue, which is in turn determined by the characteristics of the workers, particularly fields of education which are closely linked to the training costs and labor queue.

In the job assignment theory, some workers are more qualified than others as a result of the former's general and job-specific skills but are forced to choose unrelated jobs or fields of study due to unavailability of jobs. Specifically, the job assignment theory postulates that horizontally mismatched (field-of-study mismatch) workers suffer a wage penalty as a result of lower productivity (attributable to lack of field-specific skills) and higher retraining costs (in order to acquire field-specific skills).

Literature Review

Measurement of Horizontal Mismatch

Horizontal mismatch or field-of-study mismatch is defined as a mismatch between the type of qualifications acquired by individuals (i.e., fields of study) and those required for the current jobs. There are two measurements of horizontal mismatch: subjective and objective measures.

For subjective measure or employees' self-assessment, employees are classified as horizontally mismatched when they report that they work in a field unrelated to their field of education. Examples of the self-assessment questions are: Which field of education is most appropriate for the current job (Allen, J. and Rolf V., 2001); How matched their field of study is to their current job (Kelly, E., Philip O.J., and Emer, S., 2010); and Whether their field of study matches or mis-

matches the requirements of their current job (Kim H.K., Ahn S.C., and Kim, J., 2016).

For objective measure of horizontal mismatch, Bédoué and Jean-Francois (2011) relied on a normative correspondence table for horizontal mismatch measures. Specifically, the normative correspondence table categorizes the areas of vocational knowledge into 25 groups to which both educational qualifications and occupations belong. Horizontal mismatch occurs the field degree and occupation do not correspond.

Furthermore, other studies rely on the International Standard Classification of Occupations (ISCO) to assign occupational codes to fields of study. Wolber (2003) used objective methods to classify mismatched workers whereby eight fields of education are matched with ISCO-88 occupations. For instance, all teaching professionals belong to the category of education (codes 230-235); health professionals (code 222) and nursing and midwifery professionals (code 223) belong to the category of health/welfare (Table A1). Quintini (2011) measures field-of-study mismatch whereby education majors are categorized by one of eight fields of study, and ISCO-08 three digit occupations are matched to one or more fields of education (Table A2).

Prevalence of Horizontal Mismatch

Previous studies made a distinction between severely mismatched and moderately mismatched employees when reporting the incidence rate of mismatched employees (e.g., Robst, 2007a; 2007b). Meanwhile, several other studies combine both categories of horizontal mismatch into one single category (e.g., Allen, J. and Rolf V., 2001).

For subjective measure, Robst (2007b), relying on the 1993 National Survey of College Graduates, reported that 20% of graduates were employed in jobs unrelated to their fields of study. Meanwhile, the incidence of horizontal mismatch is about 30% in the Netherlands (Hensen, De Vries, and Corvers, 2009), 33.33% in Russia (Rudakov, Figueiredo, Teixeira, and Roshchin, 2022) and about 11.3% in Pakistan (Farooq, 2001).

For objective measure, Nordin, Inga, and Dan-Olof (2010) found that the incidence of horizontal mismatch is about 19.2% in Sweden. Malamud (2010) studied horizontal mismatch in Scotland and England and reported an overall mismatch of 45.17%. Nevertheless, the incidence of horizontal mismatch depends on how horizontal mismatch is specified.

Outcomes Associated with Horizontal Mismatch

Horizontal mismatch has a negative impact on earnings, occupational status attainment, job search activity, and job satisfaction (Bender and Kristen, 2013; Wolber, 2003;). Specifically, individuals working in jobs related to their fields of education earn higher wages than those employed in unrelated fields (Werfhorst, 2001). In other words, horizontally mismatched employees generally experience a wage penalty. Zhu (2014) reported that graduates with a degree in medicine (i.e., highly job-specific skills) face the largest wage penalties in the event of horizontal mismatch. Schweri, Eymann and Aepli (2020) found sizable mismatch wage penalties for workers with vocational and general education background. Mavromaras and Seamus (2012) found that horizontal mis-

match has no bearing on hourly wages of male workers, as opposed to female workers.

However, certain studies found no significant negative effect of horizontal mismatch on earnings. Beduwe, C. and Jean-Francois, G. (2011) reported that, unlike vertical mismatch (skills mismatch), horizontal mismatch have no significant negative effect on wages. Allen and Rolf (2001) documented that horizontal mismatch has no negative effect on wages while vertical mismatch is significantly negatively correlated with wages.

On the occupational status attainment, Wolber (2003) documented that graduates with a job mismatch attain a significantly lower occupational status than those with a matching job. Besides, loss in occupational status among graduates with a job mismatch is smaller in countries in which the education system is more vocationally oriented.

Furthermore, according to the job search theory, mismatched employees improve their fit by changing jobs until an optimal match is found (Jovanovic, 1979). The likelihood of new job search is greater for horizontally mismatched employees than well-matched employees. Wolber (2003) reported that for graduates with a job mismatch, the likelihood of new job search is 1.576 times higher than those with a matching job. Malamud (2010) found that the likelihood of new job search is higher horizontally mismatched employees than their well-matched counterparts. However, Shevchuk, Strebkov, and Shannon (2015) found no relationship between horizontal mismatch and on-the-job search.

Meanwhile, the association between horizontal mismatch and job satisfaction is inconclusive. Shevchuk, Strebkov, and Shannon (2015); Beduwe and Jean-Francois (2011) found a negative association between horizontal mismatch and job satisfaction. On the other hand, Allen and Rolf (2001) found no relationship between horizontal mismatch and job satisfaction.

III. STUDY DATA AND RESEARCH METHODOLOGY

The study data belong to the 2017 Thailand Labor Force Survey (LFS) published by the National Statistics Office (NSO). The survey is conducted annually by interview and consists of four quarterly datasets: January-March, April-June, July-September, and October-December.

Samples are individuals aged 15-60 years with university degree levels: bachelor's *degree*, master's *degree* and doctoral *degree*. The samples are drawn randomly from households throughout the country. In this study, horizontal mismatch occurs when a worker who was trained or studied in a particular field works in another field. Specifically, this research relies on the objective measures by Wolbers (2003) and Quintini (2011b) to measure horizontal mismatch (Appendix 1).

In the job-education mismatch analysis, a sample selection bias arises when the samples exclude non-employed individuals from the analysis (Nicaise, 2001). The problem can be addressed by using Heckman's two-step procedure. The first-step model for the employment choice can be written as

$$E_i^* = \beta_1 X_{i1} + \varepsilon_{i1} \text{ where } \varepsilon_{i1} \sim N(0,1)$$

where E_i^* is a dummy variable coded 1 if an individual is employed and 0 otherwise, β_1 is a parameter vector, X_{i1} is a vector of covariates for individual i , and ε_{i1} is a normally distributed error term with a zero mean and unit variance.

In the first-step estimation, the dependent variable is labor force participation, coded 1 for employed workers and 0 otherwise. The explanatory variables include age, gender, marital status, household head, educational level, and field of education. Specifically, age is the number of years of biological age, and gender is a dummy variable coded 1 for male and 0 for female. Marital status is also a dummy variable coded 1 for married and 0 for divorced, widowed, or separated. Household head is a dummy variable coded 1 for head of household and 0 otherwise. The education data in the labor force survey are levels of education (not years of schooling), and the conversion of educational levels into years of schooling could result in bias. As a result, educational levels are designated a dummy variable and categorized by skill levels: low-skilled education (educational levels below upper-secondary education), intermediate-skilled education (upper-secondary and post-secondary education), and high-skilled education (university education).

The second-step model for determining the impact of horizontal mismatch on earnings is expressed as:

$$\ln(wage)_i = \alpha_1 X_i + \alpha_2 mm_i + \alpha_3 imr + \epsilon_i$$

where $\ln(wage)$ is the natural logarithm of the monthly wage, mm_i is a dummy variable coded 1 for an individual employed in unrelated field of study and 0 for otherwise, imr is the self-correction term included for bias correction, X_i is the control variable including age, age squared, gender, marital status, educational level, occupation, and household head.

IV. RESULTS AND DISCUSSION

Descriptive Analysis

Fig. (1) shows the probability of horizontal mismatch by ISCED fields of study. The finding indicates that almost one-third of university graduates (32.02%) in Thailand are horizontally mismatched. More specifically, graduates with a degree in health and welfare have the lowest probability of being mismatched (2.33%), while those with a degree in social science, business and law have the highest probability of being mismatched (34.43%). The results could be attributed to the job-specific skills of health and welfare degree holders; and to the general skills of those majoring in social science, business and law. The findings are consistent with Robst (2007a) and Salas-Velasco (2021).

Figure 2 illustrates the average monthly wages (in Thai baht) of Thai graduates by ISCED fields of study, given THB 35/USD exchange rate. The results show that graduates with a degree in health and welfare and in education earn the highest monthly wages, while those majoring in agriculture and veterinary earn the lowest monthly wages.

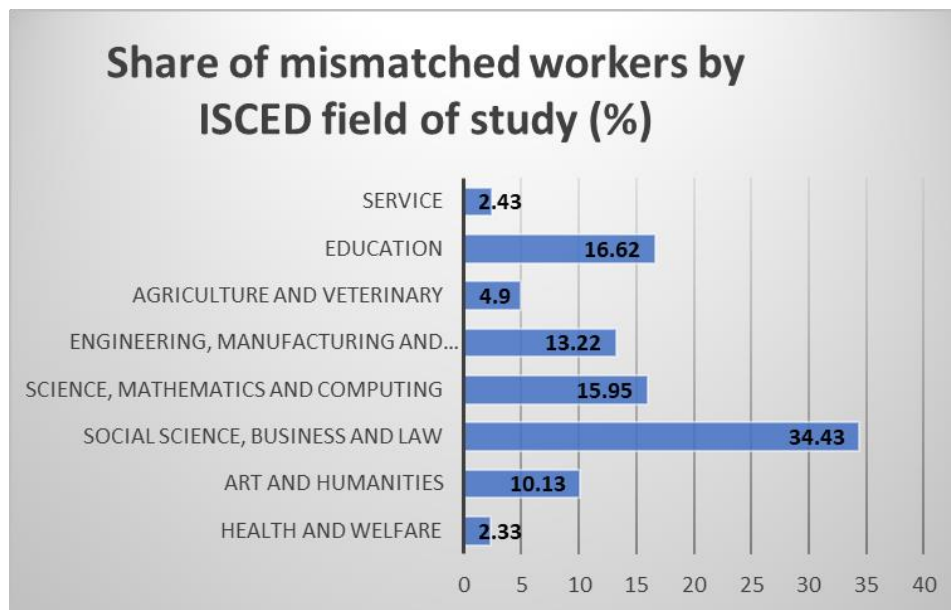


Fig. (1). Share of mismatched workers by ISCED fields of study (%).

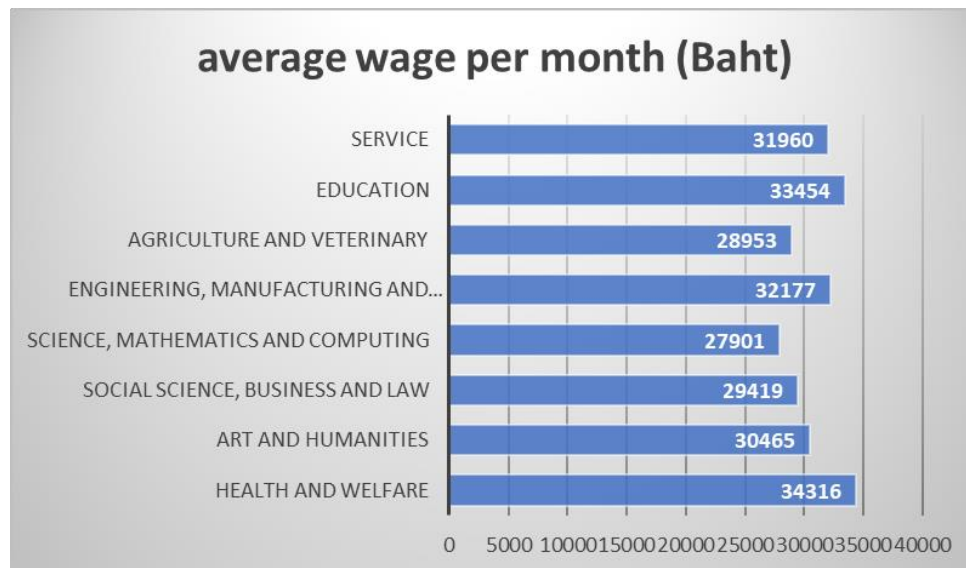


Fig. (2). Average monthly wage by ISCED fields of study (Thai baht), given THB 35/USD exchange rate.

Study Results

Table 1 presents the first-stage probit results of the relationship between socioeconomic variables and labor force participation; and the effect of horizontal mismatch (field-of-study mismatch) on earnings.

In the first-stage probit model, the dependent variable (i.e., labor force participation) is dichotomous: 1 if an individual is participating in the labor force and 0 for otherwise. The probit model is used to estimate the probability of employment in the labor force.

The results indicate that gender is the most important determinant of labor force participation, especially in Thailand where the labor participation of male workers is substantially higher than their female counterparts. In this research, female workers are designated as the reference, and the results

reveal that male workers are more likely to participate in the labor market than females ($\beta = 0.30, p < 0.05$), consistent with Bibi and Asma (2012) and Lee, Soomyung, and Jayanta (2008).

Age is another important determinant of labor force participation. The result shows that the marginal productivity of workers increases with increasing age ($\beta = 0.23, p < 0.05$). However, after a certain age (i.e., advanced age), the marginal productivity decreases due to deteriorating health ($\beta = -0.003, p < 0.05$). Specifically, advancing age contributes to lower labor force participation, consistent with Naqvi and Lubna (2002).

Marital status is another factor that significantly affects the labor force participation. In the analysis, single workers are designated as the reference, and the results indicate that married workers are less likely to participate in the labor market

($\beta = -0.09$, $p < 0.05$). The finding could be attributed to child-rearing and parenting responsibilities of married workers with children. Household head is more likely to work than to

stay unemployed ($\beta = 0.36$, $p < 0.05$) because of the responsibility as the family breadwinner.

Table 1. The Results of Heckman's two-Step Procedure.

Variables	Labor Participation		Ln Wage	
	First Stage Probit		Selection Corrected	
	Coefficients	Standard Errors	Coefficients	Standard Errors
Age	0.23*	0.005	-0.02*	0.004
Age squared	-0.003*	0.00	0.001*	0.00004
Gender	0.305*	0.014	0.05*	0.006
Marital status	-0.09*	0.015	0.02*	0.005
Household head	0.36*	0.02		
Education				
-low-skilled education (reference)				
-intermediate-skill education	0.26*	0.022	0.25*	0.007
-high-skilled education	0.33*	0.125	0.39*	0.03
Fields of education				
-Health and Welfare (reference)				
-Art and Humanities	-0.68*	0.043	-0.1*	0.02
-Social science, Business and Law	-0.56*	0.034	-0.14*	0.01
-Science, Mathematics and Computing	-0.53*	0.04	-0.11*	0.013
-Engineering, Manufacturing and Construction	-0.43*	0.04	-0.03*	0.01
-Agriculture and Veterinary	-0.49*	0.05	-0.14*	0.016
-Education	-0.30*	0.04	-0.18*	0.01
-Services	-0.58*	0.05	-0.07*	0.019
Occupation				
-Low-skilled occupation (reference)				
-Intermediate skilled occupation			0.52*	0.03
-High-skilled occupation			0.79*	0.03
Region				
-Bangkok (reference)				
-Central			-0.18*	0.007
-North			-0.3*	0.008
-Northeast			-0.28*	0.008
-South			-0.31*	0.008
Horizontal mismatch			-0.06*	0.006
Self-selection term			-0.36*	0.04
Constant	-2.73*	0.09	9.4*	0.08

Note: * denotes 5% significance level.

Table 2. The Regression Results of Horizontal Mismatch on Workers' Earnings by Major Fields of Education.

Major Field of Study	Ln_wage	
	Coefficients	Standard Errors
Social Science and Humanities	-0.07*	0.006
Health Science	0.025	0.027
Physical Science	-0.02**	0.011

Note: The control variables are the same as those in Table 1.

* and ** denote 5% and 10% significance levels, respectively.

Individuals with higher education are more likely to participate in the labor force than those with lower education. Given low-skilled education as the reference group, the labor force participation increases with increase in levels of education, as evidenced by the positive coefficients associated with higher education. Specifically, the higher the level of education, the higher likelihood to participate in the labor force than those with low-skilled education.

In addition, graduates with a degree in health and welfare are more likely to be employed in their field of study than those majoring in art and humanities; social science, business and law; science, mathematics and computing; engineering, manufacturing and construction; agriculture and veterinary; education; or services.

In the second-stage selection-corrected analysis, the explanatory variable is horizontal mismatch which is a dummy variable, while the remaining variables are control variables, including age, age squared, gender, marital status, level of education, field of education, occupation, and region of residency. The results show a significant inverse correlation between horizontal mismatch and earnings. Specifically, horizontally mismatched workers earn lower wages or face wage penalties. The mismatch analysis also shows that horizontally mismatched graduates earn 6% less than matched graduates ($\beta = -0.06$, $p < 0.05$).

Furthermore, male workers earn 5% higher than their female counterparts ($\beta = 0.05$, $p < 0.05$). Age is an intermediary index for years of experience, and earnings generally decrease with age due to knowledge depreciation (Mincer, 1974)). The higher the level of education, the more earnings workers receive. Meanwhile, graduates with a degree in health and welfare earn more than those in other fields of education.

Workers in high-skilled occupations (e.g., legislators or senior officials) earn 79% more than those in low-skilled occupations or the reference group (e.g., butlers or janitors). Workers in intermediate-skilled occupations (e.g., clerks, sales workers, or assemblers) earned 52% more than the reference group. In addition, workers in the capital Bangkok receive higher wages than those in other regions, i.e., the North, Northeast, Central, and South.

The inverse Mills ratios are significantly negative, indicating that the selection-bias assumption is valid. As a result, Heckman's two-step procedure is necessary to determine the impacts of horizontal mismatch on earnings (wage penalty). The omission of the probability of employment (i.e., in the first step) in the analysis (in the second step) could result in a bias in the analysis results.

Table 2 presents the impacts of horizontal mismatch on workers' earnings by major fields of education. Due to small sample sizes of certain fields of study, the eight ISCED fields of study are thus grouped into three major fields of education: social science and humanities, health science, and physical science. The results show that wage penalties are the highest among workers in social science and humanities. Specifically, graduates with a degree in social science and humanities who are employed in jobs unrelated to their fields of study earn 7% less than those employed in jobs related to their fields. In addition, horizontally mismatched graduates with a degree in physical science earn 2% less than horizontally matched graduates. Meanwhile, the earnings coefficient of health science graduates is positive but insignificant.

Essentially, the research findings underscore the urgency to reorient university-level education in the country due to high field-of-study mismatch (32.02%). Furthermore, proper guidance and practical advice about the labor market and remuneration should be offered to high school graduates planning to sit for university entrance examinations. The goal should be to inform and convince the high school graduates to select technical sciences over social sciences.

V. CONCLUSION

This research investigates the extent of horizontal mismatch or field-of-study mismatch in Thailand and its impact on earnings using the Thailand Labor Force Survey of 2017. Samples are individuals aged 15-60 years with university degree levels: bachelor's degree, master's degree and doctoral degree. The samples are drawn randomly from households throughout the country. The results show that almost one-third of graduates (32.02%) in Thailand are horizontally mismatched. More specifically, graduates with a degree in health and welfare have the lowest probability of being mismatched (2.33%), while those with a degree in social science, business and law have the highest probability of being mismatched (34.43%).

Heckman's two-step procedure is necessary to determine the impacts of horizontal mismatch on earnings (wage penalty) because the Inverse Mills ratio is significantly negative, indicating that the selection-bias assumption is valid. The result found that horizontal mismatch is inversely correlated with earnings. In other words, horizontally mismatched workers earn lower wages or face wage penalties. Specifically, the mismatch analysis indicates that horizontally mismatched graduates earn 6% less than matched graduates. Furthermore, graduates with a degree in social science and humanities who are employed in jobs unrelated to their fields of study (i.e.,

horizontally mismatched) earn 7% less than those employed in jobs related to their fields (horizontally matched). Meanwhile, horizontally mismatched graduates with a degree in physical science earn 2% less than horizontally matched graduates. Essentially, the research findings are in line with the human capital theory, which postulates that job-education mismatch (i.e., horizontal mismatch) results in wage penalties due to human capital underutilization.

CONFLICT OF INTEREST

The authors reported no potential conflict of interest.

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APPENDIX 1 MATCHING OCCUPATIONS WITH FIELDS OF STUDY

Table A1. ISCED Fields of Education and Matching Jobs.

Field of Education by ISCED	Matching Jobs (ISCO-88 3-Digit Codes)
Education	200, 230, 231-235, 300, 330, 331-334
Humanities/Arts	200, 230, 231, 232, 243, 245, 246, 300, 347-348, 500, 520, 521, 522
Social science/Business/Laws	100, 110, 111, 121-123, 130, 131, 200, 230-232, 241-245, 247, 300, 341-344, 346, 400, 401-422
Sciences	200, 211-213, 221, 230-232, 300, 310-313, 321
Engineering/Manufacturing/Construction	200, 213, 214, 300, 310-315, 700, 710-714, 721-724, 730-734, 740-744, 800, 810-817, 820-829, 831-834
Agriculture	200, 221, 222, 300, 321, 322, 600, 611-615, 800, 833, 900, 920, 921
Health and Welfare	200, 221-223, 244, 300, 321-323, 330, 332, 346, 500, 510, 513, 900, 910, 913
Services	300, 345, 400, 410-419, 421, 422, 500, 510-514, 516, 520, 522, 800, 831-834, 900, 910, 913

Source: Wolber (2003).

Table A2. The List of Horizontally Matched Individuals Based on Field of Study and ISCO-08 Occupation.

Field of education	Occupation (ISCO-08)
Teacher training and Education	-university, higher education, vocational, secondary, primary, early childhood and other teaching professionals (ISCO 231-235) - sports and fitness workers (ISCO 342) - child care workers and teachers' aides (ISCO 531)
Humanities, languages and arts	- university, higher education, vocational and secondary education teaching professionals (ISCO 231-233) - architects, planners, surveyors and designers (ISCO 216) - librarians, archivists and curators (ISCO 262) - social and religious professionals (ISCO 263) -authors, journalists and linguists (ISCO 264) -creative and performance artists (ISCO 265); legal, social and religious associate professionals (ISCO 341) -artistic, cultural and culinary associate professionals (ISCO 343)
Social sciences, business and law	-directors and chief executives (ISCO 112) -managers (ISCO 121-122, 131-134, 141-143) -university, vocational and secondary education teaching professionals (ISCO 231-233) -business and administration professionals (ISCO 241-243) -other health professionals (ISCO 226) - legal professionals (ISCO 261)

Field of education	Occupation (ISCO-08)
	<ul style="list-style-type: none"> - librarians, archivists and curators (ISCO 262) - social and religious professionals (ISCO 263) -authors, journalists and linguists (ISCO 264) -business and administration associate professionals (ISCO 331-335) - other health associate professionals (ISCO 325) - legal, social and religious associate professionals (ISCO 341) - clerical support workers (ISCO 411-413, 421-422, 431-432, 441) - sales workers (ISCO 521-524) - street vendors (excluding food) (ISCO 952)
<p>Science, mathematics and computing</p>	<ul style="list-style-type: none"> -physical and earth science professionals (ISCO 211) - mathematicians, actuaries and statisticians (ISCO 212) - life science professionals (ISCO 213) - other health professionals (ISCO 226) - university, vocational and secondary education teaching professionals (ISCO 231-233) - Information and communications technology professionals (ISCO 251-252) - physical and engineering science technicians (ISCO 311) - process control technicians (ISCO 313); life science technicians and related associate professionals (ISCO 314) - medical and pharmaceutical technicians (ISCO 321) - financial and mathematical associate professionals (ISCO 331) -information and communications technicians (ISCO 351-352)
<p>Engineering, manufacturing and construction</p>	<ul style="list-style-type: none"> -engineering professionals (ISCO 214) - electrotechnology engineers (ISCO 215) - architects, planners, surveyors and designers (ISCO 216) - university, higher education and vocational education teaching professionals (ISCO 231-232) - information and communications technology professionals (ISCO 251-252) - physical and engineering science technicians (ISCO 311) - mining, manufacturing and construction supervisors (ISCO 312) - process control technicians (ISCO 313) - ship and aircraft controllers and technicians (ISCO 315) -regulatory government associate professionals (ISCO 335) - information and communications technicians (ISCO 351-352) - building and housekeeping supervisors (ISCO 515) - crafts and related trades workers (ISCO 711-713, 721-723, 731-732, 741-742, 751-754) - plant and machine operators and assemblers (ISCO 811-818, 821, 831-835) -labourers in mining, construction, manufacturing and transport (ISCO 931-933)
<p>Agriculture and veterinary</p>	<ul style="list-style-type: none"> -life science professionals (ISCO 213) - veterinarians (ISCO 225) - university, higher education and vocational education teaching professionals (ISCO 231-232)

Field of education	Occupation (ISCO-08)
	<ul style="list-style-type: none"> - life science technicians and related associate professionals (ISCO 314) - medical and pharmaceutical technicians (ISCO 321) - veterinary technicians and assistants (ISCO 324) - other health associate professionals (ISCO 325) -skilled agricultural, forestry and fishery workers (ISCO 611-613, 621-622, 631-634) - food processing and related trades workers (ISCO 751) - other craft and related workers (ISCO 754); mobile plant operators (ISCO 834) -agricultural, forestry and fishery labourers (ISCO 921)
Health and welfare	<ul style="list-style-type: none"> -life science professionals (ISCO 213) - health professionals (ISCO 221-227) - university and higher education teaching professionals (ISCO 231) - primary school and early childhood teachers (ISCO 234) - social and religious professionals (ISCO 263) - health associate professionals (ISCO 321-325) - legal, social and religious associate professionals (ISCO 341) - other personal service workers (ISCO 516) - personal care workers (ISCO 531-532) - protective services workers (ISCO 541)
Service	<ul style="list-style-type: none"> -professional services managers (ISCO 134) -sales, marketing and public relations professionals (ISCO 243) - other health associate professionals (ISCO 325) -administrative and specialised secretaries (ISCO 334) - regulatory government associate professionals (ISCO 335) - legal, social and religious associate professionals (ISCO 341) - artistic, cultural and culinary associate professionals (ISCO 343) - clerical support workers (ISCO 411-413, 421-422, 431-432, 441) - service and sales workers (ISCO 511-516, 521-524, 531-532, 541) - drivers and mobile plant operators (ISCO 831-835) - cleaners and helpers (ISCO 911-912) - food preparation assistants (ISCO941) - street and related service workers (ISCO 951) and street vendors (excluding food) (ISCO 952)
Coded as missing	<ul style="list-style-type: none"> -all self-employed workers and those who majored in “general programmes”; armed forces occupations (ISCO major group 0) - legislators and senior officials (ISCO 111) - refuse workers and other elementary workers (ISCO 961-962)

Source: Quintini (2011).

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