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Wage earning differentials by field of study: Evidence from Vietnamese university graduates

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ABSTRACT

Using data from the 2018 Labor Force Survey, this paper analyzes wage differentials by field of study among Vietnamese university graduates. In contrast to previous findings, we find that many fields, even more technically and quantitatively oriented disciplines, such as engineering, science/math/computer science and business/finance, afford lower earnings than do the arts/humanities disciplines. The differences are statistically significant and, in many cases, large, even after controlling for other individual and regional characteristics. Also, the differences are greater among female than among male graduates. Our results shed light on the value of various types of human capital represented by the various disciplines. Such findings offer useful policy implications for policymakers and educational managers.

1. Introduction

The literature on wage differentials by field of study (major) among university graduates (hereafter called "graduates") often provides findings from developed countries, where the post-secondary education system and labor market conditions may be very different from those in developing economies (Doan et al., 2018aa; Doan et al., 2018ab).- Vietnam offers an interesting case study because on the one hand, the country is characterized by a transitional economy that has experienced massive structural changes in all sectors towards a marked-based economy over the past three decades (Le & Tran, 2019). High economic growth, the radical shift in economic structure and the emergence of new manufacturing and service sectors (banking and finance, communications, technology) in the economy have provided graduates with a wide range of high-return job opportunities (Le & Tran, 2019).

On the other hand, recent official statistics often indicate that more highly educated workers face challenges in finding suitable jobs and are more likely to suffer from unemployment[1] (Le & Tran, 2019; Tran, 2015). In particular, a recent study by Doan et al. (2018a, 2018b) reports a declining return to post-high school education levels, which sends "a negative signal" that may discourage investment in human capital formation in Vietnam, especially in higher education. The declining return on university education may be the result of both the supply and demand sides. There were huge changes in higher education policies in the 2000s, which substantially increased the supply of highly educated workers over the past decades[2] . On the demand side, there has been a lower demand for highly educated workers due to slowing economic growth, distortion in the labour market, education/job mismatch, and poor quality of education (Doan et al., 2018a, b; Nguyen, Nguyen et al., 2015).

While there has been a growing number of studies focusing on the return on the number of schooling years and/or a specific level of study (e.g., high school vs university level) (Doan & Gibson, 2012; Doan, Le, et al., 2018; O'Connor, 1996; Tran et al., 2019), no evidence exists as

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[1] For instance, the unemployment rate of university graduates is around 2.7-3.2%, while this rate for people without post high-school training is limited to roughly 1.0–1.5% (General Statistical Office of Vietnam [GSO], 2019).

[2] The government has opened up higher education opportunities for all sectors, including public, semi-public and private education providers, to expand or establish new educational facilities (Doan et al, 2018a, 2018b). As a result, the gross enrolment rate in tertiary education dramatically increased from only about 9.41% in 2000 to about 30.48% in 2014 (World Bank [WB], 2018).

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yet for wage differentials by field of study in Vietnam. Estimations of the return on various majors or earning differences by field of study among graduates provide useful information on the value of various kinds of human capital which the corresponding disciplines represent (Finnie & Frenette, 2003). More importantly, policymakers need evidence concerning which disciplines should be given more or less priority when considering expanding enrolments and public spending (Webber, 2014). In addition, such findings may help future students plan or make a reasonable choice with a better understanding of differences in earning by field of study. Considering the gap in the literature and the importance of the research topic, our study is the first to examine wage differentials by field of study among Vietnamese graduates.

Our study provides evidence that many fields, even more technically and quantitatively oriented disciplines such as engineering, science, math, computer science and business and finance, offer lower earnings than do disciplines in the arts and humanities. The differences are statistically significant and, in many cases, large, even after controlling for other individual and regional characteristics. This finding is inconsistent with that in several high-income economies, where the arts and humanities have always been the field leading to the lowest earnings, whereas the highest wages are earned in engineering, business and finance, and math and computer science. Notably, our study finds that the differences are greater among female than among male graduates. Our results shed light on the value of various types of human capital which the sundry disciplines represent and provide important policy implications for policy makers and educators in Vietnam.

The current paper is structured as follows: the next section includes a literature review while data and methods are given in Section 3, followed by results and discussion in Section 4, and a conclusion outlining policy implications is provided in Section 5.

2. Literature review

Estimating the economic return on a higher education degree (relative to completion of a high school diploma) or more broadly, on an additional year of formal schooling, is one of the oldest and most widely studied topics in modern labor economics (Finnie & Frenette, 2003; Webber, 2014). According to the human capital theory and neoclassical approaches (Becker, 1975; Schultz, 1961), more years of education are expected to increase productivity, and therefore earnings, through the provision of knowledge, skills and a methodology for solving problems (Finnie & Frenette, 2003). A common approach to measure the rise in earnings resulting from higher levels of education is to quantify differences in earnings between university graduates (or college graduates in American terms) and high school graduates. Econometric evidence often confirms the positive effect of an undergraduate degree on wage earnings or the so-called “university premium” in many developed (Finnie & Frenette, 2003; Kantrowitz, 2007; Perna, 2003; Stark, 2007; Tamborini et al., 2015) and developing countries (Doan et al., 2018a, b; Tran et al., 2019; Wang, 2012).

There is a steadily accumulating body of studies, most of them on developed countries, on the topic of wage earnings by field of study graduates (Altonji et al., 2012; Beblavý et al., 2015; Finnie & Frenette, 2003; Lemieux, 2014; Stark, 2007; Walker & Zhu, 2011). There is concrete empirical evidence that field of study is a crucial determinant of graduates’ level of earnings (Finnie & Frenette, 2003; Grave & Goerlitz, 2012). It was found that graduates from more technically and quantitatively oriented disciplines, such as engineering, math, computer science, and finance and business, tend to obtain higher than average earnings. Those in the less quantitative or ‘softer’ disciplines, such as the arts and humanities, tend to be characterized by lower earnings in Canada (Finnie & Frenette, 2003) and the United states (Webber, 2014). In particular, graduates in the natural sciences tend to achieve the highest income while those in the arts and humanities have the lowest earnings. Examples include Germany (Wahrenburg & Weldi, 2007), the United States (Arcidiacono et al., 2012), the UK (Bratti & Mancini, 2003), Italy (Pietro & Cutillo, 2006), Australia (Chia & Miller, 2008) and Ireland (Kelly et al., 2010).

3. Data and method

3.1. Data

The current study utilizes secondary data from the 2018 Labor Force Survey (2018 LFS), a survey conducted annually by the General Statistical Office (GSO) of Vietnam. The objective of the survey is to gather information on labor market participation from respondents who are 15 years old and up and currently living in Vietnam. The survey is representative at the national, rural, urban, and regional levels. The results provide a basis for developing and planning policies on human resource development, and investment, production and business activities associated with developing trends in the labor market.

The survey contains rich information about respondents’ socio-economic characteristics, including labor market participation, age, gender, education level and field of study, occupation and education-occupation mismatch, job sector, income and working hours, and income and other work conditions. From the 2018 LFS, we used a sample of graduates who are current wage earners and are less than 61 years of age. The sample provides a cross-sectional dataset, consisting of about 38,623 respondents.

3.2. Econometric model

Following previous studies (Black et al., 2003; Fan & Zhang, 2015; Finnie & Frenette, 2003; Kelly et al., 2010; Walker & Zhu, 2011), we adapted the Mincer model to estimate the economic return on education by field of study among Vietnamese graduates. In the estimations, we limit the sample to individuals with university degrees as the highest level of education. Although we cannot completely avoid potential selection bias, excluding those without university degrees would remove some possible selection issues (Morikawa, 2015). We included education-occupation mismatch as a control variable because it was a major determinant of Vietnamese graduates’ earnings (Tran et al., 2019). In addition, we included the occupational variable in the models, often considered to be an important control variable in previous studies (Black et al., 2003; Finnie & Frenette, 2003; Kelly et al., 2010).

The estimation model of economic returns is given in equation (1), where $LogW_i$ represents the natural logarithm of the monthly wage earnings of an individual i. X_i denotes individual characteristics (gender, marital status, work experience and its squared value, and household size). F_i consists of 12 dummy variables representing different fields of study, while the arts and humanities comprise the reference group that is omitted in the models. M_i is a dummy variable of occupation-education mismatch (1 = yes; 0 = no)[3] . O_i includes four dummy variables representing various occupations (leaders, high-level technicians and professionals, mid-level technicians and associates, low-skilled non-manual workers), with the reference group consisting of manual workers (both unskilled and skilled workers). S_i represents employment sectors, measured by three dummy variables (the public sector, state-owned enterprises and foreign direct investment [FDI] enterprises) with those working in the domestic private sector omitted as the reference group. R_i comprises regional variables, namely five dummy variables representing five geographical regions and the Red River Delta constitutes the reference group. Also, the model includes

[3] Question 51 concerning education-occupation mismatch in the 2018 LFS uses a subjective approach (self-declared/self-reported/self-assessment—SA) and asks workers whether their job matches or is related to their field of study at the highest level of their education (GSO, 2018).

Table 1
Distribution of university graduates by field of study
Source: Authors' calculation from LFS 2018.

Field of study	Female	Male	Urban	Rural	Public	Private	All
Education/pedagogy	38.91%	15.08%	23.26%	40.04%	42.12%	4.83%	27.49%
Arts/humanities	3.86%	1.73%	3.14%	1.96%	2.17%	3.88%	2.84%
Social sciences	2.49%	3.11%	2.83%	2.67%	3.03%	2.40%	2.79%
Journalism/information	1.53%	1.29%	1.46%	1.26%	1.72%	0.94%	1.41%
Business/finance	33.61%	23.19%	31.48%	20.14%	16.59%	47.27%	28.62%
Law	4.06%	7.10%	5.32%	6.11%	7.77%	2.03%	5.52%
Science/math/computer science	2.92%	6.95%	5.12%	4.06%	3.05%	7.65%	4.85%
Engineering	3.34%	21.94%	12.75%	10.75%	5.20%	23.18%	12.25%
Agriculture/veterinary science	2.17%	4.94%	3.01%	4.96%	4.01%	2.71%	3.50%
Medicine/health	4.28%	3.58%	4.10%	3.48%	5.49%	1.55%	3.94%
Other services	0.99%	1.94%	1.55%	1.14%	0.98%	2.17%	1.44%
Defense/security	0.93%	7.93%	4.84%	2.62%	6.82%	0.35%	4.28%
Other	0.91%	1.20%	1.14%	0.81%	1.07%	1.03%	1.05%
Observations	20,114	18,509	28,885	9,738	23,478	15,145	38,623

one dummy variable for urban/rural areas and one provincial gross domestic product (PGDP) continuous variable. As expected, wage earnings are closely linked with the level of PGDP. Finally, ε_i denotes the error term in the model.

$$LogW_i = \beta_0 + \beta_1 X_i + \beta_2 F_i + \beta_3 M_i + \beta_4 O_i + \beta_5 S_i + \beta_6 R_i + \varepsilon_i \quad (1)$$

As in many other countries (Vaughan-Whitehead, 2013), though fewer now than in past decades, a large percentage of university graduates in Vietnam work in the public sector (Table 1). A problem arises when the calculation of returns on education are based on samples that include civil servants, because public sector wages commonly do not reflect market wages (Psacharopoulos & Patrinos, 2004). As suggested by Psacharopoulos and Patrinos (2004), however, estimating the return on education for civil servants is useful for analyzing government incentives to invest in education and job seekers' preferences for public employment. Thus, we run two separate regression models for the public (Equation 2) and private sectors (Equation 3).

$$LogW\,(public)_i = \beta_0 + \beta_1 X_i + \beta_2 F_i + \beta_3 M_i + \beta_4 O_i + \beta_5 R_i + \varepsilon_i \quad (2)$$

$$LogW\,(private)_i = \beta_0 + \beta_1 X_i + \beta_2 F_i + \beta_3 M_i + \beta_4 O_i + +\beta_5 R_i + \varepsilon_i \quad (3)$$

A problem that might arise with sectoral wage estimates in Equations 2 and 3 is that the employment sector is likely to be endogenous to wage earnings (Lokshin & Sajaia, 2004). Some unobserved characteristics that affect the probability of a graduate choosing a particular employment sector could also affect the wages the graduate earns once he or she is employed. Thus, we apply a switching endogenous regression model to correct for potential selection bias. However, the Wald test in Appendix B does not reject the hypothesis that the three equations are jointly independent (Lokshin & Sajaia, 2004), which suggests that the wage equation can be separately estimated for each sector using an ordinary least squares (OLS) estimator. We further analyze whether the returns differ by gender by regressing a separate model for men (Equation 4) and women (Equation 5). All coefficients and standard errors are accounted for in sampling weights and are clustered at the commune level.

$$LogW\,(male)_i = \beta_0 + \beta_1 X_i + \beta_2 F_i + \beta_3 M_i + \beta_4 O_i + \beta_5 S_i + \beta_6 R_i + \varepsilon_i \quad (4)$$

$$LogW\,(female)_i = \beta_0 + \beta_1 X_i + \beta_2 F_i + \beta_3 M_i + \beta_4 O_i + \beta_5 S_i + \beta_6 R_i + \varepsilon_i \quad (5)$$

4. Results and discussion

4.1. Descriptive statistics

Our sample includes 38,623 graduates whose main employment is simply as wage-earning workers. It should be noted that the detailed information on field of study in Vietnam was only collected for the first time in 2018, which allowed us to examine wage differentials by field of study among graduates. Using the four-digit field of study code in the 2018 LFS (Appendix A), we list 13 major areas of study with the corresponding proportion of graduates, as given in Table 1. Those graduating in two major fields, namely education and pedagogy, and business and finance, account for the largest proportion. Combined, they make up about 56% of the total number of graduates. These are followed by graduates in engineering (12.25%), law (5.52%), science, math or computer science (4.85%), defense and security (4.28%), and health and medicine (3.94%). The proportion of graduates from the arts and humanities is 2.84%, which is similar to that for the social sciences.

However, the distribution of majors between male and female graduates differs considerably. For example, the number of female graduates in education and pedagogy, business and finance, and the arts and humanities, is greater than that for their male counterparts. On the other hand, the number of graduates in engineering, in science, math and computer science, in agriculture and veterinary science, and in law is higher for men than for women. Comparing urban and rural regions, it can be seen that the number of graduates in education and pedagogy is much higher in rural areas, whereas the number of business and finance graduates is lower in rural areas. The reason for this discrepancy is that the larger number of graduates tend to work in education and training institutions located predominantly in rural rather than urban areas, while the greater number mainly work for enterprises located predominantly in urban rather than rural areas. Unsurprisingly, the ratio of graduates in education and pedagogy, and defense and security, is higher in the public sector, while business and finance graduates mainly work in the private sector. In particular, the number of graduates in engineering and in science, math, and computer science, is much higher in the private sector.

Covering 13 majors, graduates' monthly earnings are reported in Table 2. The table shows that average earnings for all majors total approximately 7.80 million VND, while the corresponding figures for men and women are about 8.68 million VND and 7.00 million VND, respectively. Both male and female graduates in the defense and security fields achieved the highest earnings, whereas those who had graduated in agriculture and veterinary science earned the least. Female graduates in the arts and humanities earned about 8.16 million VND per month, just behind female graduates in the defense and security field. In the male group, however, those in the arts and humanities fields earned about 8.48 million VND, ranking behind those who had graduated in the fields of defense and security, other services, health and medicine, and engineering. Based on descriptive statistics, our finding is similar to that for China (Fan & Zhang, 2015) but contrasts with that for the United States (Webber, 2014) and Canada (Finnie & Frenette, 2003), where graduates in the arts and humanities

Table 2
Monthly wages of university graduates by field of study

Field of study	Male		Female		All	
	Mean	SD	Mean	SD	Mean	SD
Agriculture/veterinary science	7101	3189	5766	2617	6670	3079
Arts/humanities	8476	5938	8162	4449	8254	4930
Business/finance	8652	4392	7114	3744	7711	4077
Education & pedagogy	8102	3315	6973	2417	7270	2728
Engineering	8949	4941	7030	3799	8677	4842
Health/medicine	9238	5209	7569	3640	8296	4468
Journalism/information	7591	2704	6202	2668	6810	2768
Law	7808	3599	6418	3153	7275	3500
Other services	9834	8685	6205	3041	8539	7402
Other	7586	3081	6602	2464	7141	2858
Science/math/computer science	8362	5241	6617	2925	7815	4711
Defense/security	11045	3641	9209	2572	10838	3583
Social sciences	8717	5377	6840	3356	7843	4643
Total	8683	4557	7029	3221	7822	4005

Note: Earnings include all income from wage-paying work, given in thousands of Vietnamese dong (VND).
[1]USD equated to about 23,000 VND in 2018. Source: Authors' calculation from the 2018 LFS.

earned much less than those in other fields.

The main characteristics of graduates are given in Table 3. Graduates' mean age is about 36.81 years but the figure is higher for men (38.40) than for women (35.35). For the whole sample, the proportion of graduates reporting that their current job is unrelated to their field of study is 10.60% and this figure is much the same for both men and women. Most graduates work in the public sector (about 61%), followed by the private sector (about 26%), state-owned enterprises (SOEs) (about 9%), and foreign direct investment (FDI) enterprises (about 4%). A similar result is found in several countries where the major proportion of graduates also work in the public sector (Vaughan-Whitehead, 2013). While wage earnings are lower in the public sector than in the private sector, a higher percentage of graduates work in the public sector. This situation can be explained by the fact that the public sector generally offers favorable working conditions and fringe benefits, such as more stable, secure employment and more free time to do extra work or relax.

Examination of the two groups reveals that the proportion of female graduates working in the public sector is higher than that of their male counterparts (64% vs 57%), while the proportion of graduates working in SOEs is higher for men (about 12%) than for women (about 7%). The proportion of male graduates working in the private sector is about 27%, which is slightly higher than for female graduates (about 24%). Finally, the percentage of graduates working in FDI enterprises is higher for women (4.6%) than for men (3.9%).

Regarding occupational characteristics, Table 3 reveals that only 0.5% of the total number of graduates have unskilled jobs whereas 2.8% work in skilled manual jobs. Breaking this down, 1.5% of female graduates have skilled manual jobs while 4.2% of male graduates work in skilled manual jobs. Of the total number of graduates, 8.4% are leaders or managers in the public or private sectors, and the percentage for men (11.9%) is more than double the corresponding figure for women (5.1%). A higher proportion (81%) of female graduates work as high-level technicians and professionals, compared with 67.4% of male graduates. The percentages of graduates who are mid-level technicians and associates and low skilled non-manual workers are 3.5% and 9%, respectively.

4.2. Econometric results

4.2.1. Returns by field of study

The results from OLS wage regression analysis are provided in Table 4, where we also report several results from six model specifications. We can see that the R-squared value is significantly increased by gradually including more control variables from Model 1 (only the variables of interest) to Model 6 (full model). The R-squared value increases from 0.043 to 0.37, while many variables are statistically highly significant, with their signs as expected. This suggests that the full model (Model 6) results should be used for our econometric analysis. Table 4 reports the discipline coefficients generated by the regression models, which include the proxy control variables for labor market experience, gender, marital status, job sector, occupation and job

Table 3
Characteristics of university graduates by gender
Source: Authors' calculation from the 2018 LFS. Six main occupations were identified using the four-digit occupational code in the occupational list of Operational Handbook for the 2018 Labour Force Survey (GSO, 2018).

Explanatory variables	Female		Male		All	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	35.350	8.180	38.389	9.524	36.807	8.979
Marital status (1 = married; 0 = not married)	0.786	0.410	0.815	0.389	0.800	0.400
Gender (1 = male; 0 = female)					0.479	0.500
Household size (number of family members)	4.227	1.497	4.190	1.524	4.209	1.510
Private sector (1 = yes; 0 = no)	0.242	0.428	0.272	0.445	0.256	0.437
Public sector (1 = yes; 0 = no)	0.643	0.479	0.569	0.495	0.608	0.488
State-owned enterprise (1 = yes; 0 = no)	0.069	0.254	0.119	0.324	0.093	0.291
Foreign Direct Investment (FDI) (1 = yes; 0 = no)	0.046	0.209	0.039	0.195	0.043	0.202
Unskilled manual workers (1 = yes; 0 = no)	0.005	0.067	0.006	0.077	0.005	0.072
Skilled manual workers (1 = yes; 0 = no)	0.015	0.123	0.042	0.200	0.028	0.165
Low-skilled non-manual workers (1 = yes; 0 = no)	0.085	0.279	0.096	0.294	0.090	0.286
Mid-level technicians and associates (1 = yes; 0 = no)	0.033	0.179	0.038	0.190	0.035	0.184
High-level technicians and professionals (1 = yes; 0 = no)	0.810	0.392	0.674	0.469	0.745	0.436
Leaders/managers (1 = yes; 0 = no)	0.051	0.219	0.119	0.324	0.084	0.277
Education-occupation mismatch (1 = yes; 0 = no)	0.101	0.301	0.111	0.314	0.106	0.308
Red River Delta (1 = yes; 0 = no)	0.233	0.423	0.216	0.411	0.225	0.418
Northern Mountains/Midlands (1 = yes; 0 = no)	0.247	0.431	0.235	0.424	0.241	0.428
Northern and Southern Central Coast (1 = yes; 0 = no)	0.208	0.406	0.209	0.407	0.208	0.406
Central Highlands (1 = yes; 0 = no)	0.074	0.261	0.072	0.258	0.073	0.260
Southeast (1 = yes; 0 = no)	0.121	0.326	0.130	0.337	0.126	0.331
Northern Mountains/Midlands (1 = yes; 0 = no)	0.117	0.321	0.139	0.346	0.127	0.333
Urban (1 = urban;0 = rural)	0.743	0.437	0.753	0.431	0.748	0.434
Provincial GDP/capita (1000 VND)	3,061	1,310	3,100	1,318	3,080	1,314

Table 4
Determinants of wage earnings among graduates

Explanatory variables	Field of study (1)		Individual characteristics (2)		Job sectors (3)		Occupations (4)		Education-occupation mismatch (5)		With regional characteristics (6)	
	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se	Coef	Se
Education/pedagogy	−0.16***	(0.024)	−0.24***	(0.024)	−0.06***	(0.022)	−0.07***	(0.022)	−0.08***	(0.022)	−0.01	(0.021)
Social sciences	−0.09***	(0.035)	−0.20***	(0.034)	−0.11***	(0.030)	−0.11***	(0.030)	−0.11***	(0.029)	−0.09***	(0.029)
Journalism/information	−0.19***	(0.038)	−0.26***	(0.038)	−0.16***	(0.036)	−0.15***	(0.035)	−0.16***	(0.035)	−0.15***	(0.032)
Business/finance	−0.07***	(0.023)	−0.08***	(0.024)	−0.10***	(0.022)	−0.11***	(0.021)	−0.12***	(0.021)	−0.09***	(0.020)
Law	−0.18***	(0.028)	−0.31***	(0.028)	−0.16***	(0.027)	−0.16***	(0.026)	−0.16***	(0.026)	−0.13***	(0.025)
Science/math/computer science	−0.03	(0.029)	−0.07**	(0.029)	−0.07***	(0.026)	−0.07***	(0.025)	−0.08***	(0.025)	−0.05**	(0.023)
Engineering	0.04	(0.025)	−0.05*	(0.026)	−0.09***	(0.024)	−0.09***	(0.023)	−0.10***	(0.023)	−0.08***	(0.023)
Agriculture/veterinary science	−0.23***	(0.030)	−0.35***	(0.030)	−0.26***	(0.028)	−0.25***	(0.026)	−0.24***	(0.026)	−0.16***	(0.026)
Medicine/health	−0.03	(0.032)	−0.11***	(0.032)	0.04	(0.031)	0.02	(0.031)	0.01	(0.031)	0.04	(0.029)
Other services	−0.02	(0.039)	−0.06	(0.041)	−0.06	(0.037)	−0.02	(0.036)	−0.03	(0.036)	−0.02	(0.034)
Defense/security	0.24***	(0.028)	0.09***	(0.028)	0.28***	(0.026)	0.36***	(0.026)	0.34***	(0.026)	0.33***	(0.025)
Others	−0.18***	(0.038)	−0.28***	(0.040)	−0.19***	(0.037)	−0.17***	(0.035)	−0.18***	(0.035)	−0.10***	(0.034)
Marital status			−0.02*	(0.013)	0.01	(0.012)	0.01	(0.011)	0.01	(0.011)	0.03***	(0.010)
Gender			0.12***	(0.008)	0.12***	(0.008)	0.12***	(0.007)	0.12***	(0.007)	0.12***	(0.007)
Experience			0.04***	(0.002)	0.05***	(0.002)	0.04***	(0.002)	0.04***	(0.002)	0.04***	(0.002)
Squared experience			−0.00***	(0.000)	−0.00***	(0.000)	−0.00***	(0.000)	−0.00***	(0.000)	−0.00***	(0.000)
Household size			−0.01**	(0.003)	−0.01***	(0.003)	−0.01***	(0.003)	−0.01***	(0.003)	−0.01***	(0.003)
Public sector					−0.33***	(0.012)	−0.36***	(0.012)	−0.37***	(0.012)	−0.30***	(0.011)
State-owned enterprises					−0.01	(0.017)	−0.02	(0.016)	−0.02	(0.016)	−0.00	(0.014)
FDI enterprises					0.21***	(0.020)	0.23***	(0.019)	0.23***	(0.019)	0.23***	(0.018)
Low skilled non-manual							0.01	(0.021)	0.01	(0.020)	0.01	(0.020)
Mid-level technicians and associates							0.15***	(0.023)	0.11***	(0.022)	0.09***	(0.022)
High-level technicians and professionals							0.25***	(0.018)	0.21***	(0.018)	0.16***	(0.016)
Leaders/managers							0.34***	(0.023)	0.30***	(0.023)	0.29***	(0.022)
Mismatch									−0.16***	(0.013)	−0.16***	(0.013)
Northern Mountains/Midlands											−0.08***	(0.021)
Northern and Southern Central Coast											−0.09***	(0.016)
Central Highlands											−0.03*	(0.018)
Southeast											−0.04*	(0.026)
Mekong River Delta											−0.08***	(0.018)
Urban											0.08***	(0.009)
Provincial GDP/capita											0.20***	(0.020)
Constant	8.96***	(0.023)	8.62***	(0.029)	8.62***	(0.026)	8.45***	(0.029)	8.53***	(0.030)	6.91***	(0.156)
Observations	38,623		38,623		38,623		38,623		38,623		38,623	
R-squared	0.043		0.192		0.286		0.321		0.331		0.371	

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Estimates are adjusted for sampling weights and clustered at the commune level. Monthly dummy variables (included)

relatedness (or occupation-education mismatch) and so on, as mentioned in Section 2.2. The effects given here are therefore net of any impact from those other variables (e.g., certain disciplines afford better opportunities for obtaining public employment).

Model 6 in Table 4 reports the estimated coefficients for twelve disciplines. Controlling for all other factors considered, Model 6 shows that relative to the reference group (arts and humanities), the economic returns are much higher in the defense and security field (33%), but lower in eight fields, namely the social sciences (-9%), journalism and information (-15%), business and finance (-9%), law (-13%), science, math and computer science (-5%), engineering (-8%), agriculture and veterinary science (-16%), and other fields (-10%). However, the results show that there is no statistical difference in wage earnings between the reference group and the fields of education and pedagogy, health and medicine, and other services. Our study provides the first evidence that in Vietnam, the arts and humanities field offers higher earnings than some quantitatively-oriented disciplines, such as science, math, computer science, and engineering, business and finance, and agriculture and veterinary science. Our results are partly in line with Fan and Zhang's in China (2015), which found that the arts/humanities bring higher returns than do some quantitatively-oriented majors, such as engineering, agriculture, economics and management.

However, our findings contrast with those from research in Germany (Grave & Goerlitz, 2012), Ireland (Kelly et al., 2010) and Australia (Chia & Miller, 2008), where graduates in the fields of engineering, math, science and computer science, and business and finance achieve much higher earnings than those graduating in the arts and humanities. Some possible reasons may be adduced to explain the contrast. First, lower returns for those in such technically and quantitatively oriented fields may be due to the poor quality of their education. Secondly, there may be a relatively low labor demand for graduates in such fields. Finally, while the arts and humanities may be a less quantitatively oriented field, these disciplines tend to promote valuable "soft skills," such as problem-solving, creative and critical thinking, adaptability and flexibility (Deming, 2019; Dumitru, 2019). It is hard to quantify such skills, but they have a prolonged influence in a wide variety of careers (Deming, 2019). Our finding suggests that from an economic perspective, studying in the arts and humanities field offers an attractive investment in Vietnam.

In Model 2, the returns for most fields fell significantly when individual characteristics were included. However, when the job sector was included in Model 3, the returns for several fields increased significantly. For example, the returns for education and pedagogy increased from -24% to -6%, while those for the social sciences rose from -20% to -11%. Given the inclusion of occupation, education-occupation mismatch, and regional characteristics in Model 6 (full model), the

Table 5
Determinants of wage earnings among graduates, by gender

Explanatory variables	Males		Females	
	Coef	Se	Coef	Se
Education/pedagogy	0.09***	(0.034)	−0.07***	(0.025)
Social sciences	0.03	(0.040)	−0.17***	(0.039)
Journalism/information	−0.08*	(0.044)	−0.17***	(0.043)
Business/finance	0.01	(0.034)	−0.14***	(0.024)
Law	−0.04	(0.037)	−0.15***	(0.033)
Science/math/computer science	0.04	(0.036)	−0.10***	(0.030)
Engineering	0.01	(0.034)	−0.12***	(0.032)
Agriculture/veterinary science	−0.07*	(0.038)	−0.18***	(0.037)
Medicine/health	0.14***	(0.043)	−0.00	(0.037)
Other services	0.11**	(0.049)	−0.15***	(0.047)
Defense/security	0.44***	(0.035)	0.33***	(0.039)
Other	−0.03	(0.047)	−0.09**	(0.046)
Marital status	0.08***	(0.016)	−0.01	(0.013)
Experience	0.03***	(0.002)	0.04***	(0.002)
Squared experience	−0.00***	(0.000)	−0.00***	(0.000)
Household size	−0.01***	(0.004)	−0.01**	(0.003)
Public sector	−0.33***	(0.015)	−0.27***	(0.014)
State-owned enterprises	−0.03	(0.019)	0.02	(0.018)
FDI enterprises	0.24***	(0.024)	0.21***	(0.023)
Low skilled non-manual	−0.02	(0.025)	0.03	(0.033)
Mid-level technicians and associates	0.11***	(0.026)	0.06*	(0.038)
High-level technicians and professionals	0.16***	(0.018)	0.14***	(0.031)
Leaders/managers	0.30***	(0.025)	0.26***	(0.037)
Mismatch	−0.18***	(0.018)	−0.13***	(0.017)
Northern Mountains/Midlands	−0.04	(0.027)	−0.12***	(0.024)
Northern and Southern Central Coast	−0.05**	(0.020)	−0.13***	(0.017)
Central Highlands	0.02	(0.022)	−0.07***	(0.021)
Southeast	0.00	(0.032)	−0.08***	(0.029)
Mekong River Delta	−0.02	(0.022)	−0.13***	(0.022)
Urban	0.07***	(0.012)	0.08***	(0.011)
Provincial GDP/capita	0.20***	(0.025)	0.19***	(0.022)
Constant	6.90***	(0.193)	7.04***	(0.173)
R-squared	0.341		0.349	
Observations	19,509		20,114	

Note: Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Estimates are adjusted for sampling weights and clustered at the commune level. Monthly dummy variables (included).

corresponding returns on education and pedagogy and health and medicine are -1% and 4% but not statistically significant. Unsurprisingly, the highest returns are found in defense and security because graduates in this field often work in the national defense or security sectors, and are paid more highly than those in the public sector.

Separate regression results for male and female graduates are displayed in Table 5. For women, all discipline coefficients are statistically significant except for health and medicine. Specifically, this indicates that of the 12 discipline coefficients, only defense and security offer higher returns (33%) than do the arts and humanities, whereas ten fields have much lower returns (-7%, -17%, -17%, -14%, -15%, -10%, -12%, -18%, -15% and -9%), for education and pedagogy; social sciences; journalism and information; business and finance; law; science, math, and computer science; engineering; agriculture and veterinary science; and other services and other fields, respectively.

However, a very different pattern emerged for male graduates. Only six field coefficients are statistically significant. Two are negative, for agriculture and veterinary science (-10%) and journalism and information (-8%), while four are positive, for education and pedagogy, health and medicine, other services and defense and security, with their corresponding returns being 9%, 14%, 11% and 44%, respectively. A comparison between men and women reveals some interesting points. The returns for the arts and humanities are higher than for most fields, ranked just after defense and security for women. By contrast, returns for men in the arts and humanities are only higher than for those in journalism and information and agriculture and veterinary science, but

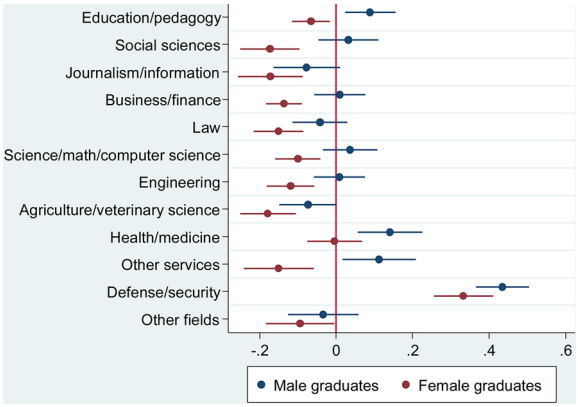

Fig. 1. Coefficient plots of returns by field of study, by gender.

lower than for education and pedagogy, health and medicine, other services and defense and security. Combined with the description of coefficient plots in Fig. 1, it is evident that degrees in the arts and humanities are more likely to bring higher returns for women, whereas studying education and pedagogy, health and medicine, and other services offer higher returns for men; defense and security offers higher returns for both. The higher returns in arts and the humanities for women may be explained by the suggestion that this field is more suitable for women than for men, enabling the former to improve their labor productivity and, consequently, their wages. Our results are similar to those of Fan and Zhang in China (2015), who found that the arts field occupied the highest position in returns on education by field of study among female graduates, while it was only in an intermediate position among male graduates.

We further analyze the difference in returns by field of study between the private and public sectors. The corresponding regression results and coefficient plots for each sector are shown in Table 6 and Fig. 2. As already mentioned in Section 2.2, we performed an additional robustness check to rule out the potential selection bias of job selection by using a switching endogenous regression model (Appendix B). While the results from the Wald test confirm the joint independence of equations, the magnitude, sign and statistical significance of coefficients on most majors are similar to those from the OLS estimator.

Looking at the private sector, we see that the coefficients of all fields are negative and statistically highly significant, except for the health and medicine, defense and security, other services and other fields. The results show that many fields, even those that are technical or quantitatively oriented, offer lower returns than do the arts and humanities. For example, the corresponding returns are much lower (-19%, -10%, -19%, -12%, -21%, -9%, -8%, and -18%) for education and pedagogy, social sciences, journalism and information, business and finance, law, science/math/computer science, engineering, agriculture and veterinary science, respectively.

The results for the public sector show a somewhat different pattern. First, as in the private sector, we find that some fields, namely the social sciences, journalism and information, business and finance, law, and engineering bring lower returns than do the arts and humanities, with the corresponding wage earnings differences being smaller than those in the private sector. Second, in contrast to the private sector, we find no difference in wage earnings between the fields of education, pedagogy and science, math and computer science, and the reference group. Notably, we find higher wage earnings for those in the fields of medicine and health, and defense and security, with their corresponding returns at 10% and 38%, respectively. For the public sector, wages are highly regulated by the Government, which in turn is the main reason why there is little variation in returns across majors except the defense and security field (The Government of the Socialist Republic of Vietnam, 2004). By contrast, private wages are determined by the

Table 6
Determinants of wage earnings among graduates, by sector

Explanatory variables	Public sector		Private sector	
	Coef	Se	Coef	Se
Education/pedagogy	0.03	(0.025)	−0.19***	(0.037)
Social sciences	−0.06*	(0.035)	−0.10**	(0.044)
Journalism/information	−0.08**	(0.040)	−0.19***	(0.046)
Business/finance	−0.06**	(0.026)	−0.12***	(0.027)
Law	−0.06**	(0.030)	−0.21***	(0.045)
Science/math/computer science	−0.01	(0.030)	−0.09***	(0.031)
Engineering	−0.06*	(0.033)	−0.08***	(0.031)
Agriculture/veterinary science	−0.11***	(0.032)	−0.18***	(0.042)
Medicine/health	0.10***	(0.033)	−0.03	(0.054)
Other services	−0.06	(0.046)	−0.04	(0.044)
Defense/security	0.38***	(0.029)	−0.09	(0.082)
Other	−0.08*	(0.042)	−0.06	(0.050)
Marital status	0.02	(0.014)	0.05***	(0.013)
Gender	0.09***	(0.008)	0.15***	(0.012)
Experience	0.05***	(0.002)	0.03***	(0.002)
Squared experience	−0.00***	(0.000)	−0.00***	(0.000)
Household size	−0.00	(0.003)	−0.01	(0.004)
Low skilled non-manual	−0.20***	(0.031)	0.06***	(0.023)
Mid-level technicians and associates	−0.11***	(0.033)	0.14***	(0.028)
High-level technicians and professionals	−0.02	(0.024)	0.18***	(0.018)
Leaders/managers	0.03	(0.026)	0.50***	(0.037)
Mismatch	−0.20***	(0.023)	−0.11***	(0.015)
Northern Mountains/Midlands	−0.06***	(0.023)	−0.08**	(0.034)
Northern and Southern Central Coast	−0.08***	(0.016)	−0.09***	(0.028)
Central Highlands	−0.01	(0.018)	−0.07*	(0.037)
Southeast	−0.06**	(0.027)	−0.00	(0.039)
Mekong River Delta	−0.06***	(0.019)	−0.07**	(0.031)
Urban	0.09***	(0.010)	0.02	(0.015)
Provincial GDP per capita	0.09***	(0.022)	0.37***	(0.028)
Constant	7.48***	(0.172)	5.56***	(0.217)
R-squared	0.400		0.346	
Observations	23,478		15,145	

Note: Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Estimates are adjusted for sampling weights and clustered at the commune level. Monthly dummy variables (included).

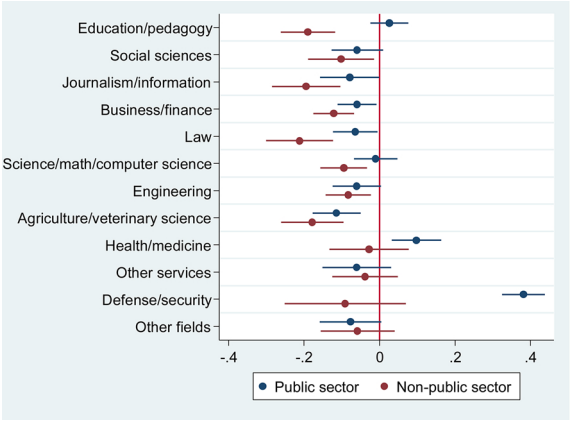

Fig. 2. Coefficient plots of returns by field of study, by job sector.

unregulated interaction of labor supply and demand. Variations in wage earnings across fields are the outcome of such interaction for the various types of human capital which the various fields represent (Finnie & Frenette, 2003).

4.2.2. Other determinants of wage earnings

Our research also provides a number of interesting findings regarding other determinants of wage earnings among graduates. The results in Table 4 show that monthly wage earnings for men are about 12% higher than for women. This gap is larger in the private sector (15%) than in the public sector (9%), however (see more in Table 5). The wage gap between the public and private sectors is -30%, whereas between the FDI and private sectors it is 23% (Table 4). The relatively low level of official government wages has emerged as one of the main causes of minor corruption in Vietnam (Duong, 2017). The wage gap between mid-level technicians/associates and manual workers (the reference group) is about 9% and is greater for high-level technicians and professionals (16%) and leaders and managers (29%). Fig. 2 confirms that within the private sector, the wage premium increases with the higher the level of occupational status. For instance, the results for the private sector in Table 6 reveal that the wage premium is 14% for mid-level technicians and associates, 18% for high-level technicians and professionals, and 50% for leaders/managers. However, the results for civil servants show a totally different picture, evident in Table 6. Specifically, no wage premium is found for high-level technicians/professionals and leaders/managers, while this amount is negative for low-skilled non-manual jobs (-20%) and mid-level technicians and associates (-11%).

Consistent with previous findings in Vietnam (Tran et al., 2019), our research finds a negative influence on graduates' wages from education-occupation mismatch, higher for men (-18%) than for women (-13%), but much higher in the public (-20%) than in the private sector (-11%). We also find that wage earnings vary across geographical regions. For instance, graduates with the same characteristics would, on average, have corresponding wage earnings that are lower (-8%, -9%, -3%, -4%, -8%) in the Northern Mountains/Midlands, Northern and Southern Central Coast, Central Highlands, Southeast and Mekong River Delta regions, respectively, than in the Red River Delta region. Table 4 shows that the urban-rural wage gap is 8%. This gap, however, is much higher in public employment (9%) than in private employment (2%) (Table 5). Finally, higher levels of provincial gross domestic product (PGDP) are also closely linked with higher levels of wage earnings. A 1% increase in the PGDP is associated with a 0.2% increase in wage earnings (Table 4). However, the results in Model 6 confirm that this link seems much stronger in the private (0.37%) than in the public sector (0.09 %).

5. Conclusion and policy implications

5.1. Summary of findings

The aim of this study was to provide an empirical analysis of earnings differences by discipline among university graduates in Vietnam, using the 2018 LFS survey. Both descriptive statistics and econometric analysis were applied in the study. The main findings can be summarized as follows.

Those graduating in business and finance account for the largest proportion of total graduates (about 29%), followed by education and pedagogy (about 27%), and engineering (around 12%). The field distribution pattern is quite different, comparing men and women. The two fields making up the largest proportion of all female graduates are education and pedagogy (about 39%), and finance and business (about 34%), while the three largest fields for male graduates include business and finance (about 23%), engineering (about 22%), and education and pedagogy (about 15%).

Looking at the field distribution by sector and region, we find a higher concentration of education and pedagogy graduates in the public sector (about 42%) and in rural areas (about 40%) than in the private sector (about 5 %) and urban areas (about 23%). Unsurprisingly, a higher number of business and finance graduates work in the private sector (about 47%) and in urban areas (about 31%) than in the public sector (about 17%) and in rural areas (about 20%). A similar distribution pattern is also found for engineering graduates; more work in the private sector and in urban areas.

Our econometric analysis shows that among Vietnamese graduates, differences in earnings by discipline are consistent and large, in many cases. This shows that relative to the reference group (arts and humanities), the field offering the highest earnings is defense and security (33%) and the field with the lowest is agriculture and veterinary science

(-16%). Notably, many other fields, even more technically or quantitatively oriented disciplines such as engineering, science/math/computer science, and business and finance, offer lower earnings than do the arts and humanities. Our research finding on the lower returns of engineering contrasts with previous findings in several high-income economies (Grave & Goerlitz, 2012), where the field offering the highest earnings has often been engineering, while the arts and humanities field has always afforded the lowest earnings.

Further econometric analysis for male and female graduates reveals several interesting points. The arts and humanities offer higher earnings than do many fields for women, and studying education and pedagogy, health and medicine and other services results in higher returns for men, whereas the defense and security field offers higher returns for both. Notably, we find that wage differentials by discipline are large and statistically significant in most cases in the private sector but not in the public sector. Specifically, the arts and humanities bring higher earnings than do most fields, except for health and medicine, defense and security, other services and other fields in the private sector. By contrast, we find in the public sector that wage earnings in the fields of medicine/health and defense/security are higher than those for the arts and humanities. Notably, we find no statistical difference in wage earnings between graduates in the fields of education and pedagogy, and science, math and computer science, and those in the arts and humanities.

We find a number of major determinants of graduates' earnings. Men earn more than women and the gender gap is larger in the private sector. Wage earnings vary considerably across sectors and occupations. FDI enterprises offer the highest earnings while the lowest earnings are found in the public sector. Wage earnings increase with higher levels of occupational status. However, this pattern is only true in the private sector. Education-occupation mismatch results in lower earnings and its negative effect is larger in the public than in the private sector. Wage earnings also differ across regions. Average wage earnings are lower in all regions than in the Red River delta region. We also note the urban-rural wage gap but this gap is much larger for public employment. Finally, wage earnings are positively linked with the level of provincial gross domestic product and this connection is much stronger for those working in the private sector.

5.2. Policy implications

There are several reasons why earnings vary across fields of study. First, there are the vagaries of the labor market for various types of human capital (which the corresponding disciplines represent), whereby short-term changes in supply or demand can affect relative earnings patterns. Second, in Vietnam's case, lower earnings for more technical or quantitatively oriented majors may be due to the low quality of education in those areas. In particular, differences in earnings across fields among public servants may result from government policies. For instance, employees in the national defense and security sectors are paid much more highly than others in the public sector.

Our research finding concerning the higher returns for arts and humanities graduates than for those in engineering signals that studying the former has been a more attractive investment than the latter. As already mentioned, our finding differs from that in several developed countries, where engineering offers the highest earnings while the lowest earnings are in the arts and humanities field. International experience indicates that educating the engineering and scientific workforce is vital for economic and technological development (Fan & Zhang, 2015). A lower rate of return for the engineering field may discourage individual investment in engineering education, which in turn would mean a shortage of engineering talent necessary to support Vietnam's modernization. Thus, comprehensive measures from both the supply and demand sides should be implemented to improve the returns for engineering, thereby attracting more future engineering students. On the supply side, the government and universities should enhance their investment in engineering and the quality of education in that field. On the demand side, it is essential to expand the manufacturing sector and improve the linkage between universities and industry, which is expected to provide more job opportunities for engineering graduates.

As already discussed, compared to employees in the private sector, government employees are disproportionately under-paid and consequently need to seek alternative avenues to earn their living (Duong, 2017). This situation is one of the main reasons why bribery and informal payments remain widespread in the education and health sectors (PAPI, 2018). This situation results from the high concentration of public servants in the education and health sectors. It may be suggested that government policy for improving wages in these sectors may be an effective way for combating corruption and promoting integrity in Vietnam.

5.3. Limitations and future research

We acknowledge that our study has certain limitations that nevertheless suggest paths for future research. First, using cross-sectional data, we are unable to estimate life-time earnings. Future longitudinal studies should examine life-time earnings differences by field of study, given the availability of longitudinal datasets. Second, introducing another interesting topic, future work should examine earnings by field of study in the first job, then at later points in time after graduation. Notably, it would be very interesting to model the choice of discipline, and such selection dynamics and omitted heterogeneity should be controlled for. Finally, in the current study, the occupation-education mismatch (OEM) variable was measured using a solely subjective approach. This suggests that future research should examine the impact of OEM on wage earnings using both objective and subjective measurements.

Declaration of Competing Interest

The author agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare absence of conflicting interests with the funders.

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Appendix A. 13 major fields of study

	Field of study
Education/pedagogy	Educational sciences; pedagogy
Arts/humanities	Arts; performance art; audiovisual art; applied arts; Vietnamese languages and culture; foreign languages and cultures; other disciplines in the humanities
Social sciences and behavior	Economics; politics; sociology; psychology; anthropology; geography
Journalism/information	Journalism; communications; library and information science; archives and museums; publishing.
Business/finance	Business; finance; banking; insurance; auditing; accounting; business administration; management
Law	Law

Science/math/computer science	Biology and applied biology; physics; earth science; environmental science; math; statistics; computer science and information technology.
Engineering	Architecture; planning; construction; mechanics; electricity; electronics and telecommunications; chemistry; materials science; metallurgy and environment; construction management; industrial management; technical physics; geological, geophysical and geodetic engineering; mining technology; food and beverage; yarn, fabric, shoes and leather; others
Agriculture/veterinary science	Cultivation; forestry; aquaculture; veterinary science
Medicine/health	Medicine; traditional medicine; health services; pharmacy; nursing and midwifery; dentistry; hospital management
Other services	Social work; hotels and restaurants; transportation; environment control protection; household business; labor safety and industrial sanitation
Defense/security	National security and defense
Others	Other fields

Sources: GSO (2018).

Appendix B. Switching endogenous regression estimates for wage differentials by field of study

Explanatory variables	Public sector		Private sector	
	Coef	Se	Coef	Se
Education/pedagogy	0.053**	0.022	−0.162*	0.086
Social sciences	−0.046	0.029	−0.092***	0.036
Journalism/information	−0.060*	0.032	−0.1732***	0.050
Business/finance	−0.068***	0.023	−0.120***	0.028
Law	−0.051**	0.024	−0.191***	0.066
Science/math/computer science	−0.015	0.026	−0.095***	0.026
Engineering	−0.081***	0.027	−0.083**	0.037
Agriculture/veterinary science	−0.118***	0.026	−0.181***	0.033
Medicine/health	0.124***	0.027	0.009	0.069
Other services	−0.058	0.038	−0.033	0.037
Defense/security	0.429***	0.025	−0.0253	0.161
Other fields	−0.070**	0.036	−0.050	0.046
Other individual variables (included)				
Regional variables (included)				
Monthly dummy variables (included)				
Wald test of independent equations				
Chi2(1) = -6.3e+06				
Prob > chi2 = 1.0000				

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Estimates are adjusted for sampling weights and clustered at the commune level. In the job selection equation, the instrumental variable is the average rate of public employment at the commune level.

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