Higher Educational Type and Major Area: Which Is the More Important Indicator of Earnings in Mainland China?

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ข้อใดเป็นตัวบ่งชี้รายได้ที่สำคัญกว่าในจีนแผ่นดินใหญ่

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Using data from Chinese General Social Survey (CGSS) 2018 which contain comprehensive information of the highly educated in mainland China, this paper estimates which of the two variables, type of tertiary education and major fields, is of greater importance to private earnings. With adoption of Ordinary Least Square (OLS) and Shapley Variance Decomposition based on R-squared, empirical results reveal considerable heterogeneity in returns to educational type (vocational college and academic university) and to major area. The former one is the more significant determinant of labor market outcomes and higher vocational qualification holders face a huge wage penalty. What’s more, the two factors show different patterns between genders: educational type matters more to women, whereas both are approximate of equal importance to men.

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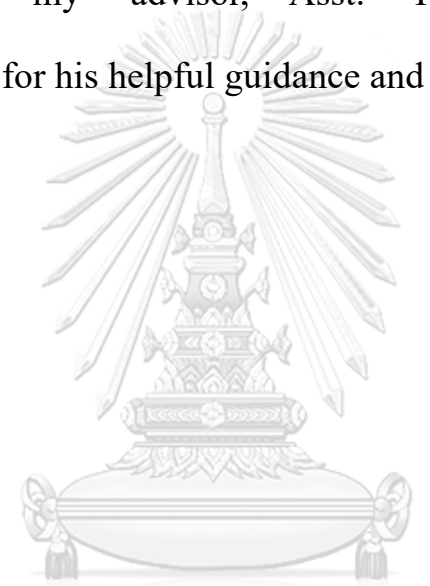

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ABSTRACT

Using data from Chinese General Social Survey (CGSS) 2018 which contains comprehensive information of the highly educated in mainland China, this paper estimates which of the two variables, type of tertiary education and major fields, is of greater importance to private earnings. With adoption of Ordinary Least Square (OLS) and Shapley Variance Decomposition based on R-squared, empirical results reveal that there is a considerable heterogeneity in returns to educational type (vocational college and academic university) and to major area. The former one is the more significant determinant of labor market outcomes and higher vocational qualification holders face a huge wage penalty. Moreover, the two factors show different patterns between genders: educational type matters more to women, whereas both are approximately of equal importance to men.

1. INTRODUCTION

A considerable part of studies in returns to education are contributed by economists. It is of interest for several reasons. The first is enrollment into schools, on the one hand, is a type of individual investment to improve human capital, hoping to receive desirable labor market outcomes. In this regard, research in this topic offers insight into the extent to which current labor market operates under control and in an efficient way (Chen & Hamori, 2009). On the other hand, education, as a public good, has its spill-over effects on the economy, such as transfers, taxes, growth rate of gross domestic product (GDP), disposable and discretionary income of residence in underdeveloped locations and so forth (Blundell et al., 2001; Guo et al., 2019). For better human resources allocation, policymakers and the public can treat relative findings as important inferences and guidelines (Fan et al., 2015; Zhang et al., 2005).

Chinese authorities have always given priority to development of tertiary education ever since its foundation in 1979 (Stewart, 2015). Enrollments entering higher education institutions (HEIs) increased slightly from 619,000 to 754,000 during a seven-year period (1985 - 1992).

The turning point came in 1999 when the Central Committee of China issued an educational reform which planned to expand its tertiary education and to cultivate talents and potentials highly demanded by current economic development (Hou et al., 2016). It was after that higher education experienced an unprecedented expansion both in the number of HEIs and enrollments (Hou et al., 2016; Ye et al., 2018). As presented in Figure. 1., within only five years (2005 - 2010), the number of freshmen rose by over 1 million with an admission rate of over 83%. Furthermore, Ye et al. (2018) stated that in 2010, the nation launched a plan for its medium and long-run education reform, projected to increase investment in education and carry out institutional reforms to promote educational balance and equity.

Undoubtedly, massification of higher education has made it available to a wider population, but it has also caused a series of issues: declining funding together with climbing tuition fees hindered those at low social status, leading to an even bigger gap between rich and poor; uneven economic development across regions cannot guarantee a generally identical opportunity for everyone to continue studying; teaching objectives, course design and resource management lagged behind the rapidly changing world (Ye et al., 2018); Oversupply of the white collar from academic universities and high demand for the blue collar from vocational colleges have formed an unbalanced labor market (Altbach, 2016; Meng et al., 2013; Shang et al., 2020; Zhang et al., 2021)

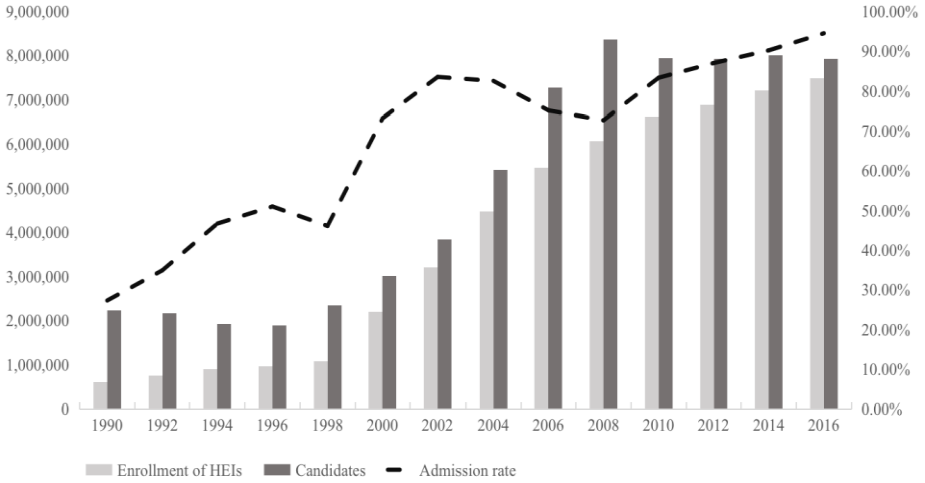

Figure. 1. *HEI Admission 1990 - 2016*
Source: Chinese National Bureau of Statistical (2018).

Starting at the bottom, returns to schooling in China had increased considerably during 1990s before declining gradually from mid-2000s onwards (Patrinos & Psacharopoulos, 2020; Montenegro & Patrinos, 2014; Yang, 2005; Ye, 2021). As for higher vocational schooling, results vary across countries. In nations with a long history of VET, graduates with vocational qualifications enjoy wage advantage over those with academic degrees, such as Finland, Sweden, Denmark and Norway (Geel & Backes, 2011; Pfister et al., 2017; Wolter & Weber, 1999) . Other countries show a different pattern (Conlon, 2005; Dearden et al., 2002). In the context of China, findings differ in terms of education level and of group studied. Students with average earnings potential or poor grades may be better off studying in vocational high school rather than academic one (Guo & Wang, 2020; Dai & Martins, 2020). There is an obvious salary premium for those cultivated in academic universities (Kang & Peng, 2021; Patrinos & Psacharopoulos, 2020). Regarding returns to major area, STEM and business and related are generally the most profitable major fields and Humanities the least in most countries.

This paper is meaningful for the following reasons. At first, studies about educational returns were published mainly before 2010, thus updated information is highly needed. Secondly, much attention has been paid to vocational high schools but little to higher vocational colleges. What's more, even though most researchers have estimated daily, weekly or annual income rewards offered by an additional year of higher education (including higher vocational and academic schooling), estimations of return difference between the two education categories are obviously scarce. Gender gap has been a great concern in major related work, but almost no analysis considers the effect of type of higher education within each major group. More importantly, there is no literature to answer whether education type or major field is the more crucial

determinant of earnings in China, this paper thereby is to fill the research gap.

To do so, we constructed a sample of 999 higher education graduates aged between 18 and 60 based on Chinese General Social Survey (CGSS) 2018 of 12,787 participants. This paper first estimates modified Mincer earnings regressions with a series of control variables including gender, labor market experience, ethnic group one participant belongs to, employment type (self-employed or not), as well as job type to explore the comparative impact of educational type on personal yearly income to area of study. Next, we decompose percentage of explained variances in logged form of earnings by each variable. In addition to analysis of the whole sample, the same methodology is also employed to gender, educational type and major field sub-samples to estimate whether the conclusions drawn from the entire sample still hold.

Estimation results indicate payoffs from type of tertiary education is significantly higher than that from field of study. Those who graduate from an academic university earn 25% higher than those from a vocational college and those who major in *Major Applied Science* and *Social Science* field own wage advantage over those in *Humanities*. While both factors approximately share the impact on male income, educational type plays a decisive role in female earnings.

The following is the structure of this paper. After an overview of research findings in monetary returns to education, to vocational education and to major criteria in China and worldwide as well in Section 3, Section 4 introduces the Chinese education system, sample source and construction. Section 5 presents empirical results from OLS and Shapley Variance Decomposition for the whole sample, two groups for gender, two groups for education types and lastly five groups for major areas. Conclusions and discussions are in Section 6.

2. LITERATURE REVIEW

Much research on education return has been done and thus highlighted a number of potential problems and issues of local labor market and education policies in the nations studies. Scholars shed light mainly on the following three perspectives: *Private returns to schooling* measures the extent to which individual's education (education year, type, field of study, quality of schools and others) can affect his or her earnings. There is a substantial literature in this topic exploring percentage change in daily, weekly or annual personal income associated with an additional year of study; *Societal returns to education* offers insight into spill-over effects from education to the society, such as transfers, taxes, growth rate of Gross Domestic Product (GDP),

disposable and discretionary income of residence in underdeveloped locations and so forth. Acemoglu and Angrist (2000) concluded two commonly-used strategies: one discovers change of total earnings in an area resulting from the change of average years of schooling there and the other explores after deduction of private returns to schooling, the extent to which the share of highly educated residence in an area would affect total wages there. According to Blundell et al. (2000), *non-financial returns to education* is estimated by the contribution of schooling to individuals or economies in non-economic aspects, such as reducing income inequity, and forming better working environment.

2.1 Private returns to education

Dating back to 1999, China had a relatively lower individual monetary returns to schooling to average value of other Asian countries and Mincer-type earnings equation has been widely used. This is proved by evidence from Maurer-Fazio (1999) by estimating returns to education for a pooled sample and also gender sub-samples employing Mincerian equation and dataset from Chinese Household Income Project (CHIP) 1988 and Chinese Labor Market Research Project (CLMRP) 1992. Results from this paper suggested annual earnings would rise by about 1% but markedly lower than the figure for South Korea and Indonesia (Maurer, 1999; Yang, 2005). In addition, Sub-sample analysis shown women gain higher income rewards from education than men and the return for rural areas is higher than that for urban ones. These findings are consistent with Kang and Peng (2012) and Johnson and Chow (1997). Later, Li (2003) provided estimates for Chinese urban areas and explored how type of income (hourly and annual wage) applied to equations can affect regression results. It is noteworthy that overall return with usage of hourly wage is above that for annual wage (Li, 2003; Gunderson & Oreopolous, 2020), different from the opinion in Card (1999).

Subsequent to 1999, Ren and Miller (2012) indicated scholars seem to reach a consensus that China experienced a fast growing returns to education and the figure for female is higher than that for male. There is a vast body of research related to important stages throughout the revolution of Chinese education structure, with the purpose of revealing the efficiency of relevant policies (Cuifu & Hamori, 2009; Ma & Zhang, 2017). The contribution by Guifu and Hamori (2009) emcompassed two respects: the first is that contribution of education to hourly wage is 7% - 8% in urban China, similar to the international average; what also deserves special attention is that the conclusion of gender disparities drawn from instrumental variable (IV) is opposite to that from ordinary least square (OLS) and the difference is even bigger after attenuating potential biases.

More recently published work presented a downward trend for overall returns to education from mid-2000s and afterwards and a soaring pattern for individuals with master degree but a slightly decreasing trend for those with bachelor degree, namely meaning bachelor-degree graduates were adversely affected by the higher education expansion policy but more advanced-degree holders positively (Ma & Zhang, 2017; Fan et al., 2015; Kang & Peng, 2012). This may be explained by unbalanced labor market of bachelor-degree holders due to dramatically rising supply and over-education (Ma & Zhang, 2017).

In summary, before education reform returns to education in China is extremely low. From 1990s to mid-2000s, it increased dramatically, almost doubling, and reached the global benchmark (Patrinos & Psacharopoulos, 2020; Montenegro & Patrinos, 2014; Yang, 2005; Stewart, 2015). However, from mid-2000s onwards there is empirical evidence of constant returns to vocational college and a signal of decreasing returns to academic universities (Ye, 2021). The final feature is the impact of schooling on earnings gradually decreases as labor market experience increase (Maurer, 1999; Li, 2003; Gong, 2017).

2.2 Returns to Vocational Education

Numerous studies have been devoted to whether wage penalty or premium exists for vocational school students at each education level compared to their respective academic counterparts. Findings for China vary across education levels. Aiming at upper secondary students, different targeting group for comparison leads to estimation variation. For underachieving students, studying in vocational high schools may be a better choice, which is especially true for females (Guo & Wang, 2020). Dai and Martins (2020) regarded the whole general high school students as baseline and suggested there is no significant wage differentials whereas students with average earnings potential yield more benefits. Li and Liu (2012) also found positive labor market outcomes of vocational schooling at high school level. Similar pattern can be discovered in Indonesia (Newhouse & Suryadarma, 2011). Concerning higher vocational education, most existing research has proved the vocationally educated face a relatively lower earnings by schooling to the academically educated counterparts (Kang & Peng, 2021).

Another perspective considers the quality and effectiveness of Vocational Education and Training (VET) from a standpoint of human resources development. Studying at vocational high school tends to incur relatively higher probability of absence from classes and lower general skills to studying in general high school (Loyalka et al., 2016). Similarly, using hierarchical linear modeling (HLM) to analyze their self-collected data of a province, Yi et al. (2018) identified a surprising fact that only

around 10% students completed their tasks. Misbehaving, such as cheating, disrespect to instructors, was considered as highly common (Yi et al., 2018). Cross country analysis by Brunello and Rocco (2017) again confirmed the evidence that the vocationally-educated are in a weaker position in terms of both educational payoff and their basis abilities compared with the academically-educated, but Bishop and Mane (2004) and Meer (2007) revealed a totally different situation in the United States.

Patrinos and Psacharopoulos (2020) concluded that in developing countries employees who chose higher vocational education encounter a dramatically lower income rewards than those who received higher academic education. In developed nations, findings vary by educational structures and strategies. According to Pfister et al. (2017), no matter from a financial or non-financial point of view VET is respected and admired to the same extent as academic schooling and in some particular situations even higher. This is because Swiss, similar to other European countries, has a well-constructed and efficient vocational education system. Geel and Backes (2011) adopted OLS and IV estimations and concluded that vocational qualifications are comparably more profitable and favored option to academic ones, for which part of supporting reasons is courses in VET schools are considered more practical and job-oriented from enterprise's point of view in Swiss, the same as Wolter and Weber (1999) for Switzerland. On contrary, vocational qualification holders in the UK face a large wage disadvantage, approximately 20% at NVQ level 4 (equivalent to undergraduate level in academic field), even after adding controls of abilities (Conlon, 2005; Dearden et al., 2002).

2.3 Returns to field of study

Researches in monetary returns to major criteria are all carried under a hypothesis that labor market rewards differ significantly among major studied (Finnie & Frenette, 2003; Webber, 2014). Three main questions of interest are: firstly, overall earnings effect of discipline studied; secondly, majors within which one gender group have return premium over the other; finally, major ranking based on returns within gender sub-samples.

To answer the first question, Finnie and Frenette (2003) revealed that "STEM gains the highest benefits and Arts, Humanities and Social Sciences the lowest in Canada" (p.190), similar to results in Webber (2014) for the United States and Shang et al. (2020), Fan and Zhang (2015) as well as Hu and Vargas (2015) for China. However, this pattern is not always consistent across countries. The best paid subject category in Swiss lies in commercial and related fields and the worst in social and service fields, with a profound disparity about 30% (Pfister et al., 2017), whereas individuals

specialized in economics, law and business are more preferable to humanities in the UK (Chevalier, 2011; Walker, 2020). Some paper attempts to better understand gender wage differentials within each discipline. Chevalier (2011) suggested that economics, law, IT and medicine and related seem to be more lucrative for males, while education and linguistic studies are dominated by females, in line with Machin and Puhani (2005) for Britain, France and Germany.

With regard to subject rankings based on wage returns, Walker and Zhu (2011) found that field of study does not make a huge difference to female returns to education, while males specialized in some majors, law, economics and management, enjoy higher returns than females. However, regardless of gender, top rewarding majors are computer science, medicine, law and polytechnics in Greece (Livanos & Pouliakas, 2011).

2.4 Gender Gap

The literature in gender payment gap has found large variations in the context of different countries. For China, although most research has proven women' s advantage over men, opposite conclusion was drawn due to different methods and sample selection adopted (Li, 2003; Maurer, 1999; Guifu & Hamori, 2009; Ma & Zhang, 2017; Gunderson & Oreopolous, 2020; Gong, 2017; Livanos & Pouliakas, 2011).

From literature view, there are virtually no studies investigating whether type of education or major field is the more dominant determinant of individual earnings for highly educated respondents. Pfister et al. (2017) seems to be the first in the context of Swiss.

3. DATA & SAMPLE

3.1 The Chinese Education System

To guarantee all studying-age children and teenagers' rights to be educated, Compulsory Education Law took effect in 1986. All children must be supported by the government and their guardians to receive nine-year compulsory schooling up to junior secondary without tuition fee and other expenses of basic materials.

Vocational education is composed of three levels, elementary, secondary and higher

levels. The first two are conducted by elementary vocational schools and secondary vocational schools respectively, sharing the school year with general junior secondary school and senior secondary school respectively. Higher vocational colleges are responsible for higher vocational and technical level, with the mission of cultivating highly skilled talents, including senior mechanics, technicians, senior technicians and so forth. Academic study follows the route of general junior high school, senior high school and then HEIs offering bachelor degrees, after which undergraduates can pursue a master or doctoral degree. Academic schooling focuses on training high-level talents with different levels of academic research ability corresponding with the degree level of their interest. The two educational tracks are not totally separated, meaning one can mix them during hie or her schooling, for example, you can enter into general high school when finishing elementary vocational education as depicted in Figure. 2.

As indicated by Shi (2013), higher vocational and academic education have differentiated objectives: the former cultivates practical skills and abilities, such as fixing digital products, decorate houses and so forth, whereas the latter aims to train underlying principles and logics, enabling students to invent new and creative objects in their specialized field, such as creating a new car battery with little damage to the planet but long-lasting life. In addition to different aims, bachelor-degree programs in higher academic universities provide diplomas (graduation certificate) and bachelor degrees after 4 years of learning, while higher vocational colleges only offer diplomas after 2 or 3 years of schooling. Although both are applicable to senior high school graduates, those who get enrollment into higher academic universities have higher scores in the Chinese university entrance exam, known colloquially in Chinese as “gaokao”, than those accepted by the vocational colleges.

3.2 Chinese General Social Survey

Chinese General Social Survey (CGSS) is the first national, continuing and comprehensive survey in China, funded by the National Natural Science Fund of China (NSFC) and conducted by Chinese Social Survey Network (CSSN), cooperating with 48 universities and academic institutions. Data are gathered by annual face-to-face interview with more than 10,000 citizens aged 18 and above covering all provinces in Chinese mainland except Hong Kong, Taiwan and Macau. Adopting stratified PPS random sampling ensures selected samples can represent the population of the entire country effectively. The first survey was carried out in 2003 and, most recently, 2018 containing data of 12,787.

3.3 Sample Construction

The CGSS 2018 suits our research demand perfectly. The database offers comprehensive reliable and representative information of post-secondary graduates from HEIs. Also, their educational type and studying field are recorded in detail. Moreover, there are a substantial number of personal and family information relating to accommodation, employment, education as well as economic condition, such as employment type, job type, ethnic group one belongs to, living address, graduation year, earnings and so forth, making sufficient control variables available.

For sample construction, our targeting group are those between 18 and 60 years old who have graduated from either vocational or academic HEIs. Furthermore, those in the top and at the bottom 5 percent of the earnings distribution are excluded. To avoid noise form other factors and to capture income differentials by educational type, we also drop postgraduates because higher vocational education only exists during undergraduate in China. Eventually, 999 observations are left for analysis.

4. ESTIMATION STRATEGY

4.1 OLS & Shapley Variance Decomposition

Following Pfister et al. (2017), we adopt the following earnings equation modified base on human capital earnings equation by Mincer (1958).

$$\ln(earnings) = \alpha T + \beta S + \gamma C + \epsilon \quad \text{..... (1)}$$

where *ln(earnings),* the explained variable, is the natural log of annual gross income in CNY, and *T* and *S* represent our independent variables, type of higher education (academic and vocational education) and major area of study, respectively. α, β and γ are coefficients of corresponding variables and ε is the error term. Detailed description of variables can be seen in Table. 1.

For type of education, we define a dummy for academic education. There are mainly two types of tertiary education for post-secondary students in China mainland: Higher academic education is mainly conducted by higher academic universities, which are Higher Educational Institutions (HEIs) providing undergraduates with both diplomas (graduation certificate) and bachelor degrees after 4 years of learning. Higher vocational colleges in charge of higher vocational education only offer diplomas after 2 or 3 years of schooling. One respondent's type of higher education is categorized

only according to his or her final schooling, i.e. one who studied in an academic university after graduation in a vocational school is marked as “academic education”.

Table. 1. *Variable Description*

Abbreviation	Variable	Definition
ln(earnings)	-	Natural log of annual gross income in CNY
T	Type of higher education	T = 1 if respondents graducated from acadmic uni versity, otherwise T = 0
S	Major field	Dummy variables for *Social Science, Natural Science, Major Applied Science* and *General Applied Science*, with *Humanities* as a base group
C	Control Variables	Gender (male = 1, otherwise 0)
		Ethnic group (Han population = 1, otherwise 0)
		Employment type (self-employed = 1 otherwise 0)
		Job type (full-time = 1, otherwise 0)
		Work experience (3-5, 6-8 , 9-13, 14-18, 19-25, 26 years and above with 0-2 as a base group)

For the field of study, we distinguish among five discipline groups bringing from Wang and Peng (2015) : *Humanities* as a base group (Including Philosophy, Modern Languages, History and Archaeology, English Language, English Literature, and related), *Social Science* (Including Statistics and Operations Research, Sociology, Political and International Relations Studies, Economics and Econometrics, Accounting and Finance, Psychology, and related) , *Natural Science* (Including Physics and Astronomy, Mathematics, Earth and Ocean Science, Environmental Science Research, Chemistry, Materials Science, Biology and Bio-medical Engineering, Geography and related), *Major Applied Science* (Including Engineering, Medicine, Business, Law, and related) and *General Applied Science* (Including Linguistics, Education, Communication and Journalism, Art and Design, Architecture, Agricultural Sciences, and related). Dummy variables for *Social Science, Natural Science, Major Applied Science and General Applied Science* are created with *Humanities* as a base group.

C represents the following series of control variables: gender (male or female), ethnic group (Han population or others), employment type (self-employed or not), job type (full-time or part-time), and labor market experience after graduation (0-2, 3-5, 6-8, 9-13, 14-18, 19-25, and 26 years and above). The Han population, the largest ethnic group, accounts for about 92% of Chinese population with 56 ethnic groups in total. As minorities normally live in less-developed areas and have relatively lower standard of living compared to the Han population, a dummy for being Han population (Han) is needed to avoid confounding problem. With regard to work experience, the CGSS 2018 provides no precise information about it. We therefore calculate the survey year (2018) minus one's graduation year as a proxy.

In addition to OLS, Shapley variance decomposition based on R-squared is employed to make available the respective percentage contribution of tertiary education type and that of major field to variances in yearly income. It is a method of variance components analysis (VCA) derived from Shorrocks (2013) to quantify each explanatory variable's contribution to R-squared and has been widely used in a variety of fields. Also, Sharapov et al. (2021) proved this technique is more reliable and accurate than ANOVA and HLM.

Table. 2. *Summary Statistics*

	N	Mean	Sd	Min.	Max.		n	Mean	Sd	Min.	Max.
ln(earnings)	999	11.06	0.58	8.00	12.13	Self-employed	999	0.08	0.27	0	1
Academic	999	0.55	0.50	0	1	Full-time	999	0.97	0.18	0	1
Major Area						*Experience*					
Humanities	999	0.09	0.29	0	1	0-2	999	0.12	0.32	0	1
Social Science	999	0.18	0.39	0	1	3-5	999	0.17	0.37	0	1
Natural Science	999	0.07	0.25	0	1	6-8	999	0.15	0.36	0	1
Major Applied Science	999	0.52	0.50	0	1	9-13	999	0.19	0.40	0	1
General Applied Science	999	0.13	0.34	0	1	14-18	999	0.17	0.38	0	1
Gender (male)	999	0.50	0.50	0	1	19-25	999	0.11	0.31	0	1
Han	999	0.95	0.21	0	1	26+	999	0.09	0.28	0	1

Source: Chinese General Social Survey (CGSS) 2018.

4.2 Summary Statistics

As is shown is Table. 2. mean of the natural log of annual gross income is 11.062, approximately equal annual earnings of 63,708 in CNY. It is also shown that 55% of the individuals continue their post-secondary study in academic universities, and the left 45% in vocational colleges. Concerning major area, *Major Applied Science*

accounts for the largest portion, about 52%, followed by *Social Science* and *General Applied Science*, approximately 18% and 13% respectively. *Natural Science* is the smallest group, at only 7%. 95% of survey participants are Han population, which is a strong proof that our sample is representative.

5. EMPIRICAL RESULTS

5.1 Entire Sample Analysis

5.1.1 OLS Results for Entire Sample

The results of the whole sample are shown in Table. 3. Four models are specified. Specification (1) only contains dummies for educational type and work experience, thus revealing earnings differential by type of tertiary education. Similarly, Specification (2) substitutes type of education with major fields. On the basis of Specification (2), Specification (3) includes educational type. Specification (4) contains all educational choice variables and all control factors mentioned in variable description part.

For higher education type, it is estimated that returns to academic university is around 25% higher than that to vocational college, statistically significant at 1%. In terms of subject area, individuals majoring in the *Major Applied Science* earn 15.8% higher than their counterparts in *Humanities* field with a significance level at 5%. Similar pattern can be seen in *Social Science*, social science majoring graduates enjoy approximate 14% higher income than those in *Humanities*, statistically significant at 5% level. The results are in line with previous research about China (Kang & Peng, 2021; Patrinos & Psacharopoulos, 2020; Brunello & Rocco, 2017; Shang et al., 2020; 36 Fan & Zhang, 2015; 37 Hu & Vargas, 2015).

5.1.2 Shapley Variance Decomposition for Entire Sample

Table. 4 reports results from Shapley variance decomposition. All independent variables explain about 11.46% of heterogeneity in logged annual earnings. The variance resulting from educational type is 0.0153 which accounts for the biggest proportion of the explained variance, approximately 40%, among all independent factors. The contribution of area of study equals 0.0006 with its 11% share of explained variance in *ln(earnings),* less than one-third of the figure for education type. As presented in rows 6-10, working experience contributes to nearly 20% of explained earnings difference, followed by Han population with its figure of 13%.

The left three factors' contributions are all below 7%.

In summary, type of higher education accounts for more than three times as much the explained variance in earnings as major field. Conversely, Pfister et al. (2017) suggested major field is relatively more important in deciding wage in Swiss because the value of work is judged more on field of study than on education type. The vocationally-educated in China, however, appear to suffer from employment discrimination. They are considered less capable than bachelor-degree holders, a majority of local firms and corporations thereby set graduation from academic universities as a prerequisite of job application even though some positions actually don not require advanced abilities (Xu & Zhang, 2000).

Table. 3. *OLS Results for Entire Sample*

	Specification			
	1	2	3	4
Academic	0.2404 (0.0360)***		0.2478 (0.0358)***	0.2511 (0.0358)***
Humanities		Base	Base	Base
Social Science		0.1152 (0.0722)	0.1452 (0.0707)**	0.1399 (0.0704)**
Natural Science		0.0665 (0.0903)	0.0776 (0.0883)	0.0491 (0.0884)
Major Applied Science		0.1606 (0.0636)**	0.1901 (0.0623)***	0.1584 (0.0627)**
General Applied Science		−0.0383 (0.0765)	-0.010 (0.0748)	-0.0096 (0.0745)
Experience				
0-2	Base	Base	Base	Base
3-5	0.2837(0.0673)***	0.2893(0.0685)***	0.2917(0.0669)***	0.2850(0.0666)***
6-8	0.2909(0.0689)***	0.2912(0.0701)***	0.2921(0.0685)***	0.2843(0.0681)***
9-13	0.3401(0.0655)***	0.3393(0.0667)***	0.3440(0.0651)***	0.3384(0.0648)***
14-18	0.4325(0.0669)***	0.4169(0.0682)***	0.4460(0.0668)***	0.4399(0.0665)***
19-25	0.3672(0.0743)***	0.3303(0.0754)***	0.3764(0.0740)***	0.3508(0.0739)***
26+	0.4345(0.0799)***	0.4084(0.0816)***	0.4520(0.0799)***	0.4248(0.0801)***
Gender (male)				0.1237(0.0363)***
Han				0.1628(0.0828)**
Self-employed				-0.0200(0.0658)
Full-time				0.0135(0.1015)
Constant	10.6196 (0.0559)***	10.6560 (0.0796)***	10.4794 (0.0818)***	10.2774 (0.1520)***
Adjusted R^2	0.0756	0.0475	0.0908	0.1011
R^2	0.0821	0.0570	0.1007	0.1146
Sample size	999	999	999	999
Prob>F	0	0	0	0

Notes: Standard errors are in parentheses. ***, ** and * represent 1%, 5% and 10% significance level, respectively (applicable to all tables); *Source:* CGSS 2018.

Table. 4. *Shapley Variance Decomposition for the Entire Sample*

	Variance	Percentage of total variance	Percentage of explained variance
Total variance	0.3394	100	
Explained variance	0.0389	11.46	100
Type of higher education	0.0153	3.91	39.29
Subject area	0.0044	1.47	11.32
Gender (male)	0.0024	1.28	6.07
Han	0.0051	0.42	13.21
Self-employed	0.0018	0.03	4.68
Full-time	0.0022	0.01	5.74
Experience	0.0077	4.34	19.69

Source: Shapley variance decomposition based on CGSS 2018.

Table. 5. *OLS Results for Female & Male*

	Specification			
	1	2	3	4
Female				
Academic	0.3248 (0.0546)***		0.3233 (0.0550)***	0.3156 (0.0552)***
Humanities		Base	Base	Base
Social Science		0.0263(0.0976)	0.0646(0.0946)	0.0664(0.0947)
Natural Science		0.0866(0.1415)	0.0515(0.1370)	0.0721(0.1372)
Major Applied Science		0.0436(0.0895)	0.0562(0.0866)	0.0581(0.0868)
General Applied Science		-0.1092(0.1044)	-0.0788(0.1011)	-0.0585(0.1015)
Experience				
0-2	Base	Base	Base	Base
3-5	0.3796(0.0974)***	0.4039(0.1009)***	0.3810(0.0977)***	0.3778(0.0973)***
6-8	0.3416(0.0992)***	0.3348(0.1037)***	0.3256(0.1003)***	0.3294(0.0973)***
9-13	0.3666(0.0929)***	0.3555(0.0969)***	0.3557(0.0937)***	0.3523(0.0932)***
14-18	0.5119(0.0956)***	0.4773(0.0995)***	0.5082(0.0963)**	0.5228(0.0961)***
19-25	0.4496(0.1161)***	0.3988(0.1201)**	0.4605(0.1166)***	0.4557(0.1161)***
26+	0.6224(0.1274)***	0.5496(0.1331)**	0.6131(0.1292)***	0.6388(0.1305)***
Han				0.3540(0.1293)

				***
Self-employed				-0.0509(0.1161)
Full-time				0.1196(0.1606)
Constant	10.4371 (0.0798)***	10.6302 (0.1111)***	10.4148 (0.1135)***	9.9589 (0.2413)***
Adjusted R^2	0.1103	0.0481	0.1099	0.1195
R^2	0.1229	0.0674	0.1297	0.1444
Sample size	495	495	495	495
Prob>F	0	0	0	0
Male				
Academic	0.1743 (0.0464)***		0.1900 (0.0459)***	0.1902 (0.0462)***
Humanities		Base	Base	Base
Social Science		0.2626(0.1090) **	0.2880(0.1075) ***	0.2874(0.1082) ***
Natural Science		0.0779(0.1199)	0.1100(0.1183)	0.1091(0.1189)
Major Applied Science		0.2670(0.0935) ***	0.3041(0.0924 ***	0.3035(0.0930) ***
General Applied Science		0.0657(0.1149)	0.0940(0.1133)	0.0939(0.1143)
Experience				
0-2	Base	Base	Base	Base
3-5	0.1398(0.0912)	0.1423(0.0914)	0.1584(0.0900)*	0.1577(0.0904)*
6-8	0.2017(0.0936) **	0.2151(0.0938) **	0.2211(0.0924) **	0.2210 (0.0927)**
9-13	0.2927(0.0903) ***	0.2985(0.0906) ***	0.3070(0.0891) ***	0.3074(0.0895) ***
14-18	0.3246(0.0917) ***	0.3278(0.0921) ***	0.3534(0.0908) ***	0.3536(0.0911) ***
19-25	0.2303(0.0956) **	0.2009(0.0962) **	0.2360(0.0950) **	0.2361(0.0954) **
26+	0.2329(0.1012) **	0.2460(0.1018) **	0.2782(0.1005) ***	0.2776(0.1011) ***
Han				0.0066(0.1058)
Self-employed				-0.0074(0.0769)
Full-time				-0.0242(0.1288)
Constant	10.83(0.0769) ***	10.7021(0.1152) ***	10.5550(0.1189) ***	10.5734(0.1948) ***
Adjusted R^2	0.0429	0.0419	0.0722	0.0666
R^2	0.0562	0.0609	0.0925	0.0926
Sample size	504	504	504	504
Prob>F	0	0	0	0

Source: Chinese General Social Survey (CGSS) 2018.

5.2 Sub-sample Analysis

In this part, we will begin with exploring whether the findings from the whole sample still hold between two gender groups. Next, seven subgroups are constructed on the basis of two educational types and five major criteria before analyzing differences among these groups by means of OSL and variance decomposition.

5.2.1 Gender Analysis

There is strong empirical evidence from existing study indicating gender difference in terms of returns to education (Li, 2003; Maurer, 1999; Guifu & Hamori, 2009; Ma & Zhang, 2017; Gunderson & Oreopolous, 2020; Gong, 2017; Livanos & Pouliakas, 2011). Thus, we analyze returns to educational type and subject area within each gender.

Table. 6. *Shapley Variance Decomposition for Female and Male*

	Female			*Male*		
	Variance	Percentage of total variance	Percentage of explained variance	Variance	Percentage of total variance	Percentage of explained variance
Total variance	0.3913	100		0.2797	100	
Explained variance	0.0565	14.44	100	0.0259	9.26	100
Type of education	0.0220	5.62	38.92	0.0075	2.68	28.94
Subject area	0.0034	0.86	5.96	0.0090	3.20	34.56
Han	0.0054	1.37	9.49	0.0001	0.02	0.22
Self-employed	0.0005	0.12	0.83	0.0000	0.009	0.10
Full-time	0.0002	0.06	0.42	0.0000	0.006	0.06
Experience	0.0251	6.41	44.4	0.0094	3.35	36.18

Source: Shapley variance decomposition based on CGSS 2018.

Table. 5. reports the results of OLS for the two parties. Among females, academic-pursing women earn 31.5% higher than their vocational counterparts at 1% significance level. Although academically educated male earn more than their vocationally educated counterparts, the income difference between two parties is much lower than the figure for women, at approximately 19%. Gender difference can also been recognized in study field. Regression results for women suggest that none of study areas is significant, whereas men majoring in Social Science and Major Applied Science enjoy 29% and 30% more income respectively than those in Humanities.

The variance decomposition results in Table. 6. prove these differences. Variance in

female earnings (0.3913) is approximately 40% above the figure for male (0.2797). Type of education owns its variance of 0.0220 which contributes to nearly 39% of the earnings variance among women, while the figure for subject area (0.0034) is far less than that for educational type, with only 5% share of income differentials. In contrast, the decomposition results for men represent there is no huge heterogeneity in variance between the two factors of interest, 0.0075 for education type and 0.0090 for major filed. Hence, the explained proportions of male income variance attributable to education type and subject area are 29% and 34%, respectively.

In conclusion, apparently there is gender difference in returns to educational type and subject area. Type of education has more impact on female earnings while both variables are approximately of equal importance to male earnings in line with existing research (Blundell et al., 2001; O'Leary & Sloane, 2005; Ren & Miller, 2012; Ma & Zhang, 2017).

Table. 7. *OLS Results for Vocational & Academic Groups*

	Vocational		*Academic*	
	Specification			
	1	2	1	2
Humanities	Base	Base	Base	Base
Social Science	0.2290(0.1185)*	0.2122(0.1174)*	0.0727(0.0887)	0.0762(0.0889)
Natural Science	0.2272(0.1502)	0.1448(0.1504)	-0.0154(0.1087)	-0.0207(0.1091)
Major Applied Science	0.2159(0.1076)**	0.1434(0.1084)	0.1803(0.0763)**	0.1713(0.0768)**
General Applied Science	0.0461(0.1256)	0.0344(0.1246)	-0.0556(0.0935)	-0.0530(0.0936)
Experience				
0-2	Base	Base	Base	Base
3-5	0.2885(0.1111)***	0.2659(0.1100)**	0.2903(0.0833)***	0.2882(0.0833)***
6-8	0.2512(0.1141)**	0.2350(0.1126)**	0.3165(0.0851)***	0.3098(0.0852)***
9-13	0.3238(0.1080)***	0.3091(0.1066)***	0.3537(0.0813)***	0.3496(0.0814)***
14-18	0.4505(0.1060)***	0.4213(0.1050)***	0.4259(0.0865)***	0.4294(0.0867)***
19-25	0.3150(0.1125)***	0.2776(0.1117)**	0.4533(0.1018)***	0.4442(0.1025)***
26+	0.4329(0.1224)***	0.3810(0.1219)***	0.4670(0.1082)***	0.4596(0.1089)***
Gender (male)		0.2075(0.0572)***		0.0605(0.0472)
Han		0.2073(0.1239)*		0.1049(0.1130)
Self-employed		0.0480(0.0890)		-0.1301(0.1006)
Full-time		-0.0101(0.1323)		0.0573(0.1666)
Constant	10.4520(0.1249)***	10.2203(0.2211)***	10.7473(0.0947)***	10.5767(0.2229)***
Adjusted R^2	0.0396	0.0659	0.0671	0.0673
R^2	0.0609	0.0950	0.0841	0.0912
Sample size	451	451	548	548
Prob>F	0.0019	0	0	0

Source: Chinese General Social Survey (CGSS) 2018.

5.2.2 Type of Education & Subject Area

The following part pays attention to differences among subgroups divided by educational type and subject area. To compare vocational and academic groups, we firstly estimate OLS regressions for both and then decompose variance of earnings into subject area and control variables. This therefore makes available the contribution of each subject area to variance of earnings within each group and the extent to which the influence of the factor vary within each group. Secondly, the same strategy is adopted to comparison among major filed sub-samples.

Regression results for educational filed within each educational type are shown in Table. 7. The results are consistent with our previous conclusion for the entire sample: individuals specializing in *Social Science* and *Major Applied Science* earn more than those in *Humanities*. Variance decomposition results for each educational type are shown in Table. 8. Emphasis should be laid on three respects. Overall, the two groups show no huge difference in variance of earnings: 0.3515 for individuals following vocational track and 0.3082 for those following academic path. That means vocationally educated graduates face almost identical income variance to their academically educated counterparts.

Table. 8. *Shapley Variance Decomposition for Education Type Sub-samples*

	Vocational			*Academic*		
	Variance	Percentage of total variance	Percentage of explained variance	Variance	Percentage of total variance	Percentage of explained variance
Total variance	0.3515	100		0.3082	100	
Explained variance	0.0334	9.50	100	0.0281	9.12	100
Subject area	0.0052	1.47	15.47	0.0076	2.47	27.08
Gender (male)	0.0117	3.33	35.05	0.0015	0.49	5.37
Han	0.0026	0.73	7.68	0.0005	0.16	1.75
Self-employed	0.0003	0.08	0.84	0.0007	0.24	2.63
Full-time	0.0001	0.02	0.21	0.0001	0.03	0.33
Experience	0.0136	3.86	40.63	0.0177	5.73	62.83

Source: Shapley variance decomposition based on CGSS 2018.

On the other hand, gender variable contributes to greater share of variance in *ln(earnings)* among vocational college graduates, while field of study is of greater significance among academic university graduates. The fourth and fifth rows of Table. 9. suggest vocational sub-sample owns a variance of 0.0117 in gender, significantly higher than what is shown in academic sub-sample (0.0015). The share of variance in *ln(earnings)* originated from gender equals 35% and 5% within vocational and academic groups, respectively. On contrary, the percentage of variance in *ln(earnings)* due to major area is 15% with a variance of 0.0052 for vocational party and 27% with a variance of 0.0076 for academic party.

Then, we investigate the extent to which returns to type of education vary among all major areas. OLS estimation and variance decomposition results are shown in Table. 9. and Table. 10. Conclusions drawn from the whole sample still hold within each major field except *Social Science* and *Natural Science*: graduates from HEIs offering bachelor degrees yield higher returns than those from higher vocational colleges only providing graduation certificates. For those in *Social Science* and *Natural Science*

fields, educational type is insignificant to their earnings. The highest variance of earnings is represented by *General Applied Science* (0.4133) and the lowest by *Natural Science* (0.2399). Educational type has a considerable impact on annual income within all sub-samples with exception of *Natural Science*: Within natural science sub-sample, *ln(earnings)* has a explained variance of 0.0553 of which only 3.9% (0.0022) is associated with type of tertiary education; within other four sub-groups, the respective share of explained variance in our dependent variable resulting from education type ranges from 13% (*General Applied Science*), 15% (*Social Science*), 49% (*Major Applied Science*) to 51% (*Humanities*). Income difference between two genders appears more apparent in *Social Science* and *Major Applied Science* fields where gender accounts for a significantly high proportion of income differentials, with values of 21% and 19%, respectively. That means women in either of the two fields earn approximately 20% lower than men in the same field. The figures for other three sub-samples are all below 6%.

Table. 9. *OLS Results for Subject Area Sub-samples*

	Humanities		*Social Science*		*Natural Science*	
	Spec.1	Spec.2	Spec.1	Spec.2	Spec.1	Spec.2
Academic	0.3517	0.3665	0.1632	0.1538	0.0136	-0.0120
	(0.1179)***	(0.1212)***	(0.1985)*	(0.0945)	(0.1197)	(0.1139)
Experience						
0-2	Base	Base	Base	Base	Base	Base
3-5	0.3209	0.3496	0.4197	0.4356	0.3398	0.3771
	(0.3514)	(0.3829)	(0.1985)**	(0.1958)**	(0.1851)*	(0.2154)*
6-8	0.2601	0.2394	0.3952	0.3904	0.3786	0.3630
	(0.3409)	(0.3725)	(0.1857)**	(0.1854)**	(0.1927)*	(0.2056)*
9-13	0.3711	0.3959	0.4507	0.4266	0.4199	0.3865
	(0.3420)	(0.3748)	(0.1730)***	(0.1584)***	(0.2103)*	(0.2245)*
14-18	0.2634	0.2835	0.5024	0.4887	0.5650	0.6286(0.18
	(0.3349)	(0.3756)	(0.1698)***	(0.1657)***	(0.1854)***	00)***
19-25	0.6306	0.6348	0.4631	0.3837	-0.0275	0.0494
	(0.3527)*	(0.3876)	(0.1827)**	(0.1815)**	(0.2328)	(0.2195)
26+	0.4500	0.4865	0.5280	0.4794	0.1681	0.1333
	(0.3712)	(0.4112)	(0.2255)**	(0.2467)*	(0.2663)	(0.2920)
Gender (male)		-0.0940		0.1719		-0.1238
		(0.1259)		(0.0873)*		(0.1167)
Han		0.3071		-0.1247		0.5167(0.17
		(0.2101)		(0.1591)		61)***
Self-employed		0.0949		-0.0481		0.0901
		(0.2243)		(0.1531)		(0.2258)
Full-time		0.0359		0.1183		-0.1362
		(0.1481)		(0.2819)		(0.1932)

Constant	10.4193 (0.3406)***	10.0929 (0.4576)***	10.5880 (0.1502)***	10.5605 (0.3640)***	10.7246 (0.1685)***	10.4367 (0.3529)***
Adjusted R^2	0.0473	0.0356	0.0298	0.0270	0.0556	0.0793
R^2	0.1175	0.1472	0.0675	0.0865	0.1543	0.2305
Sample size	96	96	181	181	68	68
Prob>F	0.0515	0.0601	0.0921	0.0713	0.0669	0.0123
	Major Applied Science				*General Applied Science*	
	Spec.1	Spec.2			Spec.1	Spec.2
Academic	0.2869 (0.0480)***	0.3021 (0.0479)***			0.2269 (0.1077)**	0.2059 (0.1103)*
Experience						
0-2	Base	Base			Base	Base
3-5	0.1609 (0.0854)*	0.1431 (0.0848)*			0.5554 (0.1810)***	0.5314(0.1827)***
6-8	0.1742 (0.0877)**	0.1665 (0.0869)*			0.5612 (0.2013)***	0.4893 (0.2077)**
9-13	0.2592 (0.0836)***	0.2582 (0.0827)***			0.4309 (0.1844)**	0.3869 (0.1889)**
14-18	0.3549 (0.0893)***	0.3435 (0.0885)***			0.7703 (0.1844)***	0.7724(0.1864)***
19-25	0.2758 (0.0998)***	0.2437 (0.0994)**			0.6380 (0.2091)***	0.6267(0.2097)***
26+	0.4183 (0.1061)***	0.3834 (0.1062)***			0.7158 (0.2567)***	0.6283 (0.2627)**
Gender (male)		0.1904 (0.0482)***				0.1408 (0.1198)
Han		0.0681 (0.1171)				0.3004 (0.2060)
Self-employed		-0.0236 (0.0891)				-0.2400 (0.2160)
Full-time		0.0061 (0.1332)				-0.0713 (0.3298)
Constant	10.7343 (0.0709)***	10.5557 (0.1849)***			10.2782 (0.1459)***	10.0775 (0.3862)***
Adjusted R^2	0.0892	0.1098			0.1176	0.1189
R^2	0.1015	0.1287			0.1637	0.1912
Sample size	519	519			135	135
Prob>F	0	0			0.0016	0.0045

Source: Chinese General Social Survey (CGSS) 2018.

In general, conclusions made from the entire sample remain unchanged in sub-samples. Gender comparison indicates the contribution of educational type to

variance in earnings is six to seven times larger than that of major area for women, while the two factors are approximately of equal importance for male income. For educational type sub-samples, among those pursuing higher vocational education, gender becomes the largest contributor to variance of their earnings. However, major filed is relatively more decisive factor to those following academic track.

Regarding subject area sub-samples, how type of education affects earnings vary considerably among five major fields. About 50% of variance in *ln(earnings)* can be attributed to educational type within *Major Applied Science* and within *Humanities* and the figures in *General Applied Science* and *Social Science* are both over 10%, but lower than 4% in *Natural Science*.

Table. 10. *Shapley Variance Decomposition for Subject Area Sub-samples*

	Humanities			*Social Science*			*Natural Science*		
	Variance	Percentage of total variance	Percentage of explained variance	Variance	Percentage of total variance	Percentage of explained variance	Variance	Percentage of total variance	Percentage of explained variance
Total variance	0.2859	100		0.3838	100		0.2399	100	
Explained variance	0.0421	14.72	100	0.0332	8.65	100	0.0553	23.05	100
Type of education	0.0216	7.54	51.22	0.0049	1.29	14.91	0.0022	0.09	3.9
Gender (male)	0.0016	0.57	3.87	0.0071	1.84	21.27	0.0028	1.15	4.99
Han	0.0050	1.76	11.96	0.0010	0.27	3.12	0.0123	5.13	22.26
Self-employed	0.0005	0.19	1.29	0.0001	0.03	0.35	0.0008	0.33	1.43
Full-time	0.0003	0.11	0.75	0.0013	0.33	3.82	0.0018	0.75	3.25
Experience	0.0130	4.55	30.91	0.0187	4.88	56.42	0.0374	15.60	67.68

	Major Applied Science			*General Applied Science*		
	Variance	Percentage of total variance	Percentage of explained variance	Variance	Percentage of total variance	Percentage of explained variance
Total variance	0.3156	100		0.4311	100	
Explained variance	0.0406	12.87	100	0.0824	19.12	100
Type of education	0.0199	6.30	48.95	0.0109	2.53	13.23
Gender (male)	0.0079	2.50	19.43	0.0049	1.13	5.96
Han	0.0003	0.10	0.77	0.0088	2.05	10.72
Self-employed	0.0001	0.04	0.31	0.0022	0.50	2.61
Full-time	0.0000	0.006	0.05	0.0005	0.12	0.63

Experience	0.0124	3.93	30.54	0.0552	12.8	66.95

Source: Shapley variance decomposition based on CGSS 2018.

6. CONCLUSIONS

This study aims to discover the comparative impact of type of HEIs (vocational colleges and academic universities) to major fields on earnings of the highly-educated (those who have finished higher education) in China. Results from OLS and Shapley Variance Decomposition demonstrate that educational type is the more significant determinants of labor market outcomes and graduates from higher vocational colleges suffer from a huge wage penalty. What is more, the two factors show different patterns between male and female. The contribution of educational type to variance in earnings is six to seven times larger than that of major area for women whereas both variables are approximately of equal importance to male earnings. For the vocationally-educated, income heterogeneity is mostly originated from gender, while for the academically-educated major choice makes a difference. Finally, type of education matters to students majoring in any filed with exception of *Natural Scienc*e. One drawback of this study is not taking into account changes in a mixed educational path because individuals who obtain qualifications from one type of HEIs before altering to another can get more earnings rewards than those following either type of education (Tuor & Backes-Gellner, 2010).

The wage disadvantage faced by vocational college graduates can be explained by three reasons. First, as Wang (2016) stated, Confucianism has been deeply embedded in Chinese's consciousness since ancient times and therefore they regard academic credentials as a symbol of abilities and social status. Secondly, the quality of vocational education lagged behind its scale expansion (Shi, 2013). In addition to lacking cooperation between colleges and corporations to ensure practical training, the curriculum does not take students' cultivation objective into consideration (Shi, 2013; Zhang, 2009). What's even worse is that employers consider vocational college graduates as less capable and less intelligent because of lower grades in university entrance exam.

Our analysis is of high policy relevance. Much efforts have been made to make higher education available to more people in recent years but triggered issues simultaneously. The unbalanced labor market has signaled us an undesirable human resource allocation, shortage of highly-skilled technicians from vocational colleges but oversupply of university graduates (Wang, 2016; Altbach, 2016; Meng et al., 2013; Shang et al., 2020; Zhang et al., 2021). Our results further prove that Chinese officials need to pay more attention to vocational and technical education. This literature can

also function as a reference for the public in terms of education investment. To hedge the risk of their decision, academic education may be better off for women and those studying in academic universities should care much about the selection of major.

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