

Returns on Tertiary Vocational Education and Gender Differences: Evidence from China

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Abstract: Higher education plays a crucial role in human capital investment, especially in China, where it includes tertiary vocational education (junior college), undergraduate, and postgraduate programs. However, in China, a cultural preference for academic over vocational learning, coupled with low social recognition and uncertain employment prospects, has led to the neglect of tertiary vocational education. This sector is vital for producing skilled professionals essential to China's industrial advancement and the manufacturing sector's rise in the global value chain. This article focuses on the returns of tertiary vocational education and the gender disparities in these returns. With China's demographic dividend shrinking and its manufacturing sector undergoing transformation, understanding the return on investment in vocational education, along with gender differences, is of both practical and theoretical significance. Using data from the CFPS of China, the study estimates the trends and gender differences in the return on tertiary vocational education from 2016 to 2020, employing Mincer's income equation and OLS, followed by a robustness test.

Keywords: rate of return on Tertiary vocational education, junior college, gender difference, gender discrimination

1. Introduction

In China, GDP per capita rose from ¥1,663 in 1990 to ¥81,370 in 2021 and ¥85,698 in 2022. This steady increase in personal income reflects the crucial role of education in enhancing human capital and labor productivity. The number of graduates in tertiary vocational education has steadily increased from 2010 to 2022, with a notable surge between 2021 and 2022.

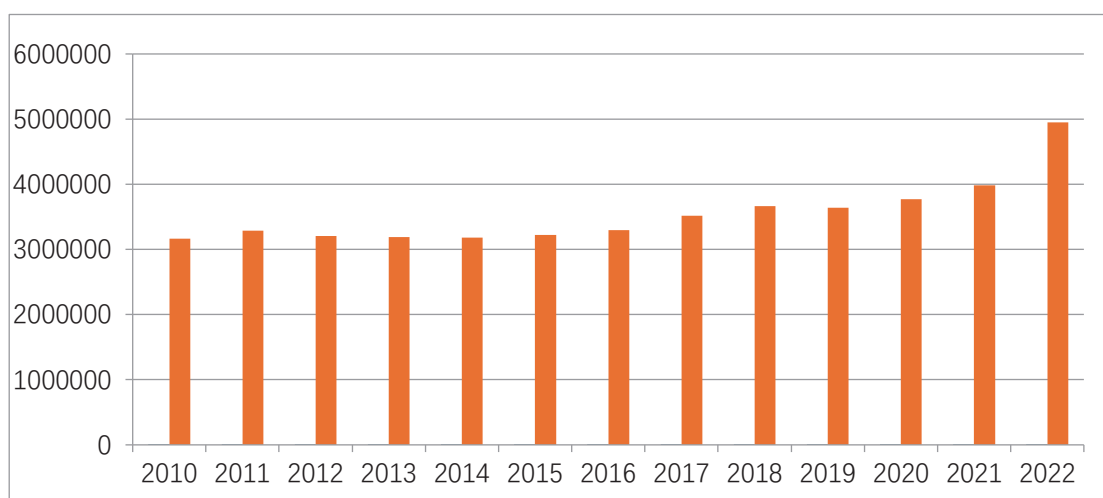


Figure 1. Number of tertiary vocational education graduates

The relationship between education and income has been a key focus in labor economics. The income growth linked to higher education levels reflects its benefits. As education expands, the returns on tertiary vocational education may follow two paths: an oversupply of graduates leading to lower income levels and a reduced return on education, or, conversely, strong regional economic growth and industrial restructuring driving higher demand for graduates, thus increasing income levels and the return on education.

In 2022, the number of female students in tertiary vocational education reached 7.91 million, an increase of 434,000 from 5.06 million in 2010. However, the percentage of female students has declined from 52.41% in 2010 to 48.33% in 2022, highlighting a growing gender inequality.

This article uses data from the CFPS (2016-2020) to estimate the returns on tertiary vocational education, offering a clearer understanding of trends and gender disparities in vocational education returns. This analysis is valuable for individuals and families when considering educational investments. Educational returns not only reflect the outcomes of educational investments but also indicate the efficiency of resource allocation across different educational sectors. Examining these trends is crucial for formulating sound public finance policies and optimizing educational resource distribution in China. Additionally, investigating the gender differences in returns and wage disparities in the labor market provides important insights for improving labor laws and reducing discrimination in China's workforce.

2. Related Literature

Foreign scholars have conducted extensive research in the field of educational returns. For example, some researchers have utilized the ordinary least square method to analyze Mincer's income equation and assess educational returns. In 2010, C.D. Goldin and L.F. Katz identified a post-World War II "baby boom" in the United States, which led to an influx of highly educated workers entering the labor market in the 1970s^[1]. This oversupply caused a decrease in education returns due to stagnant demand. However, by the 1980s, economic growth increased the demand for highly educated workers, leading to a rise in education returns as supply decreased. The study also noted that the national education system had a limited impact on education returns^[1]. Mamun and Taylor(2021), in their research on education returns in rural Bangladesh using data from BIHS, estimated varying average returns for different education levels through Mincer's income equation. They found that higher education had a return rate of 18%, secondary education had 4.86%, and primary education had 5.24%. Notably, in the agricultural sector, the return on higher education was relatively similar to that of primary and secondary education^[2]. Feigenbaum et al. (2020) employed twin samples to analyze the correlation between years of education and income in the United States in 1940, revealing that each additional year of schooling increased labor income by approximately 4 percent^[3]. Additionally, Moreno and Patrinos suggested a 6 percent return to education, marking the first estimation of schooling returns in Azerbaijan since 1995, with 6 percent for men and 8 percent for women in the country^[4]. In China, Qi and He (2022) investigated changes in the returns of secondary vocational education based on CGSS data. Their study indicated that obtaining secondary vocational education was beneficial in elevating individual income, particularly evident in rural populations^[5].

There is a substantial body of research that delves into the disparities in the economic benefits of education between genders. The consensus among these relevant studies is that women tend to yield higher returns on education compared to men. Analyzing data from the National Labor Force Survey of Thailand spanning from 2007 to 2010, Tangtipongkul (2015) employed the Mincer income equation for least squares regression analysis and unearthed that women experience a roughly 1.5 percentage point advantage in educational returns over men^[6]. Likewise, Campos et al. (2018) arrived at a similar conclusion in their investigation of gender-based disparities in educational returns in Portugal over the period of 1986 to 2013, consistently finding higher returns on education for women compared to men each year^[7]. Jaeram and Jungjoon (2020) also explored the differences in educational returns between male and female cohorts at all educational levels. Their findings indicate that women tend to have higher returns on education than men across all levels. Furthermore, researchers have also observed shifts in the trends of educational returns for both genders^[8]. Song (2021) applied the Mincer income equation to assess gender disparities in education returns. The study found that women with post-secondary education typically experience higher returns than men, while the returns for women with undergraduate education are lower than those for men^[9]. This indicates that, although women benefit more from higher education, gender disparities persist at the undergraduate level.

3. Data

This article utilizes adult survey data from the Chinese Family Panel Survey (CFPS) conducted in 2016, 2018, and 2020. The CFPS Adult database for each year contains detailed information on adults and their families, including gender, age, political affiliation, nationality, education, employment status, and income. Currently, only cross-sectional data is accessible, with no panel data available. The study investigates the fluctuating trends in the benefits of vocational education and examines gender disparities using a blend of cross-sectional data from CFPS spanning 2016 to 2020. Given that panel data is more effective in addressing omitted variable bias that remains constant across individuals, it is recommended that future research leverages panel data to delve deeper into the enduring impacts of education and gender differentials, subject to data availability.

4. Empirical Model

Previous scholarly investigations on educational returns have not only produced comprehensive theoretical findings but have also led to significant advancements in methodological research. The Mincer income approach has emerged as the predominant method for calculating the return on education, both domestically and internationally, owing to its straightforward formulaic structure and minimal data prerequisites. This method elucidates the influence of two forms of human capital on individual income: knowledge acquired through education, which constitutes the return on education, and experiential learning derived from work. As the reservoir of knowledge attained through education is not directly quantifiable, level of education serves as a proxy variable for estimation purposes. Similarly, work experience is gauged through the number of years spent in employment. The standard Mincer income equation model is delineated as follows:

$$\ln(Y) = \beta_0 + \beta_1 EDU + \beta_2 EX + \beta_3 EX^2 + \mu \quad (1)$$

Where $\ln(Y)$ is the logarithm of individual wage, Y is individual wage, EDU is the number of years of schooling, EX represents the individual's work experience, which is usually obtained by subtracting age from years of schooling and then subtracting 6, EX^2 is the square of work experience, and μ is the error term.

In the equation(1), only the effects of education and work experience on the earnings of workers are considered. In fact, in the labor market, some characteristics of workers will also impact on income, such as gender, the industry and other factors. As a result, many scholars have made various extensions to the standard Mincer equation. By referring to the existing research, this paper chooses gender, political status, registered residence and occupation as control variables. The extended Mincer equation is obtained following equation:

$$\ln(W_i) = \beta_0 + \beta_1 Edu_i + \beta_2 Gender_i + \beta_3 (Edu_i \times Gender_i) + \beta_4 Party_i + \beta_5 Region_i + \beta_6 Job_i + \beta_7 EX_i + \beta_8 EX_i^2 + \varepsilon \quad (2)$$

Where $\ln(W_i)$ is logarithm of monthly wage income of workers. Edu_i is vocational education. The questions about the educational level in the questionnaire are the highest degree completed by the individual respondents, and the options are illiteracy, primary school, junior high school, senior high school/technical school, junior college (tertiary vocational education), bachelor's degree, master's degree and doctor's degree. This paper selects the individuals with tertiary vocational education (college) education, and sets the educational level of the samples with tertiary vocational education as 1, and the educational level of the other samples as 0, so as to distinguish whether they have received higher vocational education.

EX is working experience, there is a lack of direct data on work experience in the questionnaire. So, this article comprehensively estimates the relevant literature on the returns to education, and uses working years to represent work experience.

$$EX = \text{Age} - \text{Education Years} - 6$$

5. Results

In this article, the data are processed and the missing values are eliminated, the descriptive statistics of the main variables of the research samples are shown in the following table.

Table 1. Descriptive Statistics for Variables

Year	2016	2018	2020
Average Monthly Salary	2385.36	3066.24	3593.37
Average Monthly Salary for Males	2705.77	3469.98	4096.28
Average Monthly Salary for Females	1951.50	2517.99	2921.15
Age	34.3	38.6	38.7
Proportion of Vocational Education	10.78	12.71	14.71
Sample Size	6,027	8,927	7,732

Despite the impact of COVID-19, monthly wages continued to rise from 2016 to 2020, with men consistently earning higher average monthly wages than women. The gender wage gap also widened over the five-year period. Regarding education, the proportion of the population with tertiary vocational (college) education increased from 10.78% in 2016

to 14.71% in 2020. This growth suggests that the expansion of vocational education in recent years is likely linked to the Chinese government's increasing focus on vocational education development.

Table 2. OLS Regression Results in 2016

	(1)All	(2)Male	(3)Female
Edu	0.160*** (14.80)	0.151*** (11.11)	0.161*** (9.68)
Gender	0.392*** (14.31)		
Vocational edu_gender	-0.0715 (-1.21)		
Party	0.103* (2.18)	0.0336 (0.58)	0.227** (2.78)
Province (region)	0.000576 (0.66)	-0.000344 (-0.31)	0.00198 (1.42)
Job	-0.00000161* (-2.18)	-0.00000165 (-1.85)	-0.00000153 (-1.18)
Experience	0.0326*** (14.63)	0.0321*** (11.11)	0.0346*** (9.80)
Experience_sq	-0.00132*** (-16.87)	-0.00124*** (-12.57)	-0.00147*** (-11.52)
_cons	6.686*** (93.66)	7.132*** (77.99)	6.632*** (57.11)
N	6027	3467	2560

t statistics in parentheses
 $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 2, the study estimates the gains from tertiary vocational education in 2016 and breaks down the results by gender. It shows that obtaining tertiary vocational education boosts the average monthly wage by 17.35% ($e^x - 1$). Specifically, men with tertiary vocational education experience a 16.30% wage increase, while women see a 17.46% increase. These results align with prior research, indicating that the economic benefits of education are greater for women, especially in the context of tertiary vocational education.

Table 3. OLS Regression Results in 2018

	(1)	(2)	(3)
	ALL	Man	Female
Edu	0.189*** (22.56)	0.153*** (14.94)	0.225*** (16.75)
Gender	0.484*** (24.64)		
Vocational edu_gender	-0.0519		

	(1)	(2)	(3)
	(-1.27)		
Party	-0.0381 (-0.59)	-0.0697 (-0.85)	-0.0176 (-0.17)
Province	-0.000804 (-1.28)	-0.00172* (-2.23)	0.000751 (0.71)
Job	-0.00000324*** (-5.26)	-0.00000307*** (-4.24)	-0.00000356** (-3.20)
Experience	0.0332*** (19.12)	0.0330*** (15.45)	0.0344*** (11.78)
Experience_sq	-0.00124*** (-22.89)	-0.00126*** (-19.34)	-0.00124*** (-12.85)
_cons	6.916*** (119.17)	7.548*** (105.18)	6.729*** (67.71)
N	8927	5151	3776

t statistics in parentheses

p* < 0.05, *p* < 0.01, ****p* < 0.001

The analogous outcomes in 2018 show that pursuing tertiary vocational education leads to a 20.8% rise in the mean monthly salary. For men, obtaining higher vocational education results in a wage increase of 16.53%, while for women, the increase is 25.23%. However, the disparity in returns from tertiary vocational education between women and men is growing.

Table 4. OLS Regression Results in 2020

	(1)	(2)	(3)
	All	Male	Female
Edu	0.207*** (22.03)	0.146*** (12.43)	0.260*** (17.43)
Gender	0.551*** (25.31)		
Vocational edu_gender	-0.204*** (-4.94)		
Party	0.0475 (0.70)	0.0808 (0.99)	0.0384 (0.32)
Province	-0.00188** (-2.82)	-0.00412*** (-4.97)	0.00130 (1.19)
Job	-0.00000561*** (-8.59)	-0.00000625*** (-8.18)	-0.00000434*** (-3.64)

	(1)	(2)	(3)
Experience	0.0481*** (19.83)	0.0486*** (16.09)	0.0497*** (12.52)
Experience_sq	-0.00137*** (-21.79)	-0.00141*** (-18.28)	-0.00136*** (-12.75)
_cons	6.874*** (102.53)	7.737*** (91.55)	6.480*** (57.86)
N	7732	4433	3299

t statistics in parentheses
 $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

By 2020, the return on investment for tertiary vocational education was 23%, with men at 15.7% and women at 29.7%. Empirical evidence shows a positive trend in these returns over the past five years. Vocational education plays a significant role in boosting personal income, reflecting the growing demand for skilled labor in China's labor market, driven by technological advancements and industrial upgrades.

While previous studies have primarily focused on tertiary education as a whole, rather than specifically on higher vocational education, they still reveal a general upward trend in the returns on education in China. For example, Liu (2015) noted an increase in the return on higher education from 11.72% in 1988 to 61.52% in 2007^{[10][11]}. Similarly, research by Zhang and Li (2014) showed rising returns on higher education in 1992, 2000, and 2009, with rates of return of 15.3%, 29.7%, and 33.6%, respectively, illustrating a consistent upward trend^[12].

For the analysis on gender disparity, Han (2011) utilized the CGSS (2006) dataset to discover that education exerts a more substantial positive impact on the rise of female earnings^[13]. Furthermore, the return on investment for females in higher education surpasses that of males. Similarly, Liu's (2015) research supports this finding^[14]. This phenomenon can be attributed to the Mincer earnings equation's sole consideration of opportunity cost in estimating education returns, with men facing a greater opportunity cost of education than women. Consequently, the beneficial impact of education on female earnings is more pronounced. Consistent with previous research, the study indicates that women experience higher returns from tertiary vocational education, with the gender disparity in rates of return in education widening from 2016 to 2020. Specifically, in 2016, rates of return in education was 16.3% for men and 17.46% for women, showing a marginal gap of 1.16%. However, by 2020, this gap widened to 5 (15.7% for men and 29.7% for women).

The interaction term between tertiary vocational education and gender has a negative and significant effect on log wages. The coefficients are -0.204 in 2020, -0.0519 in 2018, and -0.0715 in 2016, which also indicates that the log wage of men receiving tertiary vocational education is lower than that of women when other variables are controlled. It also reflects the different returns to vocational education for men and women, with relatively lower returns to tertiary vocational education for men.

Although women have a higher rate of return on tertiary vocational education, data from 2016 to 2020 shows that men consistently earned more than women. The gender wage gap has been increasing, with a gap of 48% in 2016, 62.2% in 2018, and 73.5% in 2020. This trend indicates a rising wage premium for men compared to women, suggesting persistent gender discrimination and bias within the workplace.

6. Robustness

By conducting robustness tests, we aim to confirm that our conclusions regarding the returns to higher education and gender differences in wages are consistent and generalizable across different scenarios and datasets.

Table 5. Results for Robustness

	2016	2018	2020
	ln_w	ln_w	ln_w
Edu	0.160*** (14.41)	0.189*** (21.43)	0.207*** (21.22)
Gender	0.392***	0.484***	0.551***

	2016	2018	2020
	ln_w	ln_w	ln_w
	(14.01)	(23.70)	(24.83)
Vocational edu_gender	-0.0715 (-1.14)	-0.0519 (-1.28)	-0.204*** (-4.69)
Party	0.103* (2.20)	-0.0381 (-0.55)	0.0475 (0.74)
Province	0.000576 (0.66)	-0.000804 (-1.29)	-0.00188** (-2.81)
Job	-0.00000161* (-2.15)	-0.00000324*** (-5.12)	-0.00000561*** (-8.53)
Experience	0.0326*** (13.63)	0.0332*** (14.29)	0.0481*** (17.11)
Experience_sq	-0.00132*** (-15.30)	-0.00124*** (-14.61)	-0.00137*** (-18.41)
_cons	6.686*** (91.77)	6.916*** (115.92)	6.874*** (98.23)
N	6027	8927	7732

t statistics in parentheses
p* < 0.05, *p* < 0.01, ****p* < 0.001

The robustness test results for each year on tertiary vocational education and gender align with the previous analysis. The standard error for robustness is also comparable, suggesting the consistency and reliability of the results.

7. Conclusion

With the expansion of college and university enrollments alongside economic growth, the sustainability of the increasing return on investment in higher education has become a critical concern. Additionally, the gender disparity in the returns on tertiary vocational education is an emerging area of interest. This study uses individual survey data from the CFPS for 2016, 2018, and 2020, applying OLS regression to Mincer's equation to examine the evolving return patterns in tertiary vocational education in China and explore gender differences. To address potential issues with sample heteroscedasticity and endogeneity, robustness tests were conducted to validate the regression results.

The findings indicate a continuous upward trend in the return on investment in tertiary vocational education from 2016 to 2020. The cumulative return rates for tertiary vocational education in China were 16%, 18.9%, and 20.7% for 2016, 2018, and 2020, respectively, demonstrating that education remains a valuable investment in the country.

Although women experience higher return rates from higher education compared to men, they consistently earn lower wages in the labor market. OLS regression results show that from 2016 to 2018, the return rate for men was 15.1%, 15.3%, and 14.6%, respectively, while for women it was 16.1%, 22.5%, and 26.0% over the same period. These figures suggest a higher return rate for women, with an increasing trend over time. However, despite these higher returns, men continue to earn significantly higher wages, with a gender wage gap of 48% in 2016, 62.2% in 2018, and 73.5% in 2020. This indicates that gender wage disparities not only persist but are also widening over time.

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