Returns to Education in Different Job Locations for Off-Farm Wage Employment: Evidence from China

Weidong Wang [1,*]**, Yongqing Dong** [2]**, Yunli Bai** [3]ⓘ**, Renfu Luo** [4]**, Linxiu Zhang** [5]**, Chengfang Liu** [4] **and Spencer Hagist** [3]

[1]   School of Economics and Management, Beijing Forestry University, Beijing 100083, China
[2]   College of Management and Economics, Tianjin University, Tianjin 300072, China; dongyq.14b@igsnrr.ac.cn
[3]   Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China; baiyl.11b@igsnrr.ac.cn (Y.B.); spencer.ccap@igsnrr.ac.cn (S.H.)
[4]   School of Advanced Agricultural Sciences, Peking University, Beijing 100087, China; luorf.ccap@pku.edu.cn (R.L.); cfliu.ccap@pku.edu.cn (C.L.)
[5]   International Ecosystem Management Partnership, United Nations Environment Programme, Beijing 100101, China; lxzhang.ccap@igsnrr.ac.cn
[*]   Correspondence: wangwd.15b@igsnrr.ac.cn

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Abstract: In this study, we explore the returns to education among different job locations for off-farm wage employment using nationally representative samples from rural China. Through a series of robustness checks, we conclude that there is heterogeneity in returns to education for different job locations within the rural labor force. Specifically, we have found that the returns to education for laborers in big cities are significantly higher than those for laborers working both in ordinary cities and within counties. That is to say, the utility of education is better-reflected in big cities. We conclude that the returns to education in big cities are 5.4 percent, while the returns to education are no more than 1 percent in ordinary cities and within counties. These results suggest that labor markets in the underdeveloped regions of China have factors that undermine the productivity effect of human capital.

1. Introduction

Recent years have borne witness to the large-scale outflow of laborers from rural areas to supplement their local sources of income through migration and wage employment [1–5]. The proportion of the rural labor force entering the labor market rose from around 22 percent in 1988 to more than 60 percent in 2015 [6–8]. According to official statistics, the number of migrant workers increased from 25 million in 1985 to 172 million in 2017. The income of households in China has grown significantly over the past few decades, and most of this growth has come from employment in the off-farm sector [9–11].

The emergence and development of the labor market plays an important role in increasing the off-farm work and income of rural laborers. An effective labor market is conducive to the integration of urban and rural labor markets in China [5,6]. Therefore, it is important to understand whether the labor market is functioning effectively for the better-coordinated development of urban and rural areas.

In the two decades following rural reform in China, many studies explored whether the emergence of the labor market played an important role in the process of national economic growth. Some studies demonstrated that labor markets do not function well, and significant barriers still exist for China's

economy [12,13]. Other pieces of research told a different story, and showed that the rural labor market is constantly improving and plays an important role in China's economic development [7,14–16].

More importantly, some studies have assessed the role of education in increasing access to off-farm jobs and wages to judge whether the labor market has begun to play a role in rural China. For example, some scholars suggested that non-market factors play an important role in the labor market, and that the role of human capital has not been reflected [17–19]. Others have demonstrated that the labor market is constantly improving because education has a significant effect on wage determination [5,20,21]. Returns to education is an effective and reliable indicator that not only reflects the incentives for human capital accumulation and the efficiency of labor resource allocation, but also guides public and private investment in education [22].

Of late, more and more studies have been conducted to explore the returns to education on off-farm employment of rural laborers [11,23–27]. These studies have made important contributions to the literature regarding the role of education in the labor market. However, most only estimate the overall returns to education, as they assume that the returns to education in different regions are the same. This supposition is at odds with creating a more accurate estimation of returns to education within the labor market, which seemingly exhibits different returns in different areas.

Although some studies have examined differences in the returns to education between urban and rural residents and found that the returns to education of urban residents was higher than those of rural households [25,28,29], the rural labor force works in different locations and is constantly moving. It is thus unreasonable to assume that their returns to education for off-farm wage employment are consistent across different employment sites.

There are also studies which use the urban labor force as a sample. They conclude that there is a difference in the returns to education at different locations. One study has drawn the conclusion that the higher the degree of labor marketization, the higher the returns to education [30]. A recent study has also found that where there is a high degree of labor marketization, the returns to education will be higher, and the high rate of returns to education in developed regions is the reason that they attract highly educated laborers [31]. Although previous studies have been concerned with differences in the returns to education among urban residents in different locations, there is still a lack of research specifically focused on the differences in the returns to education of the rural labor force in different regions.

To the best of our knowledge, only two studies have explored the returns to education for off-farm employment among different job locations using a dataset from rural China. Using data collected from 309 households in 1995 in Xiayi County of central China's Henan Province, Hare (2002) explored the differences in the returns to education for off-farm employment across destination provinces with different capital-labor ratios [2]. Xing et al. (2013) found that the eastern, richer cities have higher returns to education for off-farm employment than do cities from the central and western regions [27]. However, in their study, laborers that did not migrate across the county were excluded. Hence, with both division of job location being too broad and the data being relatively old, the study did not adequately reflect the recent characteristics of the returns to education of the rural labor force at different job locations. They also did not adopt strategies to alleviate the endogenous problem because of missing variables, such as personal ability.

Compared to previous studies, this paper uses the latest nationally representative data, which can document the recent status of returns to education for off-farm wage employment in different job locations. Further, we use the family fixed-effects model to try to mitigate endogeneity problems, which will affect the estimation results in leading toward greater accuracy.

The overall goal of this study is to estimate the returns to education for off-farm wage employment in different job locations, as well as to further assess China's labor market. To meet this goal, we have three specific objectives. First, we preliminarily describe the relationship between education and the hourly wage at different job locations. Second, we estimate the returns to education for off-farm wage employment among different job locations with different model specifications and try to

validate the robustness of the results. Third, using this knowledge, we interpret the implications for the development of China's labor market.

The remainder of this paper is organized as follows. In Section 2, we briefly introduce the data used in this study. Section 3 describes our empirical methods. Sections 4 and 5 present our empirical results. Finally, a summary of the findings and discussion are presented in Section 6.

2. Data

This study uses the China Rural Development Survey dataset collected by the Center for Chinese Agricultural Policy of the Chinese Academy of Sciences in April 2016, which is nationally representative. The sampling process was conducted as follows. Five provinces were selected from each of China's major agro-ecological zones from a list of provinces arranged in descending order of gross value of industrial output (GVIO). GVIO was used based on the conclusion from Rozelle (1994, 1996) that GVIO is one of the best predictors of standard of living and development potential and is often more reliable than the net rural per capita income [32,33]. China's major agro-ecological zones are the eastern coastal areas (Jiangsu, Zhejiang, Shandong, Fujian, and Guangdong); the southwestern provinces (Sichuan, Guizhou, Yunnan, and Guangxi); the Loess Plateau (Shanxi, Shaanxi, Inner Mongolia, Ningxia, Gansu, Qinghai and Xinjiang); the north and central provinces (Hebei, Henan, Anhui, Hubei, Hunan, and Jiangxi); and the northeastern provinces (Liaoning, Jilin, and Heilongjiang). Although we recognize that we have deviated somewhat from the standard definition of China's agro-ecological zones, the realities of survey work necessitated our compromises.

According to the above procedure, Jiangsu, Sichuan, Shaanxi, Hebei, and Jilin were selected as the sample provinces (actually, there were four waves of follow-up surveys conducted in 2005, 2008, 2012, and 2016. Considering that the fourth wave collected detailed information about job locations, therefore, we only use the dataset collected in 2016.). From each province, five counties were selected, one from each set of a list of counties arranged in descending order of their GVIO. Within each county, we chose two townships, and within each township, we chose two villages, following the same procedure as the county selection. Hence, in each sample province, we selected 20 villages (1 province × 5 counties × 2 townships × 2 villages). The survey team used village rosters and the team's own count of households that were living in the village, but not on the roster, to randomly choose 20 households in each village. Finally, a nationally representative sample of 2026 households in 100 villages was selected.

The enumerators questioned all household members regarding their formal schooling years, on- and off-farm work, job location, average working hours in a day, average working days in a month, working months in a year, off-farm earnings, and other individual traits in each household.

To focus on job location and wage premium in the labor market, we restricted our sample to those engaged in off-farm wage employment. There is no clear retirement line for rural residents. Most individuals over 60 years are still working in on- or off-farm sectors. Therefore, we considered the labor force in the age range of 16 to 64 years with off-farm wage employment as our sample group. Individuals under the age of 16, those enrolled full-time in school, retirees, the self-employed, and household members who did not work for health-related reasons were excluded. Thus, the number of individuals in this study was 2472. Further, wage was comprised of three major components: basic wage, subsidies, and bonuses.

3. Methodology

For the benchmark estimation, we use the ordinary least squares (OLS) model to examine whether there is a significant return to education for the off-farm wage employment differential across job locations. To avoid methodological shortcomings, we calculate the hourly wages using off-farm earnings and working hours. The measure of wages largely affects the estimation results. Since differences in wealth endowments depend on differences in work and leisure choices, this may cause relatively poor workers to work longer after completing their own education. Therefore, poorer

workers may work more hours per day, month, or year, and studies that utilize daily, monthly, or annual earnings to estimate the returns to education are likely to underestimate the results. The hourly wage is a more accurate measure [34,35], as it is not affected by the number of hours per day or days per month that laborers work. For convenience, we define Y_i as the hourly earnings measured for individual i.

The impact of education on wages is the focus of this study. Thus, we add the years of formal schooling in Model (1). The variable $joblocation_i$ represents the vector of the rural laborer's choice of job location. We divide the job locations into big cities, ordinary cities, and within counties (we define big cities as including provincial capitals, municipalities, and first-tier cities, and define ordinary cities as a city other than a big city. Different employment sites represent different levels of economic development. At the same time, they also reflect different degrees of labor marketization.). In order to better examine the differences in returns to education for different job locations, we further join the cross items of years of formal education and job location. X_i is the vector of variables for individual features including gender, age, age squared, whether a member of the Chinese Communist Party, gender, marital status, and laborer's home province. The detailed definitions of the variables are shown in Table 1. u_i is a disturbance term representing other forces that cannot be explicitly measured. Therefore, we obtain the following equation to demonstrate the impact of job location on wage.

$$\ln Y_i = \alpha_0 + \alpha edu_i + \chi joblocation_i * edu_i + \beta joblocation_i + \delta X_i + u_i \tag{1}$$

Considering the differences in wages that may arise from different occupations, we control for features of their jobs, including whether employers provide free housing, whether employers provide free meals, and occupation dummy variables (our occupational division is based on the latest "People's Republic of China Classification of Occupations" in 2015.) for the labor force. As we know, the work status of some individuals is that they are engaged in off-farm employment full-time, while others might spend some time on agriculture. The different work statuses may affect the estimated result. With this in mind, this paper further adds working status as a control variable to improve the accuracy of the estimation results. ocu_i stands for the job feature of individual i. Thus, we obtain the following equation to demonstrate the impact of education on wage.

$$\ln Y_i = \alpha_0 + \alpha joblocation_i + \chi joblocation_i * edu_i + \beta edu_i + \delta X_i + \varepsilon ocu_i + \theta fulltime_i + u_i \tag{2}$$

Taking into account personal ability, family culture and parenting environment affect both the education level of an individual and the individual's wage, we use the family fixed effects model to reduce this endogeneity and bias of the estimation. The definitions of the explained variables are the same as those in the OLS model. For each individual i in the family j, we have:

$$\ln Y_{ij} = \alpha joblocation_{ij} + \chi joblocation_{ij} * edu_{ij} + \beta edu_{ij} + \delta X_{ij} + \varepsilon ocu_i + \theta fulltime_i + \mu_j + \varepsilon_{ij} \tag{3}$$

where the meanings of the expressions are the same as above, μ_j is the unobservable characteristics shared in family j, and ε_{ij} is the error term assumed to be white noise. A pooled regression is not appropriate since it ignores the unobservable characteristics μ_i shared in each family, such as genetics and family culture, which have an influence on both migration choice and hourly wage. Thus, we obtain the average at the family level as shown below.

$$\overline{\ln Y_j} = \alpha \overline{joblocation_j} + \chi \overline{joblocation_j} * \overline{edu_j} + \beta \overline{edu_j} + \delta \overline{X_j} + \varepsilon \overline{ocu_j} + \theta \overline{fllutime_j} + \mu_j + \overline{\varepsilon_j} \tag{4}$$

By using the family fixed effects model, we can eliminate μ_j from the equation by differentiating the above equation in the following way.

$$\ln Y_{ij} - \overline{\ln Y_j} = \alpha(joblocation_{ij} - \overline{joblocation_j}) + \chi(joblocation_{ij} * edu_{ij} - \overline{joblocation_j} * \overline{edu_j}) +$$
$$\beta(edu_{ij} - \overline{edu_j}) + \delta(X_{ij} - \overline{X_j}) + \varepsilon(ocu_{ij} - \overline{ocu_j}) + \theta(fulltime_{ij} - \overline{fulltime_j}) + (\mu_j - \mu_j) + (\varepsilon_{ij} - \overline{\varepsilon_j}) \tag{5}$$

Table 1. Descriptive statistics of variables.

	Measurement (1)	N (2)	Mean (3)	S.D. (4)	Min (5)	Max (6)
	Dependent variables					
(1) Ln (hourly wage)	Yuan	2472	2.441	0.702	0	4.60
	Key explanatory variable					
(2) Years of formal schooling	Years	2472	9.169	3.509	0	22
	Individual characteristics					
(3) CCP member	=1, if Yes; 0, if No	2472	0.108	0.310	0	1
(4) Gender	=1, if Yes; 0, if No	2472	0.645	0.479	0	1
(5) Age	Years	2472	37.585	12.149	16	64
(6) Age squared	Years	2472	1559.779	977.851	256	4096
(7) Marital status	=1, if have spouse; 0, if No	2472	0.809	0.393	0	1
(8) Jiangsu	=1, if Yes; 0, if No	2472	0.216	0.412	0	1
(9) Sichuan	=1, if Yes; 0, if No	2472	0.222	0.416	0	1
(10) Hebei	=1, if Yes; 0, if No	2472	0.185	0.389	0	1
(11) Jilin	=1, if Yes; 0, if No	2472	0.145	0.352	0	1
(12) Shannxi	=1, if Yes; 0, if No	2472	0.108	0.310	0	1
	Family characteristics					
(13) Social capital of family	individuals	2472	1.573	4.431	0	70
(14) Size of the labor in the family	individuals	2472	4.238	1.288	1	10
	Occupational characteristics					
(15) Whether employer provides free housing	=1, if Yes; 0, if No	2472	0.315	0.465	0	1
(16) Whether employer provides free diet	=1, if Yes; 0, if No	2472	0.383	0.486	0	1
(17) Responsible person of party or government or company	=1, if Yes; 0, if No	2472	0.062	0.242	0	1
(18) Professional skill worker	=1, if Yes; 0, if No	2472	0.065	0.246	0	1
(19) Assistants and office staff	=1, if Yes; 0, if No	2472	0.019	0.137	0	1
(20) Business and service personnel	=1, if Yes; 0, if No	2472	0.324	0.468	0	1
(21) Agriculture-related wage earning occupations	=1, if Yes; 0, if No	2472	0.028	0.164	0	1
(22) Production and transportation equipment operators	=1, if Yes; 0, if No	2472	0.492	0.500	0	1
(23) Soldier	=1, if Yes; 0, if No	2472	0.006	0.075		
(24) Other occupations	=1, if Yes; 0, if No	2472	0.005	0.070	0	1
	Personal work status					
(25) Whether full-time engaged in off-farm work	=1, if Yes; 0, if No	2472	0.687	0.464	0	1

Notes: (i) data source: China Rural Development Survey. (ii) Social capital is documented by the number of relatives or friends that work in the hospital or government departments, or as a business manager.

4. Empirical Results

4.1. Descriptive Results

Table 1 demonstrates that the wage-earning workforce receives an average of 9.17 years of formal schooling, which slightly exceeds the threshold of compulsory education (Column 3, Row 2). The hourly wage of these laborers is 14.5 ($e^{2.44}$) Yuan (Column 2, Row 1). Table 1 also presents summary statistics of other main control variables in this study

Our data shows that there exists a clear positive correlation between education and hourly wage (Figure 1). However, the slope of the linear relationship between education and income seems to be different across different regions. The positive relationship between the education and hourly wages of rural laborers is even more pronounced for those working in big cities (Figure 2). In particular, the line fitting the education and hourly wage of the labor force working in large cities has a steeper slope than those of laborers working in ordinary cities and within counties (Figures 3 and 4). In comparison, the slope of the line fitting the relationship between the education and hourly wage for those working in ordinary cities does not seem to be much different from that of the workforce working within counties. However, this is only a preliminary judgment of the relationship between education and hourly wages. Therefore, we need to further explore the relationship between education and hourly wage for different job locations through empirical evidence.
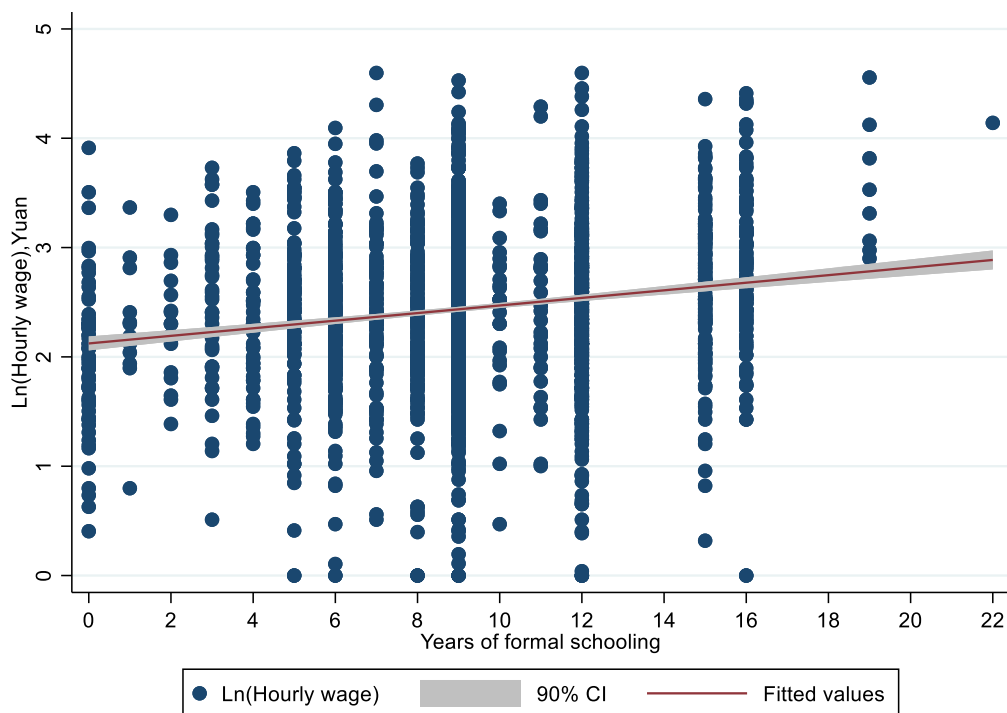

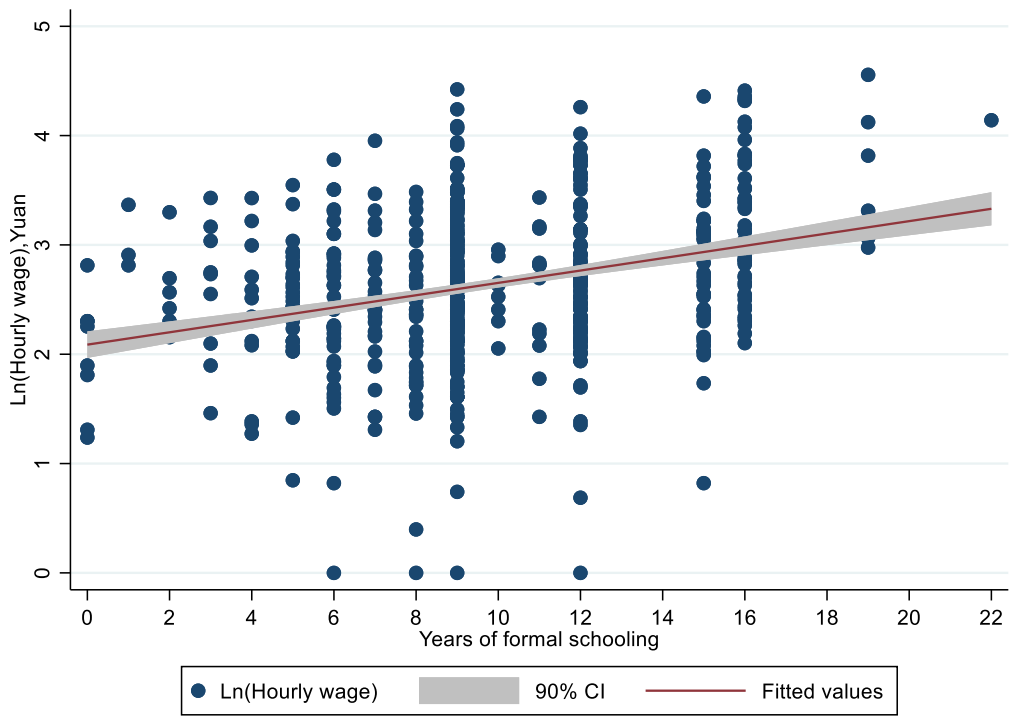**Figure 1.** The relationship between education and wage. Data source: China Rural Development Survey.

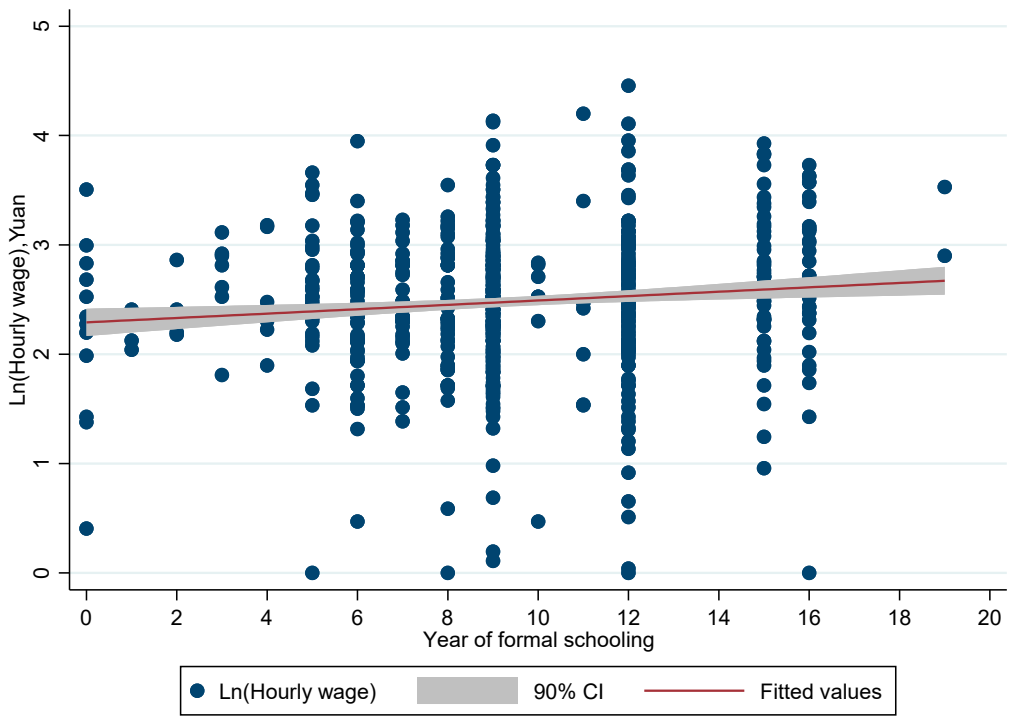**Figure 2.** The relationship between education and wage in big cities. Data source: China Rural Development Survey.

Figure 3. The relationship between education and wage in ordinary cities. Data source: China Rural Development Survey.
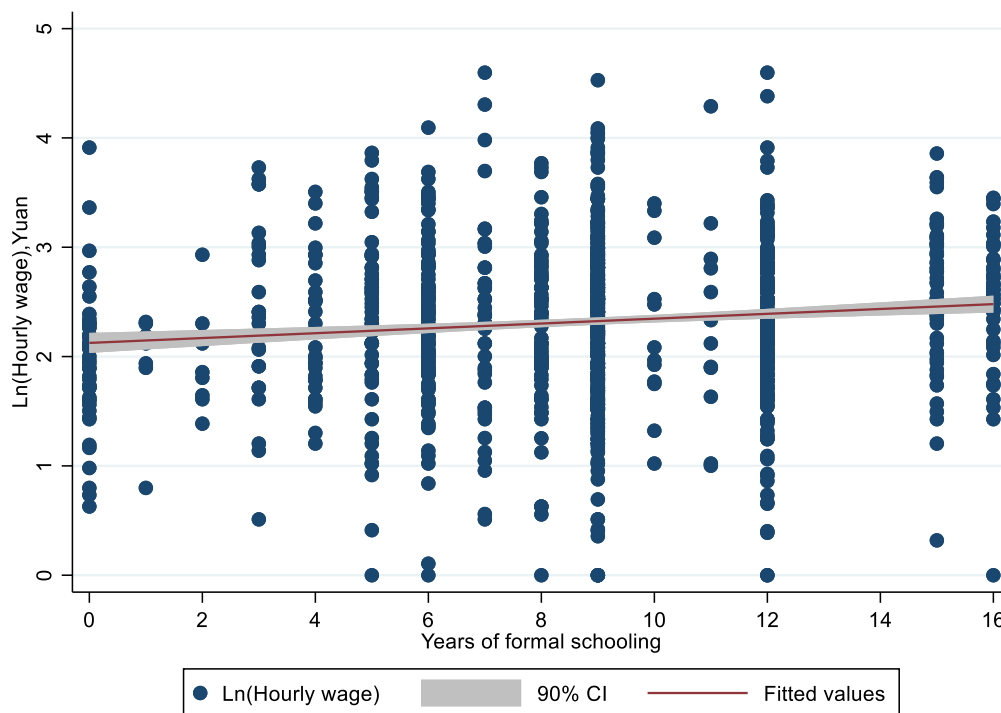
Figure 4. The relationship between education and wage within counties. Data source: China Rural Development Survey.

4.2. Multivariable Results

We use a series of regressions to verify the relationship between education and wage in different locations. Table 2 reports the first set of our estimated results using OLS estimation. When we run Model (1) and only include independent variables related to education and job location, we find that the return to education for off-farm wage employment in big cities is significantly higher, by 3.4 percentage points, than within counties ($p < 0.01$) (Table 2, Column 1, Row 3). In other words, the hourly wage for the rural labor force working in big cities for each additional year of education can be 3.4 percentage points higher than for those working within counties.

When we put the variables of individual characteristics and family characteristics into the regression equation, the estimate increases to 4.4 percentage points ($p < 0.01$) (Table 2, Column 2, Row 3). The results suggest that the individual and family covariates can explain part of the variation in hourly wage. We draw a similar conclusion after further gradually controlling for occupational characteristics and personal work status. The estimates are 4.1 and 4.4 percentage points respectively ($p < 0.01$) (Table 2, Column 3 and 4, Row 3). In contrast, the differences between the returns to education in ordinary cities and in counties are statistically insignificant regardless of the control variable added. ($p < 0.01$) (Table 2, Column 1 to 4, row 2).

After using the subsample to run the regression, we obtain the exact values of returns to education for off-farm wage employment in different job locations. The returns to education for off-farm wage employment within counties are 1.2 percent ($p < 0.1$) (Table 3, Column 1, Row 1), while the returns to education for off-farm wage employment in ordinary and big cities are 2.2 percent ($p < 0.05$) (Table 3, Column 2, Row 1) and 4.9 percent ($p < 0.01$) (Table 3, Column 3, Row 1) respectively. It seems that no matter where laborers work, increasing investment in education can bring about an increase in hourly wage, although the returns to education for off-farm wage employment are different for different job locations. Before these conclusions can be pressed seriously, we must consider potential endogeneity.

Table 2. Estimation on the impact of education on wages in different job locations, OLS, full sample.

Independent Variables	Dependent Variable (ln (Hourly Wage))			
	(1)	**(2)**	**(3)**	**(4)**
(1) Years of formal schooling	0.022 ***	0.016 ***	0.016 ***	0.014 **
	(0.006)	(0.006)	(0.006)	(0.006)
(2) Ordinary city * Years of formal schooling	−0.002	0.012	0.010	0.012
	(0.010)	(0.010)	(0.010)	(0.010)
(3) Big city * Years of formal schooling	0.034 ***	0.044 ***	0.041 ***	0.044 ***
	(0.009)	(0.009)	(0.009)	(0.009)
(4) Ordinary city	0.166 *	0.043	0.042	0.014
	(0.094)	(0.092)	(0.092)	(0.093)
(5) Big city	−0.037	−0.076	−0.054	−0.097
	(0.091)	(0.088)	(0.088)	(0.088)
(6) Individual characteristics	N	Y	Y	Y
(7) Family characteristics	N	Y	Y	Y
(8) Occupational characteristics	N	N	Y	Y
(9) Personal work status	N	N	N	Y
(10) Constant	2.125 ***	0.867 ***	0.782 **	0.680 *
	(0.055)	(0.188)	(0.376)	(0.375)
(11) Observations	2472	2472	2472	2472
(12) R-squared	0.065	0.156	0.177	0.181

Note: (i) data source: China Rural Development Survey. (ii) Robust standard errors in parentheses. (iii) ***, **, and * indicate statistical significance from zero at the 1, 5, and 10 percent levels.

Table 3. Estimation on the impact of education on wages in different job locations, OLS, subsample.

Independent Variables	Dependent Variable (ln (Hourly Wage))		
	(1) Within County	**(2) Ordinary City**	**(3) Big City**
(1) Years of formal schooling	0.012 *	0.022 **	0.049 ***
	(0.007)	(0.010)	(0.009)
(2) Individual characteristics	Y	Y	Y
(3) Family characteristics	Y	Y	Y
(4) Occupational characteristics	Y	Y	Y
(5) Personal work status	Y	Y	Y
(6) Constant	1.066 *	1.570 ***	−0.557
	(0.560)	(0.435)	(0.739)
(7) Observations	1201	636	635
(8) R-squared	0.184	0.143	0.262

Note: (i) data source: China Rural Development Survey. (ii) Robust standard errors in parentheses. (iii) ***, **, and * indicate statistical significance from zero at the 1, 5, and 10 percent levels.

5. Endogenous Considerations and Robustness Checks

5.1. Estimates of Family Fixed Effects Model

It should be considered that personal ability, family culture, and parenting environment affect both the education level of an individual and the individual's hourly wage. We make the relatively strong assumption that individuals from the same family have roughly identical genes, along with family culture and parenting environment. By using the family fixed effects model, we can eliminate family characteristics and common individual characteristics that do not change with individuals in the family.

By eliminating the influence of genetics and family culture, we can see the net impacts of education on wages (Table 4). These results are consistent with those of the OLS model, although personal abilities, family culture, and parenting environment affect the estimated results. When we run Model (5) and only include independent variables related to education, job location, and individual characteristics, we find that the returns to education in big cities is significantly higher, by 4.7 percentage points,

than within counties ($p < 0.01$) (Column 1, Row 3). After we include occupational characteristics, the estimate decreases to 4.6 percentage points ($p < 0.01$) (Column 2, Row 3). We draw a similar conclusion after further gradually controlling for personal work status, resulting in returns to education being 4.7 percent points ($p < 0.01$) (Column 3, Row 3), which is higher than the value estimated in Table 2 using the OLS model ($p < 0.01$) (Table 2, Column 4, Row 3).

Table 4. Estimation on the impact of education on wages in different job locations, family fixed effect.

Independent Variable	Dependent Variables (ln (Hourly Wage))					
	(1) All Sample	(2) All Sample	(3) All Sample	(4) Within County	(5) Ordinary City	(6) Big City
(1) Years of formal schooling	−0.001	−0.002	−0.003	0.007	0.004	0.054 ***
	(0.009)	(0.009)	(0.009)	(0.010)	(0.016)	(0.013)
(2) Ordinary city * Years of formal schooling	0.008	0.011	0.012			
	(0.014)	(0.014)	(0.014)			
(3) Big city * Years of formal schooling	0.047 ***	0.046 ***	0.047 ***			
	(0.013)	(0.013)	(0.013)			
(4) Ordinary city	0.130	0.070	0.048			
	(0.136)	(0.133)	(0.134)			
(5) Big city	−0.179	−0.199	−0.229 *			
	(0.139)	(0.136)	(0.138)			
(6) Individual characteristics	Y	Y	Y	Y	Y	Y
(7) Occupational characteristics	N	Y	Y	Y	Y	Y
(8) Personal work status	N	N	Y	Y	Y	Y
(9) Constant	1.156 ***	1.152 ***	1.063 ***	0.996	2.057 ***	−0.153
	(0.228)	(0.384)	(0.381)	(0.688)	(0.702)	(0.403)
(10) Observations	2472	2472	2472	1201	636	635
(11) R-squared	0.177	0.202	0.205	0.253	0.240	0.353
(12) Number of households	1324	1324	1324	770	439	450

Note: (i) data source: China Rural Development Survey. (ii) Robust standard errors are reported in parentheses. (iii) ***, **, and * indicate statistical significance from zero at the 1, 5, and 10 percent levels.

There are still no indications from the estimation results that there is a significant difference in the returns to education between the ordinary cities and within counties (Table 4, Column 1 to 3, Row 2). However, when we use the subsample for the family fixed effects model, the results show that the returns to education for off-farm wage employment in ordinary cities and big cities are no more than 1 percentage point and no longer statistically significant (Table 4, Columns 5 and 6, Row 1), which is lower than the estimated result from using the OLS model (Table 3, Column 3, Row 1). Only returns to education for off-farm wage employment in big cities are higher than the value estimated using the OLS model in Table 3 ($p < 0.01$) (Column 3, Row 1).

5.2. Estimates of Family Fixed Effects Model after Considering Outliers

Based on the family fixed effects model, we further consider that the occurrence of outliers may affect the accuracy of the estimates. Therefore, we delete samples with an hourly wage of 3 standard deviations above the average hourly wage, which is similar to the usual practice of mitigating the effect of outliers on the results. Table 5 reports the final results.

When we run Model (2) and only include independent variables related to education, job location, and individual characteristics, we find that the return to education for off-farm wage employment in big cities is significantly higher, by 4.8 percentage points, than within counties ($p < 0.01$) (Table 5, Column 1, Row 3). We draw a similar conclusion after further gradually controlling for occupational characteristics and personal work status. The estimates are 4.7 and 4.8 percentage points, respectively ($p < 0.01$) (Table 5, Columns 2 and 3, Row 3).

Table 5. Estimation on the impact of education on wages in different job locations after handling the outliers, family fixed effect.

Independent Variable	Dependent Variable (ln (Hourly Wage))					
	(1) All Sample	(2) All Sample	(3) All Sample	(4) Within County	(5) Ordinary City	(6) Big City
(1) Years of formal schooling	0.001	−0.002	−0.003	0.004	0.005	0.054 ***
	(0.008)	(0.008)	(0.008)	(0.010)	(0.016)	(0.013)
(2) Ordinary city * Years of	0.014	0.016	0.017			
formal schooling	(0.014)	(0.013)	(0.013)			
(3) Big city * Years of formal schooling	0.048 ***	0.047 ***	0.048 ***			
	(0.013)	(0.013)	(0.013)			
(4) Ordinary city	0.118	0.066	0.050			
	(0.134)	(0.132)	(0.132)			
(5) Big city	−0.185	−0.190	−0.212			
	(0.134)	(0.132)	(0.133)			
(6) Individual characteristics	Y	Y	Y	Y	Y	Y
(7) Occupational characteristics	N	Y	Y	Y	Y	Y
(8) Personal work status	N	N	Y	Y	Y	Y
(9) Constant	1.133 ***	1.161 ***	1.098 ***	0.956	2.476 ***	−0.137
	(0.214)	(0.381)	(0.380)	(0.665)	(0.592)	(0.403)
(10) Observations	2448	2448	2448	1188	629	631
(11) R-squared	0.215	0.241	0.242	0.283	0.268	0.353
(12) Number of households	1315	1315	1315	763	434	446

Note: (i) data source: China Rural Development Survey. (ii) Robust standard errors are reported in parentheses. (iii) We delete samples with an hourly wage of 3 standard deviations above the average hourly wage. (iv) ***, **, and * indicate statistical significance from zero at the 1, 5, and 10 percent levels.

There is insignificant difference in the returns to education for off-farm wage employment between ordinary cities and within counties (Table 5, Column 1 to 3, Row 2). The returns measured here are still no more than 1 percent point and remain statistically insignificant (Table 4, Columns 5 and 6, Row 1), which is almost the same as the estimated results in Table 4 (Table 4, Columns 4 and 5, Row 1). The returns to education for off-farm wage employment in big cities is 5.4 percentage points, and the same as the value estimated in Table 4 ($p < 0.01$) (Column 6, Row 1).

As of now, we are able to say that there exists a difference in the returns to education for off-farm wage employment for rural laborers in different job locations. The returns to education for off-farm wage employment in cities is 5 percentage points, while returns to education are no more than 1 percentage point in ordinary cities and within counties. In the meantime, the returns to education for off-farm wage employment in big cities are significantly higher than those from within counties, while the returns to education for off-farm wage employment in ordinary cities and within counties have no significant differences.

6. Conclusions and Discussion

China's reforms are reflected in the labor market; that is, the allocation of labor is coming to depend more and more on market mechanisms, and the distribution of income increasingly depends on education. The study of the returns to education for off-farm wage employment in different job locations can help us both determine whether the amount of investment in education is appropriate and provide a basis for judging the degree of development of the labor market.

In this paper, we have studied the returns to education for off-farm wage employment among different job locations using samples from rural China covering more than 2000 households in 100 nationally representative villages. Through a series of robustness tests, we conclude that there is heterogeneity for the returns to education for off-farm wage employment in different job locations. We have found that the returns to education for off-farm wage employment for laborers in big cities are significantly higher than those of laborers working in ordinary cities and within counties. That is to say, the importance of education is more pronounced in big cities. This also reveals why big cities are attractive to better-educated laborers. Moreover, we conclude that the returns to education for

off-farm wage employment in big cities are 5.4 percentage points, while the returns to education for off-farm wage employment are no more than 1 percentage point in ordinary cities and within laborers' own counties.

Some studies have been conducted to measure the wage premium of the labor force among different job locations and found the wages in cities are higher than those in rural areas [36,37]. Yankow (2006) used OLS regression analysis based on data from the US to find that the labor force flowing to big cities will receive a wage premium of 19%, of which about 2/3 will be attributed to ability and skills, with the remaining 1/3 being attributed to the horizontal effect and growth effect [38]. The horizontal effect refers to the high wage level brought by the productivity advantage of the city, while the growth effect refers to the cumulative increase in income caused by the mobility of the labor force. Wu and Tian (2008) analyzed the impact of China's labor mobility on the returns to education since the 1990s and found that about 23% of the increase in education returns is caused by labor mobility [39].

Big cities have a high level of industrial agglomeration and more employment opportunities, where members of the labor force can freely move and find jobs that match their own abilities, and labor production factors can be allocated more effectively [40]. Therefore, the role of education as an important component of human capital can also be reflected in such places. On the other hand, places closer to the hometowns of those in the rural labor force provide fewer job opportunities, and the allocation of laborers becomes more dependent on social relations [1,41].

If investments in human capital do not have enough pay-off, the labor market is probably segmented and not functioning well [5,22,42]. These results indicate that, within the labor market for rural migrants, there probably exist factors that undermine the productivity effect of human capital. From a policy perspective, eliminating institutional barriers in the labor market is crucial to the manifestation of market value for human capital. Only in this way can the human capital productivity effect be easily brought into play, so as to further motivate people to invest in human capital.

From another perspective, the returns to education in big cities are generally the highest. The root cause might be that the economic efficiency of capital and labor allocation in big cities are high. Under the circumstance of economic entities pursuing efficiency, the total economic volume and population scale of municipalities will inevitably increase. Recognizing this, governments do not blindly control the size of cities. Instead, they remove development obstacles from their policy focus, strive to eliminate economic and social issues and reduce the pressure on resources and the environment. At the same time, in less developed cities and counties, capital, labor, and other factors of production must be revitalized to increase production efficiency and collaboration, and more market factors come to play a role rather than non-market factors.

We believe our study has made at least three contributions to the literature. First, we use the latest nationally representative rural data from China to understand the role of education in affecting wages across different job locations. Second, we use the family fixed effects model to help alleviate endogeneity. Third, we verify that the returns to education are heterogeneous across different locations. However, despite the abovementioned contributions, we acknowledge that the conclusions of this study depend on a strong hypothesis: that individuals from the same family share the same genetics, ability, and family background. Additionally, we only focus on the wages of rural laborers and neglect other outcome variables, such as their happiness index or mental status. Our research can be improved in the future when more appropriate data and more advanced approaches become available.

Author Contributions: Conceptualization, W.W., Y.D., L.Z. and R.L.; Data curation, W.W., Y.D. and Y.B.; Investigation, Y.B. and W.W.; Project administration, L.Z.; Writing review & editing, W.W., Y.B., R.L., C.L. and S.H. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest. Also, the funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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