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Empirical Analysis on the Impact of Farmers' Education Level on Income

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Abstract

Ensuring and improving the income of farmers is currently one of the key issues of the "three rural issues." This study uses data from the China Household Income Project (CHIP2013) and employs an extended form of the Mincer equation to investigate how the educational level of farmers affects their income. The results show that farmers' income also increases with the improvement of their educational level. There are different returns to education at different educational levels. The average wage of those with junior high school education is 17.79% higher than those with primary school education or below, while the average wage of those with senior high school (technical secondary school) education is 32.36% higher than those with primary school education or below, and the average wage of those with junior college education or above is 65.25% higher than those with primary school education or below. At this point, the return on senior high school education is quite significant. Therefore, it is necessary to focus on the development of senior high school education, promote rural residents to enhance their own educational literacy, improve wage levels, and thus achieve better educational returns.

Keywords

Educational Level; Income Level; Farmers; Influencing Factors.

1. Introduction

How to increase the income of rural residents, achieve the growth of income for both urban and rural residents, reduce the urban-rural income gap, and realize the true phenomenon of national wealth, especially achieving national wealth for the majority of our country's rural residents, ensuring a steady increase in the income of rural residents, is related to the development of our country's rural economy, the true stability of society, and also the basis for expanding the domestic demand of our country's rural residents under the current economic context, thereby making the macroeconomy more stable. It is also key to achieving harmonious development between rural and urban residents in our country (Li Zhou et al., 2021; Han Changfu, 2019).

Related capital theory suggests that education is the main form of accumulation of human capital, and workers with different educational levels have different knowledge reserves, thus having different reserves in terms of human capital (Theodore W. Schultz, 1999).The gap in the labor force is often caused by differences in educational levels, leading to differences in labor productivity, which in turn leads to wage disparities and affects the income of rural residents. The Chinese government has paid more attention to the education of rural residents and their income. With the steady improvement of the educational level of rural residents in our country in recent years, the number of nine-year compulsory education has greatly increased. The income of rural residents in our country has increased from 702.8 yuan in 2000 to 5778 yuan in 2021, which is 8.22 times that of the year 2000, showing a rapid growth.

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The Mincer income function proposed in 1974 demonstrates the relationship between the level of education and individual income, as well as whether work experience has a nonlinear relationship with income (Mincer, 1974); Researchers have also studied the data of 98 countries and regions based on Mincer's income function and found that the return on education is higher in low-income countries, while high-income countries are influenced by many other factors, and the return on education is not so high (G, 2004); Research also investigated the gender differences in income and wages in higher education, finding that the returns to women's education are higher than those for men; Some researchers used the CHNS database to estimate the rate of return on education for urban residents in China, which rose from 2.8% in 1998 to 10.3% in 2003 (Zhong Funing et al., 2007); Regarding the income differences at different educational levels, some studies based on the CGSS2005 data analysis showed that the educational income for primary school, middle school, high school, and university urban residents in China are 4.96%, 2.33%, 6.45%, and 15.7% respectively (Xu Tao, 2013).

The academic community places more emphasis on the impact of education on urban residents, and there is relatively less research on the differences in educational levels and the income of farmers; Currently, the focus of research is on whether the educational level of rural residents can indeed increase the income of farmers, and the research hotspot is the effectiveness of the educational level of farmers in increasing the income of farmers, mainly focusing on the application of the Mincer equation model to measure the effectiveness of the educational level of farmers in increasing the income of farmers (Mincer, 1974). For example, some domestic scholars have used correlation analysis to test the core position of education in human capital investment and have shown with the Mincer model that educational investment by farmers is indeed beneficial to farmers. For every additional year of training, the income of farmers increases by 1.77% (Qian Xue et al., 2000); Some researchers have also used the Mincer model to investigate the connection between education and the income of farmers: the more human capital accumulated in rural areas, the higher the agricultural productivity, and the faster the growth of farmers' income (Bai Jvhong et al., 2003); In addition, an assessment study on the impact of rural education in China and other parts of the world has been conducted, concluding that education is an investment in human capital, which not only brings private benefits but also brings social benefits, helping to achieve the dual goals of equality and efficiency (Hossain, 2002).

In summary, most of the research on the impact of the educational level of farmers on wages is qualitative, with fewer quantitative studies, mainly statistical references; The existing quantitative research mainly uses simple cross-sectional data or time series data as sampling observations, which has certain limitations in practical application; This paper, based on the Chinese Income Survey (CHIP2013) data, proposes the use of an extended form of the Mincer income function. The study investigates the impact of the educational level of farmers on wage income to provide references for improving policies related to increasing farmers' income.

2. Model Construction and Variable Selection

2.1. Model Construction

Mincer Earnings Model: The Mincer earnings function approach is specifically designed to study the returns to education, and it is a commonly used method. Because the Mincer earnings equation only considers the relationship between education level, work experience, and income, it is relatively simple and straightforward. However, there are differences in the calculation of educational returns, leading to the extension and modification of the Mincer income function through referencing relevant literature (Liu Lingzhi et al., 2013).

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Under certain assumptions, the rate of return to education can be determined using the classic Mincer income model:

$$\ln Y = \beta_0 + \beta_1 educ + \beta_2 exp + \beta_3 exp^2 + \varepsilon \quad (1)$$

(1) In the equation, lnY represents the natural logarithm of farmers' income, educ stands for education level, exp denotes work experience, and the square of exp represents the squared work experience. Since work experience may have a quadratic relationship with income as experience accumulates, it is included in the model. ε represents the random error term. β1, β2, β3, and β4 are the coefficient terms corresponding to each variable, indicating the direction of positive or negative influence.

The classic Mincer income model provides a rough estimate of the returns to education. It only examines the impact of educational factors, consisting of years of education and professional experience, on personal income, without considering personal characteristic variables such as gender and age. Ignoring these individual characteristic variables can lead to the omitted variables being incorporated into the random error term, which may result in the error term being correlated with the explanatory variables, thus leading to inconsistent estimates (Liu Lingzhi et al., 2013). Therefore, an extended Mincer income model is adopted:

$$\ln Y = \beta_0 + \beta_1 educ + \beta_2 exp + \beta_3 exp^2 + \sum \propto_i x_i + \varepsilon \quad (2)$$

In the Equation , Xi represents the control variables. Since there are many options for control variables, they are not listed here one by one. Instead, variables such as gender, age, marital status, family background, and political status are included in the control variables for research. $\propto_i$represent the coefficients corresponding to each control variable. In the extended Mincer income model (2), β1 is the coefficient of years of education, which represents the personal income growth rate resulting from an additional year of education, i.e., the rate of return to education. Based on the estimation of the overall rate of return to education, specific educational stages are added to discuss the impact of differences in educational level on wage income. The equation is as follows:

$$\mathbf{\ln Y = \beta_0 + \beta_1 primary + \beta_2 junion + \beta_3 sension + \beta_4 college + \beta_5 exp + \beta_6 exp^2 + \sum a_i x_i + \varepsilon} \quad (3)$$

In the Equation, primary、junior、senior、college represents the different levels of education, specifically primary school and below, junior high school, high school, and college and above. These variables stand for the corresponding educational levels and their respective impacts on income.

2.2. Variable Description

In this study, the natural logarithm of individual wages is selected as the dependent variable, which is measured by the response to the question "total income from this job in 2013" in the questionnaire survey. The explanatory variables are set through two aspects. Firstly, years of education, which is a continuous variable, can represent the change in farmers' income caused by an increase of one year in education. Secondly, dummy variables are introduced, including junior high school, high school (secondary vocational school), college and above. These dummy variables are added to the model, with primary school and below serving as the control group. Additionally, gender (female = 0, male = 1), age, marital status (single = 0, married = 1), political background (non-party member = 0, party member = 1), and family background (number of

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siblings) are included as control variables to account for the impact of rural residents' characteristics.

3. Sample Sources and Data Characteristics

For this empirical study, the research utilizes the CHIP2013 survey data. Micro-level survey data, due to its vast quantity and diverse variables, often serves as the foundation for analytical research. The focus of this paper is to empirically analyze the impact of education on individual gross income, identify corresponding influencing factors, perform coding and data cleaning, eliminate missing values, remove inappropriate unanswered or inapplicable data, and conduct descriptive statistics, correlation analysis, and regression analysis. Ultimately, 15,775 sample data points are utilized to derive the final research findings.

3.1. Descriptive Statistics

Prior to conducting regression analysis, descriptive statistics are employed to understand the basic characteristics of the data. The results obtained are presented in Table 2.

Table 1. Descriptive Statistics

Variable	Number of observations	Mean	Standard Deviation	Minimum	Maximum
Farmers' Income	15775	9.8604	0.8450	0.0000	13.5924
Education Level	15775	8.5705	2.8457	0.0000	20.0000
Work Experience	15775	23.3643	13.9600	0.0000	74.0000
Gender	15775	0.6517	0.4764	0.0000	1.0000
Marital Status	15775	0.7978	0.4017	0.0000	1.0000
Political Affiliation	15775	0.0692	0.2538	0.0000	1.0000
Employment Status	15775	0.4627	0.4986	0.0000	1.0000
Family Situation	15775	2.3447	1.6482	0.0000	11.0000

After logarithmic transformation, the minimum value of lninc is 0, the maximum value is 13.5924, and the mean is 9.8604. For the variable edu (education level), the minimum value is 0, the maximum value is 20, and the mean is 8.5705, indicating that the educational attainment of the sampled population remains relatively low.The mean value of gender is 0.6517, which suggests that 65.17% of the sample is male. The mean value of exp (work experience) is 23.3643, with a minimum of 0 and a maximum of 74.For married, a mean value of 0.7978 indicates that 79.78% of the sample is married. The mean value of party (indicating Communist Party membership) is 6.92%, suggesting that 6.92% of the sample are members of the Communist Party.The proportion of individuals with job status indicated as 1 is 46.27%. The mean value of the number of siblings is 2.3447, with a maximum value of 11.

4. Empirical Research and Result Analysis

4.1. Variable Coding

In this paper, the total income of individuals for the entire previous year is selected as the explained variable. Due to the excessively large total income data, a logarithmic transformation is adopted. Since there are data points where the total income is zero, a natural logarithmic transformation is applied after adding 1 to the variable data, referencing relevant literature. The selected variable data in this paper are encoded, resulting in a table of variable indicators and their calculation methods as shown in Table 2.

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Table 2. Variable Selection and Naming

Variable Nature	Variable Representation	Variable Names	Variable Calculation
Explained Variable	Income from Wages	lninc	ln(Total income from this job in 2013)
Explanatory Variable	Education Level	education	Years of Education
Control Variable	Work Experience	exp	Age - Years of Education - 7
	Gender	gender	1-Male, 0-Female
	Marital Status	married	1-Married or Cohabitating, 0-Other
	Political Affiliation	party	1-Member of the Communist Party of China, 0-Other
	Work Status	job	1-Paid Employment, 0-Other
	Family Situation	bro	Number of Siblings

4.2. Establishment of Empirical Model

Taking into account the actual data situation, the model is set up as follows.

$$\text{lninc} = \beta_0 + \beta_1 \text{education} + \beta_2 \text{exp} + \beta_3 \text{exp}^2 + \beta_4 \text{gender} + \beta_5 \text{married} + \beta_6 \text{party} + \beta_7 \text{job} + \beta_8 \text{bro} + \beta_9 \text{edulevel} + \epsilon \quad (4)$$

In the above model, ε represents the random error term, $\beta_0$represents the constant term, and β_i represents the coefficient term.

Table 3. Frequency Analysis

Education Level	Frequency	Percentage	Cumulative Percentage
1	3242	20.55%	20.55%
2	8845	56.07%	76.62%
3	2627	16.65%	93.27%
4	1061	6.73%	100%
Total	15775	100%	

As can be seen, the number of respondents with a college degree or above is the lowest, with 1061 individuals, accounting for 6.73% of the total. On the other hand, the number of respondents with a high school (or secondary vocational) education is the highest, accounting for 56.07% of the total, exceeding half of the surveyed population.

4.3. Regression Results

Next, a regression analysis is conducted to understand the impact of education on income and to investigate whether there is a quadratic relationship between work experience. By incorporating the variables set up earlier into the model and performing multiple regression, the following results are obtained:

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Table 4. Regression Analysis

Variable	(1) Income from Wages	(2) Income from Wages	(3) Income from Wages
Education Level	0.0539***	0.0568***	
	(0.003)	(0.003)	
Work Experience	0.0248***	0.0249***	0.0267***
	(0.002)	(0.002)	(0.002)
Squared Work Experience	-0.0006***	-0.0006***	-0.0007***
	(0.000)	(0.000)	(0.000)
Gender		0.3063***	0.3140***
		(0.013)	(0.013)
Marital Status		0.1129***	0.1159***
		(0.020)	(0.020)
Political Affiliation		-0.0661***	-0.0827***
		(0.025)	(0.026)
Work Status		-0.2523***	-0.2526***
		(0.013)	(0.013)
Family Situation		-0.0246***	-0.0248***
		(0.004)	(0.004)
Junior High School			0.1779***
			(0.018)
High School (Secondary Vocational)			0.3236***
			(0.023)
College Degree or Above			0.6525***
			(0.032)
Constant Term	9.2920***	9.1328***	9.4196***
	(0.037)	(0.037)	(0.027)
Number of Observations	15,775	15,775	15,775
R-squared	0.0943	0.1497	0.1510
Adjusted R-squared	0.0942	0.1493	0.1504
F-value	547.6458***	346.9400***	280.2858***

Note: The notations ***, **, * indicate statistical significance at the 0.01, 0.05, and 0.1 significance levels, respectively. The values in parentheses represent standard errors.

4.4. Model Validation

Goodness of Fit Test: The R-squared value of the model is 0.1497, and the adjusted R-squared is 0.1493. Upon reviewing relevant literature, it is evident that the goodness of fit for total income in most studies is generally not high.

F-Test: The F-statistic value is 346.9400, with a corresponding p-value of 0.0000, which is less than 0.01. This indicates that the combined effect of all explanatory variables is significant at a significance level of 0.01, suggesting that the overall model has passed the significance test.

t-Test: Through testing, the p-values of all variables are less than 0.01, indicating that each variable has a significant impact.

Coefficient Test: The impact coefficient of 'edu' is 0.0568, indicating that for every increase in educational level, income increases by an average of 5.68%. Both 'exp' and the square of 'exp' (exp2) are significant at a significance level of 0.01. The impact coefficient of 'exp' is 0.0249, while the impact coefficient of 'exp2' is -0.0006, suggesting an inverted U-shaped relationship. Initially, income increases with work experience, but after a certain point, income begins to

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decrease. The impact coefficient of 'gender' is 0.3063, indicating that males earn an average of 30.63% more than females. The impact coefficient of 'married' is 0.1129, suggesting that married individuals earn an average of 11.29% more. The impact coefficient of 'party' is -0.0661, indicating that Communist Party members earn an average of 6.61% less than non-members. The impact coefficients of 'job' and 'bro' are -0.2523 and -0.0246, respectively, suggesting that salaried jobs pay an average of 25.23% less than non-salaried jobs, and for each additional sibling, income decreases by an average of 2.46%. In column (3), when the years of education are converted to educational levels, the significance and direction of impact of the remaining variables remain unchanged. However, as the educational level increases, the impact coefficients gradually increase to 0.1779, 0.3236, and 0.6525, indicating that compared to primary school education or below, junior high school education leads to an average increase of 17.79%, high school (or secondary vocational school) education leads to an average increase of 32.36%, and college education or above leads to an average increase of 65.25%. This gradual increase is consistent with the results obtained using years of education.

5. Conclusion and Policy Pathways

Based on the data from CHIP2013, the conclusion regarding the impact of educational differences on farmers' wage income reveals that when considering only wages and education level (measured by years of education), there exists a linear relationship between the two. Specifically, wages increase with the enhancement of education level, with a total education return rate of 5.68%. This suggests that farmers with higher education levels enjoy a greater opportunity of earning higher wages in the labor market. Looking at the income differences across different education levels, junior high school education leads to an average increase of 17.79% in wages compared to primary school education or below, while high school (secondary vocational school) education leads to an average increase of 32.36%, and college education or above leads to an average increase of 65.25%. This indicates that the educational benefits at the high school (secondary vocational school) level are particularly effective.

With regard to the relationship between farmers' education level and income, the following policy pathways can be explored:

The government should continue to promote the universalization of compulsory education based on its current achievements, and strengthen financial support for regions with low education levels and scarce educational resources, thereby enhancing the accumulation of farmers' human capital.

The education authorities should prioritize the development of secondary education, ensuring that suitable-aged individuals have access to education. By leveraging the vocational orientation of secondary education, farmers' labor income can be increased.

Given that many farmers are relatively older and have a relatively low level of education, it is no longer appropriate for them to enroll in formal education. Instead, they can be encouraged to participate in vocational education and training to acquire skills and enhance their professional knowledge. This will enable them to apply their knowledge to production, promote productivity, and thereby narrow the income gap between urban and rural areas, ultimately increasing their wages.

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