

Study on the Impact of Human Capital Investment on Farmers' Income: Evidence from Western China

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Abstract

The development of rural areas in western China has become a new hot topic in the context of the fight against poverty. At the same time, the knowledge economy has brought about a second revolution in human capital, which has significantly enhanced the economic status of human capital. This paper constructs an empirical model using panel data on rural residents' income from work, income from farming, individual human capital input, and government human capital input from 1998-2018 in twelve provinces (cities) in western China to explore the impact of human capital input on rural residents' income in the western region. The study shows that: (1) The personal human capital input of farm households in western regions has a positive impact on the increase of both labour income and farm income, and the impact on labour income is greater; (2) Both personal human capital input of farm households and government human capital input has an impact on farmers' income in western regions to some extent; (3) Except for Shaanxi and Qinghai provinces, the impact of government human capital input on the increase of income is greater than that of farm households the impact of individual inputs was greater.

Keywords

Western China; Investment in Human Capital; Farmers' Income; Regional Disparities.

1. Introduction

China is a largely agricultural country, and as of the end of 2019, the population of China's rural residents was 721.35 million, accounting for 45.68% of the country's total population. The report of the 19th National Congress of the Communist Party of China points out that the issues of agriculture, rural areas, and farmers are fundamental issues related to the people's livelihood of the country, and that the solution of the "three rural issues" must always be the top priority of the work of the whole Party. Among the three rural issues, the income of rural residents is a key issue to the well-being of rural residents and a key issue to the overall situation of the country's work. Since 2004, the Chinese government has been issuing the Central Government's No. 1 document for many years, which is dedicated to the "three rural issues". China is now at a crossroads in the transformation of traditional agriculture. It is undeniable that China's rural areas have made great strides in development since the reform and opening up of the country. However, China has sacrificed more of its economic development to the development of agriculture in exchange for industrialisation. At present, the income growth of China's rural residents is significantly lower than that of urban residents, and this gap is being widened. At the same time, under the new situation of agricultural modernisation and agricultural supply-side reform. There is a large surplus of rural labourers, and most of these surplus labourers will choose to work in cities. With the development of society, the educational background of migrant workers is increasingly valued by enterprises, and the level of education will directly affect the income of migrant workers at work, which places higher demands on farmers. To adapt to this development, it is necessary to improve the scientific and cultural level of farmers, so the impact of

human capital investment on farmers' income becomes more and more obvious. At the same time, in terms of human capital input, the main components are personal input and government input. In this new historical context, what choices should farmers and the government each make? It is in this context that this paper presents its analysis and discussion.

The remainder of the study is organised as follows: Section 2 discusses related work, focusing on the impact of human capital inputs on income. Section 3 provides sample data selection and empirical model setting. Section 4 presents the unit root test and co-integration test and performs the empirical analysis. Section 5 concludes the full paper and makes some targeted recommendations.

2. Literature Review

Mincer first proposed the human capital theory by building a mathematical model to empirically analyse the relationship between earnings and the degree of training an individual receives, and on this basis, he summarised and proposed the Mincer wage equation. He argued that an individual's stock of human capital, including education and work experience, is an important determinant of an individual's income [1]. Schultz expanded on this in subsequent studies, viewing human capital input as an improvement in manpower and mainly present in the following activities, such as compulsory education, training of in-service personnel, off-the-job training programs, and labour migration [2]. Research on human capital and human capital input has been carried out in China since the 1980s and continues to this day. The research has continued in-depth and has shown a tendency to be multidisciplinary. However, in general, it can be divided into two levels of research: macro and micro.

At the macro level, some scholars have studied the returns to rural human capital, and most of the findings show that most rural workers have a low level of education[3] and that the income level of migrant labourers is closely related to the level of education and vocational training[4]. In addition, farmers' health status also has a strong influence on income [5]. Not only that, the level of education has a significant impact on the income gap of rural residents [6]. By studying three different income groups at high, middle, and low levels, it was found that the low-income group responded most significantly to changes in years of education, that the imbalance in education was the most direct cause of their unequal income distribution, and that the accumulation of human capital could significantly affect the changes in their income[7]. Some researchers have also focused their studies on the wage income of rural residents, and the results show that an increase in rural human capital investment can raise the wage income of rural residents, and more significantly[8]. In addition, the low cultural quality and insufficient knowledge and skills of China's rural labour force have seriously restricted the transfer of rural labour. Vocational education, however, due to its unique flexibility and application, can solve this problem while also helping to increase the income of rural labourers working outside the home [9].

At the micro-level, scholars have looked at individual provinces and even smaller regions. In China's Hainan Province, the role of increasing years of education on income growth exists in a variety of contexts, with the effect of working years on income being insignificant and marginal decreasing[10]. Some scholars have also used poor counties in Hunan Province as an empirical study to explore the impact of human capital investment on farmers' income in poor areas. The results of the study show that the increase in human capital investment in poor areas is equally positive to farmers' income. Both education and labour migration had a significant impact on farmers' income, and technical training was effective in increasing farmers' income from farming, while the impact on income from labour was not significant[11]. More scholars have conducted field research and conducted empirical analysis on a county basis. The results showed that education level was the main factor affecting farmers' income, and the effect of junior secondary education on farmers' income was higher than that of high school and secondary school [12].

In summary of the studies that have been completed, the impact of rural human capital investment on farmers' incomes in China shows an increasing trend, but there is unevenness. When looking at China divided into three parts, East, West, and Central, the results are of course different. The impact of

human capital investment on farmers' incomes is more pronounced in the East and Central regions than in the West, and even in different provinces within the same region, the extent to which human capital investment affects farmers' incomes varies, depending on the constraints of local economic development. While human capital investment has an impact on farmers' income, the increase in farmers' income also affects individual human capital investment at the same time, which is an iterative result. But the government also plays an important role in human capital investment, so how can this impact be quantified and how can we understand the extent to which the government and individuals each have an impact on farmers' incomes? This question is worth addressing, and it is on this basis that this study has been undertaken.

3. Data and Methodology

3.1 Data

The investment in human capital consists of investment in education, health, and migration. The expenditure on cultural, educational, and recreational goods and services per rural resident is chosen to replace the investment in education, the expenditure on health care per rural resident is used to replace the investment in health, and the expenditure on transport and communication per rural resident is used to replace the investment in migration. The sum of the three was considered as the individual human capital investment variable for farmers in the data processing. In terms of government input, the government's per capita investment in human capital was replaced by the government's fiscal expenditure in the current year compared to the resident population in the current year, which included education, healthcare, and transport.

All data are from the China Statistical Yearbook for 1999-2019 and are in Yuan. To avoid the effect of violent data fluctuations on the fitting effect, the natural logarithm is taken separately for each series. Guangxi, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Inner Mongolia, Sichuan, Chongqing, and Tibet are replaced by GX, GZ, YN, SHX, GS, QH, NX, XJ, NMG, SC, CQ, and XZ respectively. SR, WG, WN, RL, and ZF are used to replace the net income of rural residents, income from working, income from a household business, human capital input, and government human capital input respectively; LSR, LWG, LWN, LRL1, LRL2, and LZP are used to denote net income per rural resident (2007-2018), income from working of rural residents (1998-2018), income from working of rural residents (1998-2018), income from farming (1998-2018), rural residents' human capital input (1998-2018), rural residents' human capital input (2007-2018) and the natural logarithm of government human capital input (2007-2018).

3.2 Methodology

Before estimating the panel data model, it is necessary to test which of the above forms the sample data fit into, to avoid bias in the model setting and to improve the validity of the parameter estimates. With a vector of dependent variables and $k \times 1$ -dimensional explanatory variables, satisfying the linear relationship:

$$y_{it} = \alpha_{it} + x_{it} \beta_{it} + \varepsilon_{it} \quad (1)$$

And $i=1, 2, \dots, N, t=1, 2, \dots, 9$.

Where N denotes the number of individual cross-section members, t denotes the total number of observation periods for each cross-section member, the parameter α_{it} denotes the constant term of the model, β_{it} denotes a $k \times 1$ vector of dimensional coefficients corresponding to the explanatory variable x_{it} , and k denotes the number of explanatory variables. The random error terms are independent of each other and satisfy the zero-mean, homoskedasticity assumption.

When making model choices, a fixed-effects model is appropriate for individual cross-sectional members and a random-effects model is appropriate for time series, with individual fixed effects

models chosen according to the study objectives. Random effects have the advantage of saving degrees of freedom, and for data with relatively large variation from both time and intercept, random effects models can characterise the sources of error. The advantage of fixed effects is that it is easy to analyse the extent to which the dependent variable corresponding to any cross-section of data differs from the mean value of the dependent variable corresponding to the full cross-section of data. In practical applications, the empirical approach to choosing between fixed and random effects is that if one is modelling panel data to infer economic relationships in the sample space, it makes more sense to set up a fixed-effects model.

Constructing a fixed effects model:

$$LWG_{it} = \alpha_{it} + \beta_0 + \beta_{it} LRL1_{it} + \varepsilon_{it} \quad (2)$$

$$LWN_{it} = \alpha_{it} + \beta_0 + \beta_{it} LRL1_{it} + \varepsilon_{it} \quad (3)$$

$$LSR_{it} = \alpha_{it} + \beta_0 + \beta_{it} LRL2_{it} + \varepsilon_{it} \quad (4)$$

$$LSR_{it} = \alpha_{it} + \beta_0 + \beta_{it} LZF_{it} + \varepsilon_{it} \quad (5)$$

Where LWG_{it} and LWN_{it} are rural residents' income from work (1998-2018) and rural residents' income from agriculture (1998-2018), respectively, LSR_{it} denotes net income of rural residents (2007-2018), $LRL1$ and $LRL2$ denote rural human capital investment (1998-2018) and rural human capital investment (2007-2018), respectively, and LZF denotes government human capital investment (2007-2018). 2018), and LZF denotes government investment in human capital (2007-2018). The model parameters were estimated using the Pooled EGLS (Cross-section Weights) method.

4. Results and Discussion

4.1 Unit Root Test

Table 1. Unit root test results

Variables	LLC	IPS	ADF
LWG	9.2492	1.3297	0.1896
LWN	5.5849	2.7164	0.0110
LSR	2.3150	4.9786	1.6561
LRL1	5.9466	1.6046	0.1162
LRL2	8.3189	4.7832	2.3456
LZF	9.0402	3.3091	1.6006
DLWG	-2.0287**	-1.6552**	6.1073**
DLWN	-2.0921**	-1.1994*	4.5380*
DLSR	-11.2814***	-2.8271***	48.0610***
DLRL1	-3.7375***	-2.9883***	11.1638***
DLRL2	-2.9267***	-5.3198***	68.7646***
DLZF	-5.0704***	-3.8240***	55.9956***

Standard unit root tests have low test efficacy when testing univariate time series, and are more effective when considering panel scenarios with both time and cross-sections. The selected panel unit root tests include the LLC test, which has the null hypothesis that each cross-section has the same unit root, and the IPS, ADF, and PP tests, which allow for different unit roots across cross-sections. Unit root tests were conducted on the original series and the first-order difference series with individual effects as exogenous variables, which are stationary series after first-order difference.

4.2 Co-integration Test

The cointegration test is continued as all the first-order differences of the series are stable. The Kao test is used in this study and the lag order is chosen automatically by the SIC rule. If the cointegration test is passed, it indicates that there is a stable equilibrium relationship between the variables in the long run and that the regression residuals of the equation are stationary. The Kao test shows that there is cointegration between the panel data on the logarithm of farmers' income from labour, farming income, and personal human capital input in 12 provinces (cities) in western China at the 1% level of significance, and between the panel data on the logarithm of personal human capital input, government human capital input and farmers' income at the 1% level of significance. There is also a cointegration relationship between the panel data of individual human capital input, government human capital input, and farmers' income at a 1% level of significance.

Table 2. Kao test results

Variables	LWG	LWN	LSR
Value of t-statistic	-6.0641***	-7.7670***	-6.1917***

4.3 Analysis of the Impact of Farmers' Personal Human Capital Investment on Labor and Farming Income

Table 3. Results of regression analysis of income from work

Variables	Coefficient	T-value	Fixed effects	
c	1.515	10.937		
CQ-LRL	0.693***	19.963	CQ-C	1.266
SC-LRL	0.695***	20.966	SC-C	1.178
GZ-LRL	0.793***	30.436	GZ-C	0.414
YN-LRL	0.894***	31.886	YN-C	-0.751
XZ-LRL	0.824***	21.215	XZ-C	0.420
SX-LRL	0.912***	38.545	SX-C	-0.580
GS-LRL	0.677***	22.568	GS-C	0.822
QH-LRL	0.668***	23.062	QH-C	0.850
NX-LRL	0.802***	29.262	NX-C	0.182
XJ-LRL	1.277***	37.387	XJ-C	-3.901
GX-LRL	0.692***	16.384	GX-C	1.029
NMG-LRL	0.856***	48.813	NMG-C	-0.929
R ²	0.995		F	1796.386
Adj-R ²	0.994		D-W	1.793

The results of the model regressions are shown in Table 3 and 4. Farmers' human capital investment has a positive effect on both rural residents' income from work and farming, and both are significant at the 1% level, but there is some regional variability among the 12 provinces (municipalities) in western China. In terms of income from work, the most affected province (city) in Xinjiang. For every one percentage point increase in human capital investment, the income of rural residents in Xinjiang increased by 1.277 percentage points. The rest of the provinces (cities) are Shaanxi 0.912, Yunnan 0.894, Inner Mongolia 0.856, Tibet 0.824, Ningxia 0.801, Guizhou 0.793, Sichuan 0.695, Chongqing 0.693, Guangxi 0.692, Gansu 0.677 and the lowest is Qinghai 0.668. There is not much difference between the provinces (cities), and the overall impact is in a stepped pattern. In terms of income from farming, the most affected province (city) is also Xinjiang. For every percentage point increase in human capital investment, Xinjiang's rural residents' income from farming increased by 0.586 percentage points; the remaining provinces (cities) were Yunnan 0.573, Sichuan 0.535, Inner Mongolia 0.522, Guangxi 0.522, Shaanxi 0.514, Chongqing 0.499, Tibet 0.467, Ningxia 0.464, Gansu 0.437, Guizhou 0.376 and the lowest Compared to income from work, income from farming is generally weaker as a result of farmers' human capital investment.

Table 4. Results of regression analysis of farming income

Variables	Coefficient	T-value	Fixed effects	
c	4.433	48.650		
CQ-LRL	0.499***	26.460	CQ-C	-0.141
SC-LRL	0.535***	47.089	SC-C	-0.319
GZ-LRL	0.376***	26.203	GZ-C	0.596
YN-LRL	0.573***	50.251	YN-C	-0.446
XZ-LRL	0.467***	14.379	XZ-C	0.636
SX-LRL	0.514***	28.677	SX-C	-0.589
GS-LRL	0.437***	21.629	GS-C	0.117
QH-LRL	0.353***	18.829	QH-C	0.708
NX-LRL	0.464***	26.959	NX-C	0.058
XJ-LRL	0.586***	38.345	XJ-C	-0.361
GX-LRL	0.522***	19.263	GX-C	-0.159
NMG-LRL	0.522***	30.495	NMG-C	-0.099
R ²	0.994		F	1638.754
Adj-R ²	0.993		D-W	1.750

4.4 Analysis of the Influence of Individual and Government Human Capital Investment on Farmers' Income

The results of the model regressions are shown in Tables 5 and 6. Both individual human capital input by farm households and government human capital input has a positive effect on the income of rural residents and are significant at the 1% level. In terms of individual farm household inputs, the most affected province (city) in terms of rural residents' income is Shaanxi. For each percentage point increase in human capital input, the income of rural residents in Shaanxi increased by 0.883 percentage points. The rest of the provinces (cities) in order are Xinjiang 0.754, Tibet 0.724, Yunnan 0.718, Inner Mongolia 0.684, Sichuan 0.681, Ningxia 0.673, Gansu 0.672, Chongqing 0.668, Guangxi 0.660, Qinghai 0.644 and the lowest is Guizhou 0.600. The small difference between the provinces (cities) is closely related to the continuous increase in individual farm household input is closely

related to the continued increase in individual farm household input in each province (city), and therefore did not produce a large gap. In terms of government inputs, the most affected province (city) was again Shaanxi. For each percentage point increase in human capital investment, Shaanxi's rural income increased by 0.812 percentage points. The rest of the provinces (cities) are Ningxia 0.798, Xinjiang 0.798, Tibet 0.765, Gansu 0.746, Yunnan 0.745, Inner Mongolia 0.741, Guangxi 0.734, Guizhou 0.709, Chongqing 0.702, Sichuan 0.701 and the lowest is Qinghai 0.626. The difference in the impact rate of government input is smaller than that of individual farmers' input.

Based on the results of the above model, the impact of human capital input on farmers' income from working and farming in 12 provinces (cities) in western China was found to be of different degrees. The fact that income from working is more sensitive than income from farming suggests that the increase in human capital investment is more helpful to the increase in income from working. This result is also exacerbated by the fact that rural residents in 12 provinces (cities) in western China tend to go to the eastern region for work, while those who remain in their hometowns for farming are mostly the elderly and children. In terms of geographic location, the impact of farming households' human capital investment is more pronounced in China's more remote regions of Xinjiang and Inner Mongolia. The increase in the stock of human capital prompted them to move away from agricultural production activities to work outside the home, changing their long-standing situation.

Meanwhile, Tibet and Qinghai, where government human capital inputs are much higher than in other regions, do not perform significantly in the regression model. This is the result of their long-standing poor economic base and a combination of historical factors. At the same time, their human capital investment is not significant compared to other regions. In future policy implementation, the government should probably consider taking certain measures to encourage farmers to make spontaneous human capital investments and change the status quo of over-reliance on government action.

Table 5. The impact of individual human capital inputs on farmers' income

Variables	Coefficient	T-value	Fixed effects	
c	1.591	56.042		
CQ-LRL	0.668***	24.607	CQ-C	0.1583
SC-LRL	0.681***	34.248	SC-C	0.105
GZ-LRL	0.600***	28.634	GZ-C	0.290
YN-LRL	0.718***	18.809	YN-C	-0.083
XZ-LRL	0.724***	12.404	XZ-C	0.159
SX-LRL	0.883***	29.112	SX-C	-0.685
GS-LRL	0.672***	27.457	GS-C	-0.016
QH-LRL	0.644***	18.865	QH-C	0.073
NX-LRL	0.673***	31.461	NX-C	0.026
XJ-LRL	0.754***	32.169	XJ-C	-0.169
GX-LRL	0.660***	22.643	GX-C	0.156
NMG-LRL	0.684***	20.230	NMG-C	-0.015
R ²	0.987		F	387.658
Adj-R ²	0.984		D-W	1.168

Table 6. The impact of government human capital investment on farmers' income

Variables	Coefficient	T-value	Fixed effects	
c	1.233	18.887		
CQ-LRL	0.702***	14.015	CQ-C	0.285
SC-LRL	0.701***	12.540	SC-C	0.331
GZ-LRL	0.709***	13.226	GZ-C	0.059
YN-LRL	0.745***	12.319	YN-C	0.009
XZ-LRL	0.765***	24.638	XZ-C	-0.443
SX-LRL	0.812***	9.4948	SX-C	-0.223
GS-LRL	0.746***	15.849	GS-C	-0.072
QH-LRL	0.626***	7.0307	QH-C	0.213
NX-LRL	0.798***	16.218	NX-C	-0.194
XJ-LRL	0.798***	10.691	XJ-C	-0.213
GX-LRL	0.734***	9.492	GX-C	0.171
NMG-LRL	0.741***	8.968	NMG-C	0.078
R ²	0.954		F	107.047
Adj-R ²	0.945		D-W	0.719

5. Conclusion

The above empirical results and analysis bring us two insights. On the one hand, in western China, the impact of individual farm household human capital input on income from work is greater. Every 1% increase in farm household human capital input will increase the income from working in most provinces (cities) by more than 0.6%. However, for every 1% increase in human capital input, most provinces (municipalities) will only see a 0.4% increase in farming income. With the increase in human capital investment in rural areas, the gap between income from work and farming has been widened. On the other hand, in western China, the impact of government human capital investment on the income of rural residents is even greater. Every 1% increase in human capital investment will increase the income of rural residents by more than 0.7% in most provinces (cities). However, for every 1% increase in individual farm household human capital input, household business income in most provinces (cities) will only increase by 0.6%. This is roughly the same trend as the increase in the amount of human capital input.

On this basis, we make the following targeted recommendations. First, farmers should be encouraged to invest in human capital in their initiative. Like the government, farmers themselves are an important subject of human capital investment. In the process of human capital accumulation, therefore, one cannot rely solely on government input. Farmers themselves must also have a sense of planning or a sense of investment, and spontaneously and purposefully receive education and skills training. For its part, the government should play a good propaganda and guidance role and motivate farmers to invest in human capital through various means. Secondly, the government should pay attention to and change the current situation of uneven investment between regions. In the context of poverty eradication in the new era, the main approach to changing the regional imbalance is still for the government to continuously increase the proportion of human capital investment in government expenditure. It will also focus on rural areas and improve the disparity between urban and rural areas while improving regional imbalances. Strengthen basic education in rural areas, reduce rural school failure rates and focus on the hollowing out of rural primary schools. Improve the quality of the

teaching force in primary and secondary schools, optimise the educational environment at the basic education level, and explore an all-around, multi-level education support system that is financially led. Thirdly, develop vocational skills education in rural areas. Based on reality and market-oriented, vocational and technical training should be developed in a targeted manner. The form of vocational training can also be innovative, for example, village committees or farmers can take the lead in setting up vocational and technical training courses on their initiative, and professional guidance can be provided through cooperation with institutions and research institutes to improve the vocational skills of farmers. Alternatively, contracts can be signed with enterprises according to their needs, and order-based training can be used to provide targeted skills training and secure employment for farmers. Fourthly, while attaching importance to investment in education, we should not neglect investment in healthcare. Efforts have been made to improve the social security system in rural areas and to establish a sound medical and health service system and network at the county, township, and village levels. Through the establishment of a social security system in rural areas, support is provided for investment in rural human capital. Improve farmers' risk resilience, and ultimately work together to promote the investment and accumulation of human capital in rural areas.

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