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Research Article

Education Investment, Fixed Asset Investment and Regional Economic Development Differences——Empirical analysis based on Chinese

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Abstract: In this article, it discusses the differences in economic development between urban and rural areas and regions in our country from the perspective of education investment and fixed asset investment. Based on the provincial data of 31 provinces from 1999 to 2017 released by National Bureau of Statistics, it expends the Cobb-Douglas model and Lucas model, and analyses the data with multiple linear regression models. From the study, it finds that compared with investment in fixed assets, investment in education has a larger role in promoting economic development, which is more obvious in the underdeveloped central and western regions and rural areas. However, at the same time it needs to note that the positive effects of education investment will be restricted by the economic structure and policy environment, and education expenditure policies should also be implemented in accordance with time and local conditions.

Keywords: Education investment; Fixed asset investment; Regional economic development; Multiple linear regression analysis

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1 Introduction

In the context of the new normal of economy and supply-side reforms, the economy of our country is bound to realize the transformation from investment-driven to knowledge innovation. For a long time, our country's economy has been dependent on investment in fixed assets. If we want to achieve economic transformation, we must increase the level of human capital investment in our country. According to Lucas' human capital theory, education is the main means of accumulating human capital. Therefore, this article considers the use of the modified Cobb-Douglas production function combined with the Solow model to analyze the difference between the return on investment in fixed assets and the return on education in urban and rural economic development of our country. At the same time, considering the huge differences in the development of the eastern, central and western regions of our country for a long time, this article analyzes the relationship between the urban and rural economic development in the eastern, central and western regions and education investment and fixed asset investment and puts forward relevant policy recommendations. Compared with the existing domestic and abroad research, the innovation point of this article is to combine urban and rural differences with regional differences for consideration, and analyze with the modified Lucas model.

2 Literature review

Concerning the relationship among education investment, economic increase and resident income, domestic and abroad scholars have conducted profound and extensive researches. Currently, the domestic research mainly focuses on the following issues:

Chen Binkai and other scholars have conducted a series of studies, which are aiming at the relationship

between education investment and residents income. Liu Yunzhong and Xu Yingmei (2007) used co-integration theory to study the relationship between the education gap between urban and rural residents and education investment gap between urban and rural reisdents. The author found that it exists a co-integration relationship between the education gap between urban and rural areas and the logarithm of the current education investment gap between urban and rural areas. This relationship is a long-term equilibrium relationship. The expansion of the educational investment gap between urban and rural residents in my country has a significant impact on the expansion of the urban-rural education gap; Chen Binkai et al. (2010) studied the effect and mechanism of government education investment on the income gap between urban and rural area of China. The author used the data of CHIP in 2002 and adopted the decomposition method of Oaxaca-Blinder. Through the research, the authors found that the difference in education level is the most important factor on the difference between China's urban and rural areas, and the urban-tended education funding policy is an important determinant of the expansion of this gap; Feng Yun and Wang Weiguo (2011) used Mantel correlation analysis method and space econometrics method to analyze the relationship between the education investment gap and resident income gap. Through the research, the author found that the unequal investment in higher education and elementary education in various regions is the important factor for the generation and expansion of the income gap of residents in our country; Lu Wei et al. (2015) introduced the dual structure of urban and rural areas and government behaviors into the inter-temporal model proposed by Silia and studies the inner relationship between urban and rural education inequality, urban and rural income gap and government input. Based on the 2001-2011 provincial panel data, the author found that narrowing the gap between urban and rural junior high school education funding can effectively reduce urban-rural education inequality and urban-rural income gap.

Sun Yuhuan and Zhong Wuya proposed their opinions on econometric analysis regarding government investment in education and regional economic development: Based on co-integration, Zhong Wuya (2014) used casuality test, ECM model and impulse response and other methods to analyse the relationship between education investment and economic growth in Beijing, Guangdong and Shanghai. Through the co-integration test, it shows that Guangdong's education investment has the greatest effect on economic growth in short term; Shanghai has more significant effect in long term; Based on the panel data of 31 provinces in China from 2001 to 2010, Sun Yuhuan and Ji Xiaoxu (2014) used multi-index panel data clustering results analysis method to analyze the impact of educational investment on different development levels and different types of economic regions. The author found that for provinces with a better economic foundation but low literacy of residents, it has both positive interactions between education and economic growth; for the nine central and western provinces with poor economic foundation and low population quality, it has negative interactions between education and economic growth.

Abroad scholars analyzed the relationship between economic growth and education investment using their own data from their countries, and came to the following conclusions. Abdul Jabbar Abdullah (2013) used the Solow model and Malaysian education data to analyze the relationship between education and economic growth in the article 'Education and Economic Growth'. The author found that there is a significant negative correlation between the number of school students and economic growth in Malaysia. The role of education in economic growth is a long-term process; Mehmet Mercan and Sevgi Sezer (2014) used an empirical model to analyze relationship between education expenditure and economic growth in Turkey, in the article 'The effect of education expenditure on economic growth'. The author found that the increase in education expenditure has a positive effect on economic growth in Turkey, and this has more significant effect in long term; Dragoescu Raluca Mariana (2015) used error correction model and Romania's data from 1980 to 2013 to analyze the relationship between education and economic growth in the article 'Education As A Determinant Of The Economic Growth'. The author found that the number of students in higher education has a significant positive impact on economic growth.

3 Model and Data

3.1 Model

Among the articls, which analyze economic growth, the Solow model is a widely cited; the production function it is based is Cobb-Dougla production function. Solow mode attributes the factors in economic growth to two categories: the first category is fixed asset (K), the second category is labor (L). In this article, it is to analyze the how fixed assets and labor affect the contry's GDP growth during the 19 years from 1999 to 2017. Therefore, in this article it subdiveds K, which is in the Solow model, into urban fixed asset investment Ku and rural fixed asset investment Kr . Also, the labor L is subdivided into rural labor input and urban labor input Lu. In order to further reflect the promotion process of fxied asset and labor for economic growth, it uses the widely cited Cobb-Douglas production funcion as the basic analysis model and further modified in this article, as in formula 1. In this article, it assumes $\alpha 1 + \alpha 2 + \beta 1 + \beta 2 = 1$ in the model. In order to further analyze the formation of L in Cobb-Douglas production function, it introduces Lucas model in this article.

Assuming that in the absence of population growth (that means the labor force in the economy and society remains unchanged), then the improvement of the labor force in the whole society as a production factor can only come from the improvement of labor quality. According to Lucas's human capital theory, the improvement of labor quality comes from two aspects, first is the improvement of education level, and second is the accumulation of work experience. Since the accumulation of experience is a natural process and is less affected by government actions; therefore, the main purpose of this article is to analyze how improving the level of education affects the overall quality of the labor force and further promotes the development of the national economy. This article assumes that the quality of the labor force is only determined by the level of education, which can be expressed as a function of the total social education input, and that the same unit's social education input has different effects on the improvement of labor quality in rural and urban areas, and then it obtains formula 2 in this article. In formula 2, I_u^e means urban education investment, Lu is set as the function of I_u^e. At the same time, I_u^e means the rural education investment, and Lr is set as the function of I_r^e. With substituting formula 2 into formula 1, formula 3 is obtained in this article. From formula 3, it can be seen from this article that through the above assumptions and with the help of the Cobb Douglas production function, this article subdivides the factors of economic growth into 4 categories, including: urban fixed asset investment, rural fixed asset investment, urban education investment and rural education investment. In this article, it assumes that these four factors have different effects on economic growth, so this article assigns different contribution indices to these four factors.

Through formula 3, in this article, it obtains the basic model for establishing regression model and conducting empirical test. According to this modeling idea, in this article, it uses OLS (least square method) for regression analysis. With taking the logarithm on both sides of formula 3, it can get equation 1. In equation 1, in order to facilitate the regression comparison analysis, in this article, it does the process of de-unitization for GDP (Y), urban education investment (I_u^e), rural education investment (I_r^e), urban fixed asset (K_u) investment and rural fixed asset investment (K_r). At the same time, in this article it uses the GDP (Y) of the previous year as the base period to assess the growth rate. Meanwhile, all annual GDP is converted based on the prices in 1999. In this article, it uses the same method to deal with urban education investment I_u^e, rural education investment, urban fixed asset investment, and rural fixed asset investment; it converts these data to the actual value based on the prices of base period of1993, and compares and analyzes the growth rate on a period-on-month basis.[1]

3.2 Solow model with urban rural differences

Formula 1 :

$$Y = AK^{\alpha 1} K^{\alpha 2} L^{\beta 1} L^{\beta 2}$$
$$u \rightarrow r \rightarrow u \rightarrow r$$

Lucas model:

Formula 2:

[1] The conversion method of fixed asset investment refers to the fixed asset calculation of the Organization for Economic Cooperation and Development (OECD)

$L_u = f(I^e)$ u

$L_r = f(I^e)$ r

Formula 3:

$$Y = AK^{\alpha 1} K^{\alpha 2} [f(I^e)]^{\beta 1} [f(I^e)]^{\beta 2}$$
$$u \rightarrow r \rightarrow u \rightarrow r$$

Least squares regression (OLS):

Equation 1:

$$y = \beta_0 + \beta I^e + \beta I^e + \alpha K + \alpha K + u$$
$$1u \quad 2r \quad 1u \quad 2r$$

(2) Data

According to equation 1, in this article, it needs the following five data: GDP (Y), urban education investment (I_u^e), rural education investment (I_r^e), urban fixed asset (K_u) investment and rural fixed asset investment (K_r). In this article, it uses the GDP, fixed asset investment, and education investment data provided by the National Bureau of Statistics from 1999 to 2017 on the official website to search separately for urban and rural areas, and obtains the 19-year inter-provincial data for 31 provinces in mainland China2. In order to make the obtained data comparable, it uses the year 1999 as the base period for standardization. The fixed asset investment *Ku* and *Kr* use the statistical caliber provided by the National Bureau of Statistics, the calculation method used for rural fixed asset investment is to give total fixed asset investment minus urban fixed asset investment. Each provincial education expenditures I_u^e and I_r^e are not directly obtained from the China Statistical Yearbook, therefore, in this article, it splits the urban-rural ratio of education investment in each province with the urban-rural ratio of national education investment. Similarly, in order to make the data comparable, in this article, it uses the year of 1999 as the base period to calculate the sequential growth rate of education expenditure, so that the data is suitable for the analysis needs in this article.

4 Analysis and conclusion

4.1 Result analysis

In order to use the empirical data to verify the model of this article, this article classified and analyzed the obtained data of the obtained 31 provinces. According to our country's current basic national conditions and considering factors such as urbanization rate and economic development level, in this article, it uses the country's commonly used province classification method ——Eastern, Central and Western Classification Method to perform regression analysis.

Table 1. Least square regression (OLS) coefficient result

Variable	(National) GDP	(Eastern) GDP	(Central) GDP	(Western) GDP
Rural education investment	323.7***	179.9***	293.5***	419.0***
	(46.88)	(44.24)	(67.13)	(35.93)
Urban education investment	105.4***	68.74***	85.95***	110.9***
	(12.36)	(11.72)	(17.02)	(9.455)
Rural fixed asset in vestment	1.653***	1.515***	2.279***	2.253***
	(0.262)	(0.218)	(0.468)	(0.381)
Urban fixed asset investment	0.377***	0.439***	0.647***	1.114***
	(0.0441)	(0.0372)	(0.111)	(0.0539)
Intercept term	-2,412***	-1,586***	355.3	-142.7
	(277.9)	(391.1)	(400.7)	(137.3)
Sample size	434	154	112	154
R square	0.939	0.980	0.964	0.976

Standard errors in parentheses

*** $P<0.01$, ** $P<0.05$, * $P<0.1$

The first column of the regression results represents the results of regression analysis of the whole 31 provinces across the country. It can see from this article that whether it is urban education investment, rural education investment, urban fixed asset investment or rural fixed asset investment, all have a significant positive impact on economic development and GDP. However, there is a big difference between the four factors. From the point of view of the urban and rural areas, the rural investment

[2] Data from 'China Statistical Yearbook', 199-2017

[3] The provinces in the east, middle and west are classified with using the classification method on the National Bureau of Statistics website (www.stats.gov.cn)

factors, whether education or fixed assets have a much higher effect on the economy than in urban areas. In terms of investment types, whether it is rural or urban, investment in education has a much greater effect on the economy than investment in fixed assets, whether it is rural fixed assets or urban fixed assets. Therefore, in this article it finds that under the condition of fixed total investment, the return from investing in education is greater than the investment in fixed assets; and from the internal point of view of education investment, the return from investing in rural education is greater than investing in urban education. Because the economic environment, social culture, and population quality of the three regions in the east, center, and west of our country are quite different, after conducting a nationwide analysis of the relationship between education investment and economic growth, this article will also include 31 provinces across the country. Cluster regression analysis is carried out according to the eastern, central and western regions.

The regression results for the eastern provinces are shown in the second column of the table. By analyzing the regression results of the eastern provinces, in this article, it can find two differences from the national regression results. The first is that the rural education investment in the eastern provinces has a negative contribution to economic growth, and the second is that the urban education investment in the east has a higher contribution to the economy than the rural education investment. The difference between these two points and the whole country is due to the unique economic and social environmental factors of the eastern provinces. Most of the eastern provinces are provinces that have undergone trials after our country's reform and opening up. The difference between their socio-economic development and the national economic development is first reflected in the different policy environments. Taking the five cities that were the first to pilot reform and opening up as examples, the eastern provinces were the first to reform their ownership structure and foreign trade policies. The policy change has brought about a large amount of foreign investment and advanced technology. Second, compared with the national average, the eastern provinces have a better market environment. The degree of freedom and openness of the market is higher than that of other regions, bringing a lot of investment opportunities. Finally, the education level and comprehensive cultural quality of the population in the eastern provinces are higher than the national average. Therefore, in this article, it can get a reasonable explanation about the regression results of the eastern provinces. First, due to the superior market environment and open policy attitudes, the eastern provinces have more investment opportunities, and most of these investment opportunities are concentrated in light industrial industries such as clothing. These industries have low demand for cultural quality, and in the context of the times, it is easy to obtain high profits, which will inevitably lead to a higher rate of return on fixed assets in cities and towns in the eastern region during this period, and a lower rate of return on education investment, even negative.

The third and fourth columns in the table represent the regression analysis results of the central and western provinces, respectively. By comparing this article, we can find that the coefficients of fixed asset investment and education investment in western and central provinces are basically consistent with the national situation, that is, the return on investment in urban areas is less than that in rural areas, while the return on investment in fixed assets is less than education, which is different from the national trend, the benefits of fixed asset investment in cities and towns in the central region are all negative. This result is caused by the following two reasons: Firstly, the policy environment and market environment in the central and western regions are relatively poor, and there are fewer investment opportunities. Therefore, the income obtained is low; Secondly, the negative income of fixed asset investment is also due to the lower population quality in the central and western regions, so the fixed asset investment in the central and western regions is negative.

4.2 Conclusion

Firstly, human capital investment represented by education investment plays a greater role in promoting economic development than fixed asset investment. The data used in this article are data from 1999 to 2017. With the deepening of reform and opening up, the economy of our country is growing at a high speed, while the economic structure has gradually shifted to the secondary and tertiary industries, and talents who have experienced primary and secondary education gradually occupy a

dominant position in the economy. Therefore, the rate of return on education is gradually increasing, and even tends to exceed the rate of return on investment in fixed assets.

Secondly, the role of human capital investment in economic development is restricted by policy and market factors. From the perspective of the return on education and the return on fixed asset investment in the provinces in the eastern regions in this article, it is not difficult to find that both the return on education and the return on fixed assets in the eastern provinces have a significant role in promoting the economy. Then, the special case is that the return on investment in education in rural areas in the eastern region is significantly negative. This requires analysis based on the current policy environment. The eastern region was the first province to implement reform and opening up. The establishment of the market system also began in the eastern urban areas. In the eastern rural areas, the primary industry is still the main economic system. The requirements for the quality of talents are relatively low, and talents with high human capital cannot play their roles in suitable jobs. Under this background, it will inevitably lead to the problem of a decline in the rate of return to education.

Finally, the role of human capital and fixed assets in promoting economic development is restricted by the original economic foundation of the economy and society and the quality of the original population. As far as fixed asset investment is concerned, it has the greatest economic promotion effect in the east, and it has a significant effect in both rural and urban areas. For the central and western regions, the effect of fixed asset investment on the economy is not so significant. For human capital investment, that is, investment in education, cities and rural areas in the eastern, central and western regions have different trends. For urban areas, the return on investment in education in the eastern area is more significant. For rural areas, the return on investment in education in the central and western regions is more significant.

5 Suggestion and Prospect

5.1 Suggestion

Based on the empirical and theoretical research and analysis in this article, in view of the differences in the economic and social development of rural and urban areas, eastern, central and western regions, in order to better play the role of education investment in promoting economic development, in this article, it suggests when formulating education policies and allocating education funds, the government departments need to consider the following principles:

Firstly, the proportion of education expenditures in fiscal expenditures should be increased. As the economic development of our country gradually enters a new normal, the pillar industries of the economy will inevitably shift from the secondary industry to the tertiary industry, and economic development will inevitably shift from investment-driven to knowledge innovation-driven. In this situation, education investment, labor improvement and increase of per capita human capital of the population will be particularly important.

Secondly, fiscal expenditures for education should be equitable between urban and rural areas. From the research results, the rate of return to education in rural areas in our country is not lower than that in urban areas. For a long time, the problem in rural areas of our country is mainly the problem of insufficient educational resources. Since the degree of urbanization in our country is still low and the rural population still accounts for the vast majority, investment and rural education have profound significance for improving per capita human capital of our country.

Thirdly, the distribution of education funds in the eastern, central and western regions should lean towards the central and western regions. Since the reform and opening up of our country, the eastern region has always been in the position of the "policy highlands", and all aspects of social and economic development have been relatively good, while the central and western regions have been relatively poor. Through the analysis results, it can be seen that, compared with fixed asset investment, education investment can promote economic development in the central and western regions. From a national perspective, leaning educational funding to the central and western regions can achieve educational equity and help to achieve the goal of a comprehensive moderately prosperous society.

5.2 Prospect

Meanwhile, it should be noted that in the process of analysis, this article takes each province as a unit to discuss the difference between the return

on investment in fixed assets and the return on education in our country's urban and rural economic development. However, within each province, there are also large differences in the level of regional development among cities. Therefore, based on the subsequent acquisition of more abundant panel data, it will continue to conduct in-depth discussions in this article.

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