

Rural Education Investment Ratio and Regional Economic Growth

—Based on the Panel Data of China from 1993 to 2014

Shu Wen

School of Economics, Peking University, Beijing 100871, China

wspku@pku.edu.cn

Abstract. From the perspective of human capital accumulation, this paper analyzes the impact of urban and rural education investment on regional economic growth. Based on the multiple linear regression model and using the provincial panel data from 1993 to 2014. The paper thinks that in order to promote the balanced development of urban and rural economy and regional economy, the government should increase the proportion of education expenditure in fiscal expenditure, and education investment should be inclined to rural areas and central and western regions.

Keywords: Rural education investment, regional economic growth, Human capital.

1. Introduction

Under the background of the new normal of economy and supply-side reform, China's economy is bound to achieve the transition from investment driven to knowledge driven innovation. Our economy has been relying on fixed asset investment for a long time. If we want to achieve economic transformation, we must improve the level of our human capital investment. According to Lucas' human capital theory, education is the main means to accumulate human capital. Therefore, we consider using the modified Cobb-Douglas production function combined with the Solow model to analyze the difference between the investment return of fixed assets and education investment return of urban and rural economic development in China. At the same time, considering the long-time huge differences in the development of the eastern and western regions, we separately analyzed the relationship between urban and rural economic development of the eastern and western regions, education investment and fixed asset investment, and put forward relevant policy recommendations. Compared with the existing research at home and abroad, the innovation of this paper is to combine the urban-rural differences with the regional differences for consideration, and analyze with the modified Lucas model.

2. Literature Review

The domestic and foreign scholars have in-depth and extensive research on the relationship among education input, economic growth and resident income. At present, domestic researches mainly focus on the following problems:

In view of the relationship between education investment and resident income, Yunzhong Liu and other scholars conducted a series of studies: Yunzhong Liu (2007) studied the relationship between the rural and urban education gap and the rural and urban residents education investment gap by using the co-organization. The author finds that there is a co-integration relationship between the current education gap between China's urban and rural residents and the logarithm of the current education investment gap, which is a long-term equilibrium relationship. The expansion of the education investment gap between urban and rural residents has a significant impact on the expansion of the urban-rural education gap; Binkai Chen (2010) studied the influence and mechanism of government education input on China's urban-rural income gap from government investment in education, human capital investment and China's urban-rural income gap. The authors used 2002 CHIP data through the Oaxaca-Blinder decomposition method and found that the education level difference is the most important factor of the urban-rural difference in China, and the city-biased education expenditure input policy is an important determinant to widen this gap.

Feng yun (2011) studied the relationship between education investment gap and resident income gap in China by using Mantel correlation analysis and spatial econometric analysis. Through the research, the author found that the inequality of local investment on higher education and primary education is the main reason for the generation and expansion of the resident income gap in China. Lv wei (2015) introduced urban-rural dual structure and government behavior into the intertemporal model proposed by Geller and Salia, and studied the internal relationship between urban-rural education inequality, urban-rural income gap and government input. Based on the provincial panel data from 2001 to 2011, the author found that narrowing the gap of education funds in urban and rural middle schools can effectively reduce the gap between urban and rural education inequality and urban and rural income.

On the issue of the government expenditure on education and regional economic development, Yuhuan Sun, Wuya Zhong express their own opinion based on the econometric analysis: Wuya Zhong (2014) analyzed relationship between education investment and economic growth in Beijing, Guangdong, Shanghai by the method of cointegration, USES Granger causality test, ECM model and impulse response method. The cointegration test shows that Guangdong education input has the greatest effect on economic growth in the short term. In the long run, Shanghai is more significant. Yuhuan Sun (2014), analyzed the impact of education input on different development levels and different types of economic regions by using the method of multi-index panel data cluster analysis based on the panel data of 31 provinces in China from 2001 to 2010. The author found that the interaction between education and economic growth was positive for provinces with good economic foundation and low cultural quality of residents. In the nine central and western provinces with poor economic foundation and low population quality, the interaction between them is negative.

Foreign scholars analyzed the relationship between economic growth and education input with the help of domestic data, and reached the following conclusions:

In the article Education and Economic Growth, Malaysian scholar Abdul Jabbar Abdullah (2013) used Malaysian education data for regression and analyzed the relationship between education and economic growth. The author found that there is a significant negative correlation between the number of students in Malaysia and economic growth. Education plays a long-term role in economic growth. Mehmet Mercan (2014), a Turkish scholar, analyzed the relationship between education expenditure and economic growth in Turkey from the long-term and short-term these two aspects in his article Education as a Determinant of the Economic Growth. The authors found that increasing education spending had a positive effect on Turkey's economic growth, which became more pronounced in the long term; Romanian scholar Dragoescu Raluca marina (2015) analyzed the relationship between education and economic growth by using 1980-2013 data Of Romania in Education as a Determinant of the Economic Growth. The authors found that higher education enrollment had a significant positive effect on economic growth.

3. Methodology and Data

In the analysis of economic growth, the Solow model is a widely used model, among which the most commonly used production function is the Cobb-Douglas production function. The Solow model classifies economic growth factors into two categories: fixed assets (K) and labor (L). In this paper, we want to analyze how urban fixed assets and labor, as well as rural fixed assets and labor, affected the growth of national GDP in China during the 22 years from 1993 to 2014. Therefore, we subdivided K in the Solow model into K_u -urban fixed asset investment and K_r -rural fixed asset investment. At the same time, we also subdivided labor L into rural labor input L_r and urban labor input L_u . In order to reflect the process of promoting economic growth by fixed assets and labor force, the analysis model is modified, as shown in formula 1. In the model, we set them equal to $\alpha_1 + \alpha_2 + \beta_1 + \beta_2 = 1$. To further analyze the formation of L in the cobb-douglas production function, we introduce the Lucas model.

Assuming that there is no population growth (i.e., the amount of labor force remains the same in economic society), the improvement of the production factor of the whole social labor force can only

be attributed to the improvement of the quality of labor force. According to Lucas' human capital theory, the improvement of labor quality comes from two aspects: first, the improvement of education degree; second, the accumulation of work experience. As the accumulation of experience is a natural process, which is less affected by government behavior, we want to analyze how to improve the overall quality of labor force affected by education level to promote the development of national economy. We assume that the quality of labor force is only determined by education level, which can be expressed as a function of the total investment of social education, and that the same amount of social education input plays different roles in improving the quality of labor force in rural areas and cities, so we get formula 2. In formula 2, we use I_u^e to express education investment of the town, L_u is set to be I_u^e function. And we use I_r^e to express education investment of rural; L_r is set as the I_r^e function. Substitute formula 2 into formula 1, so we get formula 3. Based on the above assumptions and the Cobb-Douglas production function, the factors affecting economic growth were divided into four categories, which are urban fixed asset investment, rural fixed asset investment, urban education investment and rural education investment. We assume that these four factors contribute differently to economic growth, so we assign different contribution indices to these four factors.

By using formula 3, we obtain the basis of establishing regression model for empirical test. According to this modeling, we used OLS (least square method) for regression analysis and got the following equation 1. In equation 1, for the convenience of regression analysis, we're going to go through the process of decrement on GDP (Y), urban education investment (I_u^e), the rural education investment (I_r^e), urban fixed-asset investment (K_u) and rural fixed asset investment (K_r). For GDP (Y), we use the previous year as the base period to measure its growth rate. And translate all annual GDP in accordance with the price of 1993. We use the same method on the town of education investment (I_u^e), the rural education investment (I_r^e), urban fixed asset investment (K_u) and rural fixed asset investment (K_r), and then convert them to base prices in 1993 on the basis of the actual value, and press the quarter-on-quarter growth for comparative analysis. In order to match the data, we transformed equation 1 into an equation form that can directly use STATA for regression, namely equation 2.

The Solow model added urban-rural difference:

Formula 1:

$$Y = AK_u^{\alpha_1} K_r^{\alpha_2} L_u^{\beta_1} L_r^{\beta_2}$$

The Lucas model

Formula 2:

$$L_u = f(I_u^e)$$

$$L_r = f(I_r^e)$$

Formula 3:

$$Y = AK_u^{\alpha_1} K_r^{\alpha_2} [f(I_u^e)]^{\beta_1} [f(I_r^e)]^{\beta_2}$$

Ordinary Least Squares model:

Equation 1:

$$y = \beta_0 + \beta_1 I_u^e + \beta_2 I_r^e + \alpha_1 K_u + \alpha_2 K_r + u$$

Equation 2:

$$y = \beta_0 + \beta_1 uei + \beta_2 rei + \alpha_1 upi + \alpha_2 rpi + u$$

According to the equation 2, what we need is the following five datas: GDP (Y), urban education investment (I_u^e), the rural education investment (I_r^e), urban fixed-asset investment (K_u), rural fixed asset investment (K_r). We conducted a separate search in urban and rural areas to obtain the provincial

data of 31 provinces in mainland China in 22 years with the help of the GDP, the fixed asset investment and education investment data from 1993 to 2014, which is offered by the official website of the national bureau of statistics. In order to make the obtained data comparable, we standardized the data in 1993 as the base period, and part of education expenditure data comes from education statistical yearbook of China. The fixed asset investment K_u and K_r use the statistical calibre provided by the national bureau of statistics, in which the calculation method used for the rural fixed asset investment is gross fixed asset investment minus urban fixed asset investment. The Urban and rural education spending I_u^e and I_r^e cannot be obtained directly from China statistical yearbook, we will use the education spending of the city and town of China education statistical yearbook as urban education expenditure I_u^e , and the county education expenditure for rural education expenditure I_r^e . Similarly, to make the data comparable, the education expenditure is calculated on the basis of the sequential growth rate in 1993. The sum of urban education expenditure and rural education expenditure obtained from China education statistical yearbook is basically equal to the annual education expenditure of provinces given in China statistical yearbook, which further verifies the credibility of the data.

4. Results

In order to verify the model with empirical data, the data of 31 provinces were classified and analyzed. According to China's current basic national conditions and taking into account such factors as urbanization rate and economic development level, this paper uses the provincial classification method commonly used by the national bureau of statistics, namely the classification method of east and central China, to conduct regression analysis.

Table 1. The results of regression

| Variables | (Total) gdp | (East) gdp | (Interior) gdp | (West) gdp |
|--------------|----------------------|----------------------|---------------------|----------------------|
| uei | 9.478*** (2.654) | 43.09*** (3.518) | 5.282 (4.754) | -0.737 (2.167) |
| rei | 55.27*** (7.168) | -32.84*** (9.709) | 71.82*** (15.06) | 33.40*** (8.394) |
| upi | 0.341*** (0.0614) | 0.507*** (0.0599) | -0.0613 (0.127) | 0.895*** (0.0722) |
| rpi | 1.618*** (0.195) | 1.070*** (0.182) | 1.827*** (0.383) | 0.368 (0.330) |
| Constant | -1,139*** (193.3) | -736.5** (308.5) | -405.0 (316.0) | 388.3*** (104.0) |
| Observations | 310 | 110 | 80 | 120 |
| R-squared | 0.947 | 0.978 | 0.960 | 0.969 |

Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

From the results, we see that uei represents urban education investment, rei represents rural education investment, upi represents urban fixed asset investment, and rpi represents rural fixed asset investment. The first column in the regression results represents the results obtained from the regression analysis of 31 provinces in China as a whole. We can see that urban education investment, rural education investment, urban fixed asset investment and rural fixed asset investment have significant positive effects on economic development GDP. However, there is a big difference between the four elements: if viewed in terms of urban and rural areas, the rural investment elements, whether education or fixed assets, are far more effective in promoting the economy than cities and towns. And if viewed investment categories, investment in education, whether it's rural or urban, is going to have a much bigger economic impact than investment in fixed assets. Therefore, we find that in the case of fixed total investment, the return obtained by investing in education is greater than that obtained by investing in fixed assets; In terms of the internal structure of education investment, the

return on investment in rural education is greater than that in urban education. Because the economic environment, social culture and population quality of the three regions in the east and west of China are quite different, so after analyzing the relationship between education investment and economic growth nationwide, this paper also conducts cluster regression analysis on 31 provinces in the country according to the three regions in the east and west.

The regression results for the eastern provinces are shown in the second column in the table. By analyzing the regression results of the eastern provinces, this paper finds two points which are different from the national regression results. First, the contribution of rural education investment to economic growth in eastern provinces is negative; Second, the contribution rate of urban education investment in eastern provinces is higher than that of rural education investment. These two differences are caused by the unique economic and social environment of the eastern provinces. Most of the eastern provinces are the pilot provinces after China's reform and opening-up, and their social and economic development are different from the rest of the country. First of all, the policy environment is different. Take the five cities that were the earliest pilot cities of reform and opening up for example, there were significant changes in enterprise ownership structure and foreign trade policy, followed by a large number of foreign capital and advanced technologies. Second, the eastern provinces have a superior market environment and a freer market than the rest of the country. Finally, the education level and comprehensive cultural quality of eastern provinces are higher than the national average. Therefore, we can get a reasonable explanation about the regression results of the eastern provinces. Due to the superior market environment and open policy attitude, there are more investment opportunities in eastern provinces, most of which are concentrated on foreign-oriented industries such as clothing, which have low demand for cultural quality, and they were easy to obtain high profits in the context of the time. Therefore, the urban fixed asset returns in the eastern region during this period were higher, while the investment returns of education were lower or even negative.

The third and fourth columns in the table respectively represent the regression analysis results of the central and western provinces. By comparing, it is found that the coefficient size trend reflected by the fixed asset investment and education investment in western and central provinces is basically consistent with the national situation, that is, the investment return of cities and towns is less than that of rural areas, while the investment return of fixed assets is less than education. Differently from the national trend, the return on fixed asset investment in cities and towns in the central region is negative, which 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 few investment opportunities, so the return is relatively low. Secondly, the lower population quality in the central and western regions is also one of the reasons why the return on fixed asset investment is negative.

First of all, human capital investment represented by education plays a greater role in promoting economic development than fixed asset investment. This paper uses data from 1993 to 2014. With the deepening reform and opening-up, China's economy has been growing at a high speed, and the economic structure has gradually turned to the secondary industry. With this surroundings, talents who have received elementary education and medium education gradually occupy the dominant position in the economy, and the rate of return of education gradually increases, even exceeds the rate of return of fixed assets investment.

Secondly, the effect of human capital investment on economic development is restricted by policies and market factors. In the case of education return and fixed asset investment return in the central and eastern provinces, both education investment and fixed asset investment have a significant promoting effect on the economy in the eastern provinces. But the rural education investment return of the eastern region is significantly negative. the eastern region is the earliest part practices the reform opening up and establishes the market system, however, the economy of the eastern rural areas still depends mainly on the first industry, the requirement to the talent quality is relatively low, the person with ability cannot play their talent in their jobs, resulting in the decline of the education returns in the rural areas.

Finally, the promoting effect of human capital and fixed capital on economic development is restricted by economic foundation and population quality. For fixed-asset investment, it has the

greatest effect on economic development in the east, and it has a significant effect in both rural and urban areas. However, in the central and western regions, fixed asset investment has a less significant role in promoting the economy. For education investment, the urban and rural areas in the eastern and western regions have different trends. The return of education investment is more significant in the urban of eastern area and the same in the rural parts of the central and western regions.

5. Conclusion

Based on the empirical and theoretical research and analysis in this paper, in view of the development differences between rural areas and towns, as well as the economic and social development in the eastern and western regions, in order to play the promoting role of education investment in economic development better, we suggest that government departments should consider the following principles when formulating education policies and distributing education funds:

First, the proportion of education expenditure in fiscal expenditure should be increased. As China's economic development gradually develops into a new level, the pillar industries of the economy will inevitably shift from the secondary industry to the tertiary industry, and the economic development will inevitably shift from investment to innovation. In this case, it is particularly important to invest in education to increase the per capital human capital of the working population.

Second, fiscal expenditure on education should be fair to urban and rural areas. From the research results, the education rate of return in rural areas is not lower than that in urban areas. For a long time, the problems in China's rural areas are mainly the shortage of education resources. Due to the low degree of urbanization in China, rural population still accounts for the vast majority. Education investment in rural areas has far-reaching significance for improving the level of human capital in China.

Thirdly, education allocation in the eastern , central and western regions should be inclined to the central and western regions. Since China's reform and opening up, the eastern region has always been in the position of "policy highland", and the development of various aspects of social and economic is relatively good, while the central and western regions are relatively poor. We can know from the analysis results that compared with fixed asset investment, education investment can better promote the economic development of the central and western regions. From the perspective of the whole country, education funds are inclined to the Midwest, which can achieve education fairness and contribute to the common prosperity goal.

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