

Research on the Relationship between Education Investment of government and Economic Growth

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Abstract

VAR model is used in this paper to study the relationship between education investment of government and economic growth in China from 2007 to 2020. The results of empirical research show that: (1) Human capital is the most important production factor in modern economic development. it would enhance the core competitiveness of a country, and education investment could continuously supplies workers with a certain quantity and quality for economic growth; (2) Education investment has long-term and lagging characteristics. In the short term, education investment does not play an obvious role in driving economic growth, but in the long term, it provides competitive labors for economic growth; (3) Education investment has significant spillover effect on economic growth.

Keywords

Education investment of government; Externality of education investment; Lag of education effect; Economic growth; Impulse response

1. Introduction

According to the theory of public goods, social goods are divided into three categories: public goods, private goods, and quasi public goods. Pure public goods have complete characteristic of non-competitiveness and non-exclusivity. Quasi public goods have incomplete characteristic of non-competitiveness and non-exclusivity. It is generally believed that compulsory education is pure public goods that should be provided by government, while non-compulsory education is quasi-public goods that should be jointly provided by public sector and private sectors. Externalities can be divided into negative externalities and positive externalities. Products with positive externalities would lead to insufficient consumption and supply, while products with negative externalities would lead to excessive consumption and supply. Due to the positive externalities of education, providing education products by government could solve the problem of insufficient consumption and supply in education.

Schultz[1], a Nobel laureate in economics in 1979, known as the "father of human capital theory", divided capital into two categories: material capital and human capital. Schultz proposed that capital formed through investment in human capital can be called human capital, which is a type of capital reflected in individuals. Increasing the investment of workers can effectively enhance the value of labor, which is known as human capital investment. He believes that human capital investment can be divided into five categories: education and training, healthcare, employee training, and migration. Using historical data from five Nordic countries as research examples, Herbertsson [2] analyzes the impact of education investment, fixed assets, working hours, and total factor productivity on economic growth. The results show that the contribution rate of education investment to economic growth in Nordic countries is 12% - 33%. Ning's [3] research on the relationship between human capital investment and economic

growth in China indicates that there is a long-term cointegration relationship between education variables and the gross domestic product, the popularization of compulsory education and the increase in the proportion of labor with higher education have greatly promoted China's economic development; On the contrary, economic growth has greatly promoted the development of China's secondary and higher education. However, there are still many problems that need to be solved urgently, such as insufficient government investment in education and uneven distribution of education investment among different levels and regions, which ultimately result in low actual effectiveness of education investment. Zhang's [4] research on the relationship among public physical capital investment, public human capital investment, and R&D investment and Economic Growth suggested that the three types of public investment, which have varying degrees of positive economic growth effects, and their paths of promoting economic growth are also different. Public material capital investment mainly drives economic growth through capital accumulation effects, while public human capital investment and R&D investment promote economic growth by improving total factor productivity and externalities. Moreover, at different stages of development, the causal relationship and driving mechanisms between the three types of public investment and economic growth vary. Lin [5] analyzed the relationship between government public education investment and economic growth in China. The research results show that there is a cointegration relationship. Economic growth has a long-term positive response to government public education investment, and the contribution rate of government public education investment continues to increase over the long term. Whalley's [6] research reevaluates the contribution of human capital to China's economic growth rather than relying on years of schooling as in current literature. The results indicate that human capital plays an important role in China's economic growth, 38.1% of economic growth over 1978–2008, and even higher for 1999–2008. In addition, because human capital formation accelerated following major educational expansion increases after 1999 (college enrollment in China increased nearly fivefold between 1997 and 2007) while growth rates of Gross domestic product (GDP) are little changed over the period after 1999, total factor productivity (TFP) increases fall if human capital is used in growth accounting as we suggest. TFP, by our calculations, contributes 16.92% of growth between 1978 and 2008, but this contribution falls sharply between 1999 and 2008. TFP growth estimates along with the high contribution of physical and human capital to economic growth seem to suggest that there could have been decreases in the efficiency of input usage in China or worsened misallocation of physical and human capital in recent years. These results underscore the importance of efficient use of human capital, as well as the volume of human capital creation, in China's growth strategy.

2. Empirical Research

In this paper $rgdp$ represents the growth rate of GDP, $rjytz$ represents the growth rate of education investment of government. The data of Gross domestic product (GDP) and education investment of government from 2007 to 2020 are derived from the websites of Zhonghong and the National Bureau of Statistics.

Table 1. Dataset of 2007-2020

year	gdp	jytz	rgdp	rjytz
2007	270092.3	7122.32	0	0
2008	319244.6	9010.21	0.181983	0.2650667
2009	348517.7	10437.54	0.091695	0.1584125
2010	412119.3	12550.02	0.182492	0.2023925
2011	487940.2	16497.3	0.183978	0.3145238
2012	538580	21242.1	0.103783	0.2876107

2013	592963.2	22001.8	0.100975	0.0357639
2014	643563.1	23041.7	0.085334	0.0472643
2015	688858.2	26271.9	0.070382	0.1401893
2016	746395.1	28072.8	0.083525	0.0685485
2017	832035.9	30153.2	0.114739	0.0741073
2018	919281.1	32169.5	0.104857	0.0668685
2019	986515.2	34796.9	0.073138	0.0816736
2020	1013567	36359.9	0.027422	0.0449178

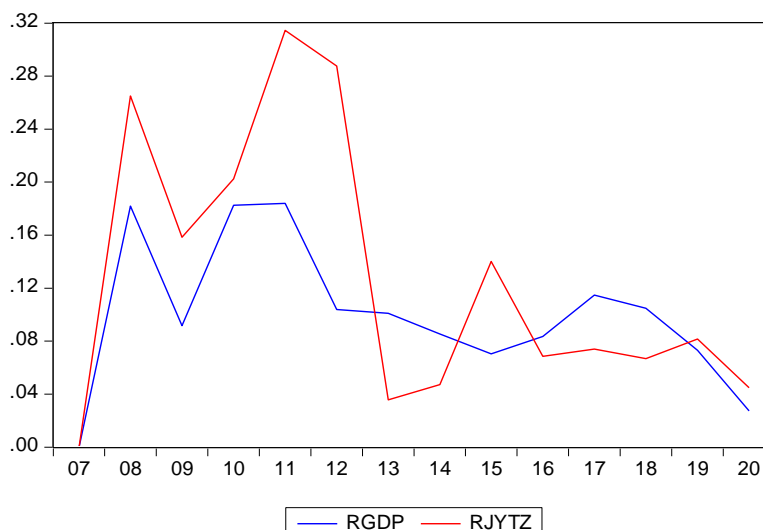


Fig.1 growth rate of GDP and growth rate of education investment of government

From Figure 1, it can be seen that growth rate of GDP and growth rate of education investment of government show an obvious fluctuation with the change of time, with no trend. it can be judged basically that the time series of growth rate of GDP and growth rate of education investment of government has non-stationary characteristics. in order to examine the relationship between growth rate of GDP and growth rate of education investment of government, this paper uses VAR model to analyze the relationship. Therefore, taking growth rate of GDP and growth rate of education investment of government as the original sequence, this paper makes an empirical analysis of the relationship between them.

The basic assumption of VAR model is the stability of time series. In order to ensure the validity of regression and avoid the occurrence of pseudo-regression, time series data need to pass the stationarity test at first. In this paper, the ADF method is used to test the stability of the sequence.

Table 2. Results of Stationarity Test

	rgdp	rjytz	d2rgdp	d2rjytz
adf	-3.654812	-2.603793	-4.259806	-5.026201
1%	-4.057910	-4.057910	-4.297073	-4.297073
5%	-3.119910	-3.119910	-3.212696	-3.212696
10%	-2.701103	-2.701103	-2.747676	-2.747676
p	0.0200	0.1169	0.0105	0.0036
Check Type	c,0,1	c,0,1	c,0,1	c,0,1
	Non-stationary	Non-stationary	Stationary	Stationary

As can be seen from Table 2, the ADF test values of the growth rate of GDP、 growth rate of education investment of government, are both greater than the critical values at the significant levels of 1%, 5% and 10%, and there are unit roots, the time series of both growth rate of GDP and growth rate of education investment is unstable, and the first-order difference is still no stable at the significant level of 10%, However, the second-order difference is stable at the significant level of 10%.

Lag period must be designed to set VAR model . If the lag period K is too small, it will lead to inconsistent of parameters estimation. In VAR model, increasing lag variables properly can eliminate the existence of autocorrelation, but the larger lag period K will lead to reduced degrees of freedom, which affect the effectiveness of parameter estimation. In this paper, the AKaike information criterion AIC is used to select the lag period. The lag period k is designed to be 1 by testing, and the model is set to VAR (1). The result of parameter estimation is expressed in matrix form as follows:

$$\begin{pmatrix} rGDP \\ rjytz \end{pmatrix} = \begin{pmatrix} -0.0137153 \\ -0.0042363 \end{pmatrix} + \begin{pmatrix} 0.4535716 & -0.0752216 \\ 1.5755702 & -0.5202365 \end{pmatrix} \begin{pmatrix} rGDP(-1) \\ rjytz(-1) \end{pmatrix} + \begin{pmatrix} -0.2506515 & 0.0431486 \\ 0.9677623 & -0.0434129 \end{pmatrix} \begin{pmatrix} rGDP(-2) \\ rjytz(-2) \end{pmatrix}$$

The test results of the VAR model show that the eigenvalues are all in the unit circle (see Fig. 2), and the residual sequence obeys normal distribution, and there is no hetero-scedasticity and autocorrelation, that is, there is no deviation in VAR model.

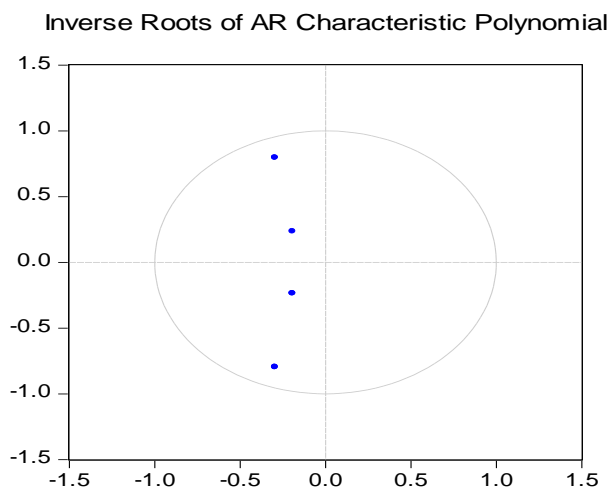


Fig. 2 Inverse Roots of AR Characteristic Polynomial

3. Impulse Response Analysis

Since the OLS parameters estimators of VAR model has only consistency, it is difficult to interpret the single parameter estimators economically, so it is necessary to analysis the impulse response of the system. Impulse response function (PRF) is the response of an endogenous variable to a random error shock. It describes the impact of a standard deviation shock on the current and future values of the endogenous variable, Figure 3 shows the results of impulse response:

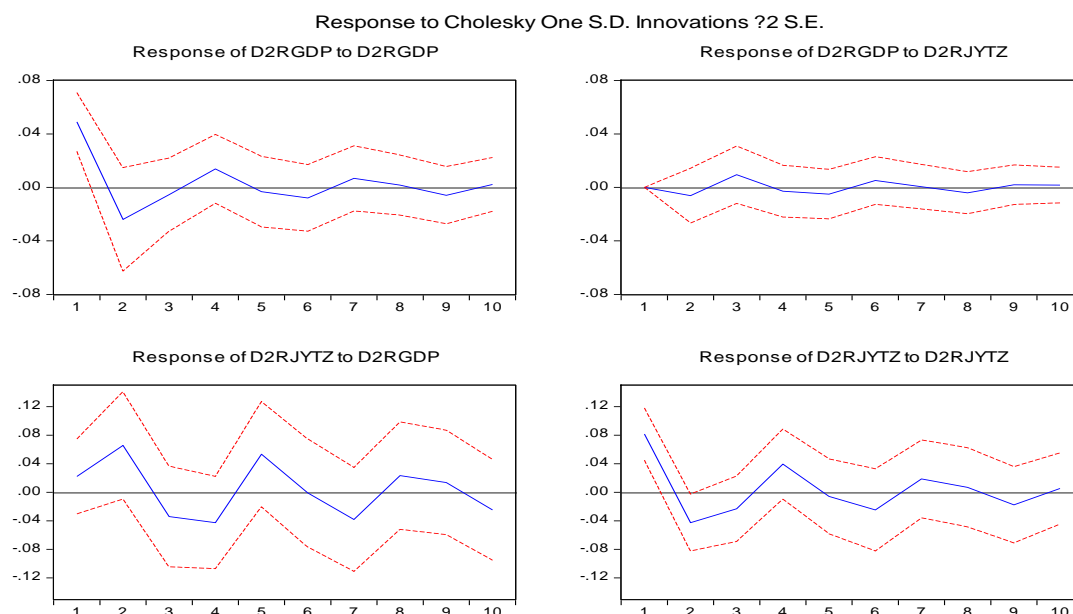


Fig. 3 Inpulse Response

Given a standard deviation shock to education investment of government, there is a negative impact on education investment of government in the 1-2 period, a positive impact in the 2-4 period, and again a negative impact in the 4-6 period, and a gradual weakening of the impact after the 7 periods. Possible reasons are as follows: Due to the lag effect of education investment, the increase of education investment would not immediately bring about the increase of GDP. However, after two periods of lag, the effect of education investment becomes apparent. Due to the long cycle of education investment and the need for continuous additional investment, it will have a negative effect on GDP. With the improvement of the quantity and quality of human capital, it will also promote the increase of GDP.

Given a standard deviation shock to GDP, there is a positive impact on education investment of government in the 1-2 period, a negative impact in the 2-4 period, and again a positive impact in the 4-6 period, and a gradual weakening of the impact after the 7 periods. Possible reasons are as follows: First, education would promote economic development by improving the quality of workers. Education investment improves the quality of the labor force, and high level of education received by workers will lead to high labor productivity. Second, education is both investment and consumption. The development of education industry and the related industries such as publishing industry would also promote economic growth. Third, Education investment would promote the upgrading of industrial structure, a large number of labor forces in China are concentrated in the primary and secondary industries, educational investment would promote the development of high value-added industries, and education investment would adapt human capital structure to industrial structure. Four, the spillover effect of education would indirectly promote economic growth.

4. Conclusion and Suggestions

Human capital is the most important factor of production in modern economic development. On the one hand, education investment not only provides the driving force for the sustainable development of economy, on the other hand, it would enhance the core competitiveness of a country and continuously supplies a certain amount and quality of human capital. In addition, education investment also promotes the improvement of individual production efficiency and forms a significant spillover effect on economic development.

Education investment has long-term and lagging characteristics. On the one hand, the overall cycle of education investment is relatively long, without considering the pre-school education,

it takes 9 years to complete primary education, 12-14 years to complete secondary vocational education, and more than 16 years to complete higher education. On the other hand, the output effect of education investment has a long time lag and would not immediately produce benefits in the process of education investment. Therefore, in the short term, education investment does not play an obvious role in driving economic growth, but in the long term, it provides competitive labors for economic growth.

Suggestion 1: Increase the scale of education investment. Increase investment expenditure for compulsory education schools. Raise the benchmark quota of public funds per student in compulsory education schools, increase the subsidy standards for public funds in boarding schools, provide free textbooks, and cancel various miscellaneous fees. Increase investment expenditure on secondary vocational education, implement tuition free and subsidy policies for secondary vocational students, actively support vocational skill training for secondary vocational students, and fully guarantee the salary and performance of secondary vocational teachers.

Suggestion2: Optimize the structure of education investment. From preschool education expenditure to primary education expenditure, from vocational education expenditure to higher education expenditure, from urban education expenditure to rural education expenditure, from student subsidies expenditure to teacher training expenditure, education investment structure should be optimized comprehensively, thus, education investment would provide labors with various skills for economic development.

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