

Research on the Relationship between Financial Investment of Higher Education and Economic Growth in Fujian Province

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Abstract—The theory of human capital holds that education investment has economic effects. Education investment provides labor and high-tech talents for the society through the transmission mechanism of human capital, thus promoting the upgrading of industrial structure and economic growth. In order to determine the relationship between financial investment and economic growth of higher education in Fujian Province, this paper analyses the relationship between financial investment of higher education and economic growth in Fujian province for 2000-2015 years by means of stability test, co-integration analysis and error correction model. The results show that there is a long term co-integration relationship between the two. That is, when the financial investment of higher education increases by 1%, the economic growth will increase by about 0.915%. It can be seen that the financial investment of higher education has a great effect on the development of Fujian's economy.

Keywords—higher education; financial investment; economic growth

I. INTRODUCTION

In the era of knowledge economy, knowledge instead of material capital has become the most important factor of production in the economy. The most basic factor in acquiring knowledge is human ^{[1][2]}, and the improvement of human quality depends on education. From this level, education is the engine of the economy, the driving force and the fulcrum of economic development and transformation ^[3]. At the same time, higher education, which takes the dissemination, preservation and innovation of information knowledge as the main task, plays a more important role in the development of economic activities. Therefore, the study of the relationship between financial input of higher education and economic growth has always been a hot topic in the education field ^[4]. Scholars at home and abroad have conducted many empirical studies on the relationship between educational investment and economic growth, and the conclusions are different ^[5]. Some scholars believe that economic development is the leading cause of education ^[6]; some scholars have shown that, in the relationship between the two, education is the cause, the development is a result of ^[7], and other scholars believe that the two is mutual cause and effect ^[8]. Moreover, domestic scholars mainly study the relationship between education investment and economic growth on the national level ^{[9][10]}, and the

research papers on the relationship between higher education and economic growth in combination with regional characteristics are not much. This paper studies the relationship between financial input of higher education and economic growth in Fujian Province, which is the main body of the economic zone on the west side of the straits. First, we make correlation analysis on the time series of financial input of higher education and economic growth, then make sequence stability test and co-integration analysis, and establish an error correction model. Thus the relationship between financial input and economic growth of higher education in Fujian province is obtained.

II. RELEVANT THEORY ANALYSIS

A. Concept Definition

Education funds are the total cost of education investment. According to the source of funds, it can be divided into three main parts: the financial education funds invested by a country, society's donation funds, and educational income based on tuition and fees. The financial investment of higher education in this paper refers to the financial education funds invested by the state for higher education in the education funds, including the educational funds in the national financial budget, the taxes and fees charged by the governments at all levels for education, the enterprise appropriations for education run by enterprise, and the funds for the education by the school run industry and the social services.

B. A Summary of the Relationship Between Higher Education and Economy

First, the economy is the material basis for the development of higher education. In order to run the higher education institutions, we need to build a teaching staff and need some material conditions, which all need human, material and financial resources to achieve ^[3]. Secondly, higher education improves the quality of the population and trains various types of talents in order to meet the needs of economic development, which has led to the rapid development of the economy. At last, everything has two sides. It is because of the mutual promotion between higher education and the economy that they have a mutually restricted relationship ^[4]. On the one hand, the economy restricts the development of higher education through

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the economic resources provided for higher education. Under certain economic conditions, the economy can only use a part of its manpower, material and financial resources for higher education. The resources allocated to higher education should be coordinated with the resources allocated to other sectors^[5]. On the other hand, higher education controls the labor productivity of the whole society through the quantity, quality and structure of talents trained for economic development, and then restricts the economic development^[6]. Therefore, in the many factors that affect economic development, talent is the most important factor, and the role of higher education should not be ignored.

III. EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN FINANCIAL INVESTMENT OF HIGHER EDUCATION AND ECONOMIC GROWTH

In order to analyze the long-term relationship of mutual promotion and influence between higher education investment and economic growth in Fujian Province, this paper uses eviews7.0 software to make an empirical analysis between the financial investment of higher education and GDP in Fujian Province from 2000 year to 2015 year.

A. Correlation Analysis and Granger Causality Test

According to the statistical data of 2000-2015 years, we calculate the Pearson correlation coefficient between the two variables of financial investment of higher education (EDU) and economic growth (GDP) in Fujian Province by eviews7.0 software, which is 0.997. We can see that there is a very close interdependence between EDU and GDP in Fujian. The results of the Granger causality test are shown in TABLE I below.

TABLE I. GRANGER CAUSALITY TEST RESULTS

Null hypothesis	F-Statistic	Probability	Result
EDU is not the Granger cause of GDP	31.4084	0.0001	Rejection hypothesis
GDP is not a Grainger cause of EDU	1.7200	0.0214	Rejection hypothesis

It can be seen from TABLE I that, under the significant level of 5%, the Granger causality test shows that there is an inevitable causality between the financial investment of Higher Education (EDU) and GDP in Fujian Province during the 17 years of 1999-2015, and the GDP of Fujian province is the Granger cause of the changes in the financial investment of higher education in Fujian, and the financial investment of higher education in Fujian is also the Granger cause of the change of Fujian's Gross Regional Product (GDP).

B. Stationary Test

Because the selected data are all time series data, if the time series is not stable, the phenomenon of "pseudo regression" will occur, this leads to the distortion of the results of the regression model.

ADF test is the most commonly used and effective method to test the sequence stability at present. Its original assumption is that the sequence is not stationary, if the ADF value obtained in the test is less than the critical value given by the ADF

distribution table, then the original hypothesis is rejected, the original sequence can be judged to be stationary, and if the ADF values in the test are all larger than the critical values given, then the original hypothesis is accepted, indicating that the original sequence is not stationary.

In order to verify the stability of the data, the natural logarithm of the series data of GDP and higher education expenditure in Fujian Province from 2000 to 2015 is recorded as LnGDP/LnEDU, and the ADF test is carried out. The results are shown in Table II below.

TABLE II. GRANGER CAUSALITY TEST RESULTS

variables	ADF test statistics	1% critical value	5% critical value	10% critical value	Result
LnEDU	6.272	-2.728	-1.966	-1.605	Non-stationary.
Δ EDU	-0.856	-2.755	-1.971	-1.604	Non-stationary.
Δ^2 EDU	-6.269	-2.755	-1.971	-1.604	stationary
LnGDP	1.629	-2.741	-1.968	-1.604	Non-stationary.
Δ GDP	-0.464	-2.741	-1.968	-1.604	Non-stationary.
Δ^2 GDP	-4.224	-2.771	-1.974	-1.603	stationary

Note: Δ represents the first order difference of the variable, Δ^2 represents the second order difference of the variable.

It can be concluded from Table II that, on the original sequence level and the first order difference level of the variable, the ADF test statistic is not less than three given critical values; all the test results do not reject the unit root hypothesis. Therefore, it can be considered that the variables LnEDU and LnGDP and the first order difference are non-stationary time series, but the second order difference of the two variables is less than three given critical values, indicating that the second order difference of the two variables rejects the original hypothesis with the unit root. Therefore, it can be concluded that both variables LnEDU and LnGDP are second-order single integral.

C. Cointegration Analysis

According to the above ADF test (sequential unit root test), the variables LnEDU and LnGDP are all second-order single integral, which meets the condition of further co-integration test. According to Engle-Granger method, OLS method is used for co-integration regression of variables. The results are shown in TABLE III below.

TABLE III. GRANGER CAUSALITY TEST RESULTS

Var.	Coe.	St.E	t	P	R ²	R ² _{adj}	F
C	5.698	0.140	40.713	0.000	0.979	0.977	646.83
LnEDU	0.915	0.036	25.433	0.000			

From TABLE III, the estimated equation is:

$$\text{LnGDP}_t = 5.698 + 0.915 * \text{LnEDU}_t \quad (1)$$

$$(40.713)(25.433)$$

$$R^2=0.979; R^2_{adj}=0.977$$

At the same time, the residual sequence e_t estimated by regression equation is obtained, and the unit root test of the residual sequence e_t is done. The results are shown in TABLE IV below.

TABLE IV. GRANGER CAUSALITY TEST RESULTS

ADF test statistics	1% critical value	5% critical value	10% critical value
-3.289	-2.728	-1.966	-1.605

From TABLE IV, it is known that the residual ADF statistics are less than the critical values of three significant levels, indicating that rejects the unit root hypothesis and the residual is stationary under the corresponding significant level. Thus, the two variables LnEDU and LnGDP are co-integration, that is, there has a long-term equilibrium relationship between the financial investment of higher education and GDP. The economic growth elasticity of financial investment in higher education is 0.915, that is, the financial investment of higher education is increased by 1%, and the economic growth will increase by 0.915%.

D. Error Correction Model

From the above co-integration analysis, we can see that there is a long-term equilibrium relationship between the two variables. However, in the short term, these variables may be non-equilibrium. The Granger theorem shows that if a group of variables have co-integration relations, there is an Error Correction Model (ECM) to describe the short-term disequilibrium relationship between these variables. Therefore, we will establish an error correction model (ECM) to describe the dynamic structure of the short term disequilibrium. The error correction model is a long-term equilibrium model. As an explanatory variable, the residual term in the system is added to the error correction model, so that the long and short term parameters of the variables can be integrated to describe the adjustment mechanism of the long term equilibrium relationship between the variables to the "negative feedback" of the short term variation.

Through the eviews7.0 software tool, the error correction model is obtained as follows:

$$\Delta \text{LnGDP}_t = 2.698 + 0.735 * \Delta \text{LnEDU}_t - 0.452 * E_{t-1} \quad (2)$$

$$(9.079) \quad (-3.208)$$

$$R^2=0.715; R^2_{adj}=0.705$$

The regression coefficient of the equation has passed the significance test, and the coefficient of ΔLnEDU_t can be interpreted as: the short-term elasticity of the financial investment of higher education to the change of GDP in Fujian, that is, the higher education investment is increased by 1%, the GDP will increase by about 0.735% in the short term, less than the long-term elasticity of 0.915. The coefficient of error correction item e_{t-1} reflects the adjustment of the deviation of

the GDP from the long-term equilibrium relationship in Fujian Province. The greater the absolute value is, the faster the speed of returning to equilibrium state in the short term is. In the short term, the error correction coefficient is -0.452, according to the reverse correction mechanism, it is shown that when the short-term fluctuation of GDP deviates from the long-term equilibrium, the gross regional product will be pulled back from the unbalanced state to the equilibrium state by 0.450 of the adjustment.

IV. CONCLUSION

This paper first analyzes the relationship between financial investment of higher education and economic development in theory, and then makes an empirical study on the relationship between the financial investment of higher education and economic growth in Fujian Province, by making sequence stability test, co-integration test and establishment of an error correction model. The following conclusions are drawn:

A. *There is a long-term equilibrium relationship between the financial investment of higher education and regional economic growth in Fujian province.*

The empirical study shows that there is a long-term equilibrium relationship between higher education financial investment and regional economic growth in Fujian province. From the regression equation (1), the long-term elasticity of higher education financial input to economic growth is 0.915, which indicates that in the period of 1999 to 2015, the financial input of higher education in Fujian has a significant promotion of economic growth. When the financial input of higher education is increased by 1 percentage points, the economic growth will increase by 0.915 percentage points. Although this long-term equilibrium relationship may be out of balance or deviation in the short term, from the error correction model (2), it will be realized with some adjustment mechanism by a 0.452 adjustment range towards long-term equilibrium to achieve equilibrium.

B. *There is a causal relationship between the financial investment of higher education and regional economic growth in Fujian Province.*

Through the Granger causality test, it is found that there is a co-integration relationship between the financial investment of higher education and regional economic growth in Fujian Province, and the relationship is causality with each other. That is, increasing financial investment in higher education is beneficial to regional economic growth, and regional economic growth, in turn, will also play a role in financial investment of higher education and achieve a win-win pattern for the spiral development between the two.

C. *In the short term, the higher education in Fujian province still needs to increase its financial investment*

The empirical study shows that the financial investment elasticity coefficient of higher education in Fujian is 0.735 in the short term, which is smaller than 0.915 in the long term. It can be seen that the impact of Fujian's financial investment of higher education on economic growth is smaller in the short

term than in the long term. This shows that we can continue to increase the financial investment of higher education, promote the further growth of regional economy, and realize the win-win effect for the spiral development.

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