

# The Impact of Science and Technology Innovation Expenditure on Chongqing's Gross Product

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## Abstract

Science and technology innovation is the driving force of economic production. This article collects relevant data from the Chongqing Bureau of Statistics from 2000 to 2017 for a total of 18 years and analyzes the impact of science and technology innovation revenue on Chongqing's GDP through the Var model.

## Keywords

technological innovation ;Var model.

## 1. Introduction

Scientific and technological innovation can promote economic development. The so-called "science and technology are the primary force". In the national development strategy, scientific and technological innovation is also an important means to enhance overall national strength. Relevant data shows that in more than 20 innovative countries in the world, the contribution rate of technological innovation to GDP is as high as 70%, the United States and Germany are as high as 80%, while my country is only about 40%. Innovation-driven and value-driven has become an important strategic move for my country to transform the mode of economic development and economic growth.

## 2. Literature Review

At present, scientific and technological innovation does not play a significant role in driving economic development. Solving the "two skins" problem of economic development and scientific and technological development has become a top priority. In Schumpeter's words, innovation is the realization of a new combination of production methods, and innovation is economic development [1]. Guo Xing believes that technological innovation drives high-quality economic development [2]. Chen Zhen believes that the economy depends on innovation to promote matching of supply and demand and promote high-quality development [3]. Shen Min explained the dual-engine effect of technological innovation and institutional innovation on economic development [4]. Gu Shengzu and others believe that promoting core technological innovation is conducive to promoting high-quality economic development in my country, and innovation has a significant effect on high-quality development [5].

Although the contribution rate of my country's scientific and technological innovation to economic development is not high, the country's emphasis on scientific and technological innovation is increasing day by day. Statistics show that since 2000, my country's R&D expenditure has been increasing at an average annual rate of 22.6%, which is much higher than the growth rate of my country's GDP during the same period. As a municipality directly under the Central Government, Chongqing has always attached great importance to technological innovation, but the impact of enterprises' investment in technological innovation on GDP remains to be studied.

### 3. Experimental Process

#### 3.1. Autocorrelation

The investment in scientific and technological innovation and Chongqing's GDP have shown an upward trend over the years, indicating that the data itself is not stable and has autocorrelation. Here it is solved by making a difference to the data, and checking whether the P value is greater than 0.05 through the unit and checking whether the data after the difference still has autocorrelation. Through the difference and unit root test, the first-order difference in technological innovation can eliminate the autocorrelation, and the GDP needs to do the second-order difference to eliminate the auto-correlation. In order to keep the data uniform, the two variables are made second-order difference. The result is shown in Fig 1.

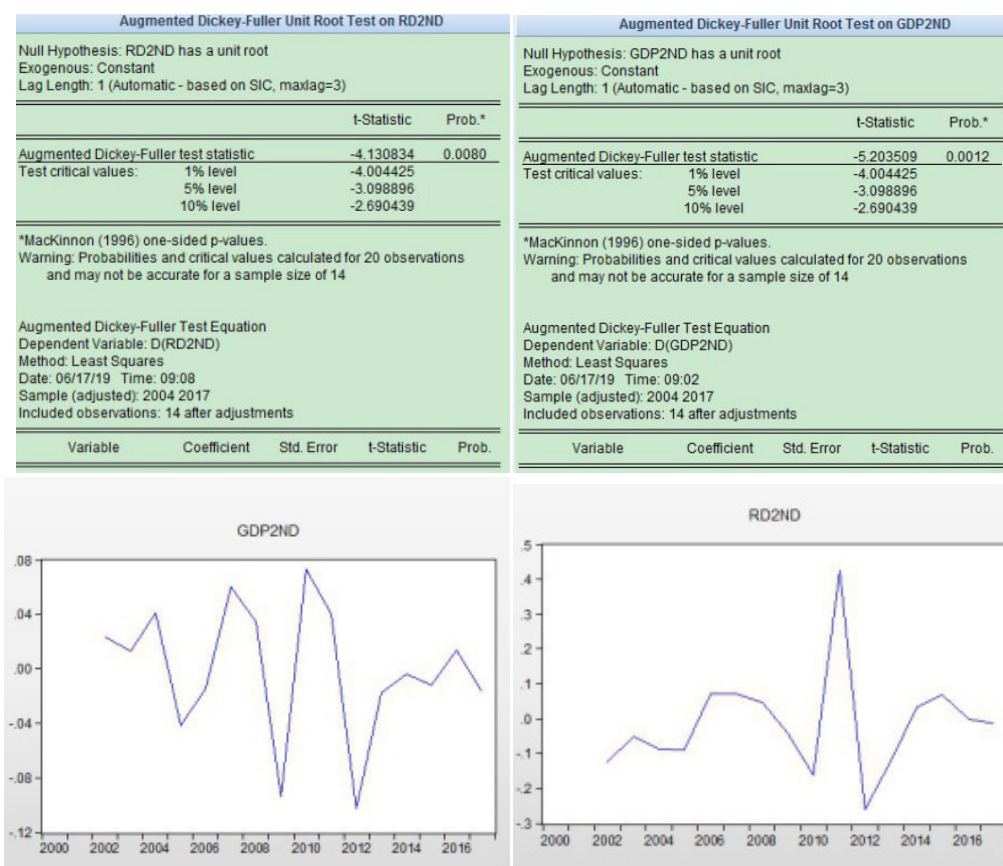
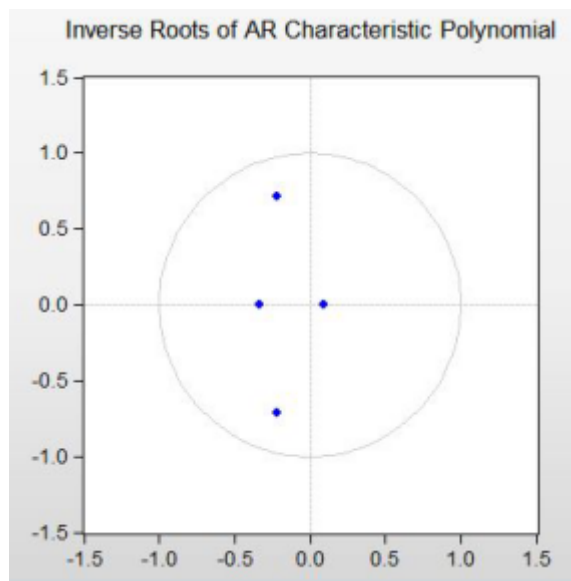


Fig 1. Elimination of autocorrelation

#### 3.2. Lagged Variable Model

##### 3.2.1. Model Construction

The current Chongqing GDP will not only be affected by the current investment in scientific and technological innovation, but the investment in scientific and technological innovation in the previous periods will also affect the current year's GDP. Therefore, a lag variable model is constructed here. In order to determine the best lag order, it is calculated from the 8th order according to usual experience. The first order with the most asterisks in AIC and SC is used as the standard for comprehensive judgment. After comprehensive judgment, the third order lag is the most Good, after adjusting the lag order, the model stability test is performed, and the test result is shown in Fig 2. The reciprocal of all root modules of the model is less than 1, that is, they are all in the unit circle, the model is stable.



**Fig 2.** Model stability test

### 3.2.2. Model Analysis

After obtaining the stability results of the model, the results can be analyzed. As follows:

This model shows that the second-order difference of Chongqing's GDP is the first and second lags of GDP2nd and GDP2nd. The first-order lags of the second-order difference of tariff income RD2nd are all inversely proportional, and the coefficients are -0.369, -0.584, -0.009, respectively, indicating GDP It is largely reversed by the value of the previous two years; while it is directly proportional to the lagging second period of RD2nd, with a coefficient of 0.017, that is, the data of the previous year of enterprise technological innovation investment has a positive impact on this year's GDP. RD2nd is proportional to the lagging second period of RD2nd and GDP lagging first period. The coefficient ratios are 0.319 and 1.164. From the coefficients, it can be seen that the first period has the greatest impact on the current period. That is to say, the income of technological innovation investment last year is very high. To a large extent affect this year's data.

### 3.2.3. Granger Causality Test

The Granger causality test is performed on the model results, and its hypothesis is set as:

H0: Variable RD2nd cannot cause variable GDP2nd by Granger

H1: Variable RD2nd can Granger cause variable GDP2nd

The result is shown in Fig 3.

VAR Granger Causality/Block Exogeneity Wald Tests  
 Date: 06/17/19 Time: 09:29  
 Sample: 2000 2017  
 Included observations: 14

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Dependent variable: GDP2ND

Excluded	Chi-sq	df	Prob.
RD2ND	0.051372	2	0.9746
All	0.051372	2	0.9746

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Dependent variable: RD2ND

Excluded	Chi-sq	df	Prob.
GDP2ND	11.54671	2	0.0031
All	11.54671	2	0.0031

**Fig 3.** Granger causality test

The test result is that under the 5% confidence level, the null hypothesis is accepted. The variable RD2nd is not the Granger cause of the change of the variable GDP2nd, but the variable GDP3nd is the Granger cause of the change of the variable RD2nd.

**3.3. Variance Decomposition**

Variance decomposition refers to the decomposition of changes in endogenous variables into quantitative impacts on VAR to analyze the contribution of the standard deviation to the endogenous variables. It can be seen from Fig 4 that the impact of technological innovation input on GDP did not exist in the first ten periods. The impact of GDP on corporate income from technological innovation did not exist in the first period. By the sixth period, the peak of the impact of GDP on tariff revenue was achieved, and its contribution was 58%. Subsequent periods from the 6th to the 19th period experienced slight fluctuations. Judging from the changes in its contribution value, the impact of GDP on tariff revenue increases rapidly in the short term and reaches a stable state after a long period of time; from a specific numerical point of view, GDP has a greater impact on enterprises' investment in technological innovation.

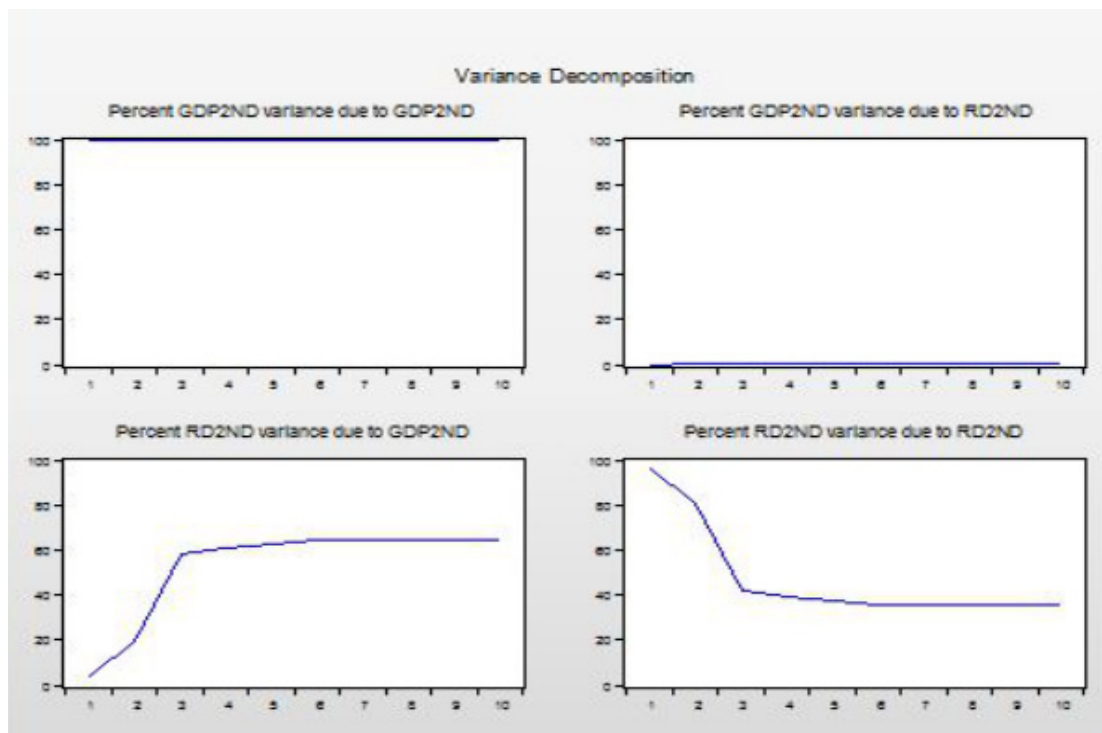


Fig 4. Variance decomposition

### 3.4. Impulse Response

Impulse response refers to the impact of applying a standard deviation on the random error term, which can have a predictive effect on the impact of the endogenous variables in the VAR model in the current and future periods. In the impulse response graph, it can be found that when a positive shock is given to GDP, the first period presents a positive shock, and from the second period onwards, there is a positive and negative alternating result. This shock response gradually weakens over time, and finally the 15th period tends to be stable. In the fourth period, it reaches the maximum value of 1.7% for the positive impact and 1.6% for the maximum value of the negative impact in the sixth period. This shows that the investment in technological innovation of enterprises has little effect on GDP growth in the initial stage. When there is a positive impact on GDP, it will bring positive and negative impacts to the company's investment in technological innovation between the first period and the 15th period. In the third period, the maximum negative impact will reach 9%. The forward shock gradually weakened over time; in the even-numbered period, the positive shock was present. In the fourth period, the positive shock reached the maximum value of 10%, and then the strength of the positive shock gradually decreased, in the 25th period. Afterwards, there is a slight change and finally towards zero to reach a steady state. It shows that in the initial stage, the growth of GDP will promote the investment in technological innovation of enterprises. The increase in investment in technological innovation means that technological investment will not be completely consumed in the current year but reserved for future use, which will reduce the demand for technological innovation investment in the next period. , Thus forming a cycle, there will be positive and negative shocks shown in the fig 5.



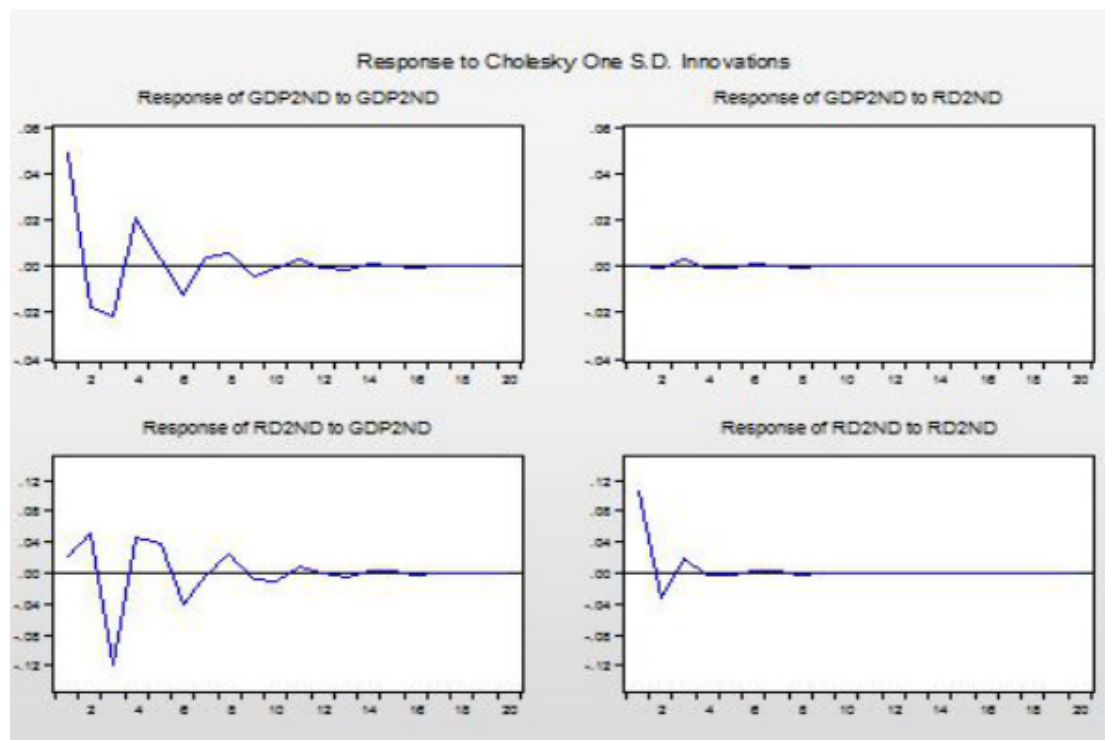


Fig 5. Impulse response

#### 4. Summary

From the above quantitative analysis, it can be found that the lag effect of GDP is stronger. The lag effect of technological innovation investment is stronger. Because economic development is now in the transition stage from high-speed growth to medium-to-high-speed growth, the gross product value of the previous two years under this background It will have an impact on the previous year. When the growth rate is found to be too fast, we must find a way to reduce it, and when we find that the GDP value is about to reach the low-end critical value, we must try our best to increase it. In the face of the massive increase in the investment in technological innovation of enterprises, the initial reflection of GDP was that there were no waves. This also indicates that technological innovation is carried out on the basis of GDP development, and technological innovation itself has little effect on GDP, and should be indirect. effect.

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