Granger causality analysis of real estate investment and county economic growth

——Empirical study based on counties in Jiujiang City

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Abstract: In the context of China's economic transformation and industrial upgrading, the development status of county economies has an important impact on the country's overall economy. Real estate investment, as an important factor in promoting county economic growth, has attracted much attention in recent years. However, over-reliance on real estate investment may bring risks such as resource mismatch and economic bubbles. This paper explores the causal relationship between real estate investment and county economic growth by using the economic data of Jiujiang counties and districts from 2018 to 2022, using the Granger causality test model. It is found that real estate investment has a significant positive causality on GDP at lag 1, indicating that it has an important role in promoting economic growth in the short term.

Keywords: Real Estate Investment; County Economy; Economic Growth; Granger Causality Test; Jiujiang City

1. Introduction

1.1 Background of the study

China's county economy is an important part of the country's economic development, and in the context of economic transformation and industrial upgrading, the state of development of the county economy directly affects the overall economic quality and social stability of the country. In this context, real estate investment, as one of the important drivers of county economic growth, has received widespread attention in recent years. The real estate industry is not only a direct promoter of the construction industry, but also influences many aspects of the local economy, such as employment, consumption and tax revenue, by pulling on upstream and downstream industries. However, as China's economy enters a "new normal", the continued growth of the real estate market is facing challenges, especially at the county level, where over-reliance on real estate investment may lead to a series of economic and social problems.

1.2 Significance of the study

In the critical period of China's economic transformation and upgrading, how to reasonably guide and optimize real estate investment to avoid the adverse impacts on the county economy due to the fluctuations of the real estate market has become a focus of attention for local governments and academics. By revealing the causal relationship between real estate investment and county economic growth, this paper attempts to provide theoretical support for policy makers and empirical references for the formulation of local economic development strategies.

2. Status of the study

The role of real estate investment as a key driver of economic growth has been widely verified in studies in different countries and regions. Classical economic growth theories, such as the Solow Model, point out that capital accumulation is one of the main forces driving economic growth, and real estate investment is one of the important forms of capital accumulation. In China, the real estate market has developed rapidly since the housing reform in 1998, and has become one of the important engines driving economic growth.

In order to explore the causal relationships between economic variables, academics have adopted a variety of econometric methods. The Granger Causality Test (GCT) is one of these commonly used methods, and is particularly applicable to the causal analysis of time series data. The core idea of the Granger Causality Test is that if the past value of a time series variable significantly improves the predictive ability

of another time series variable, then the former is considered to "Granger cause" the latter.

Granger causality tests have been widely used in economics since their introduction. For example, many studies have used Granger causality tests to explore the causal relationship between monetary policy and economic growth, and between government spending and economic growth (Ref. 5, Ref. 6). Compared with other statistical methods, such as Bayesian methods, Granger causality tests have become a common tool in economic research due to their simplicity, intuition and explanatory nature.

3. Data and methodology

3.1 Data sources

In this paper, the economic data of the counties and districts in Jiujiang City from 2018 to 2022 are selected as the research object. The data mainly come from the statistical yearbook released by the Jiujiang City Bureau of Statistics and the annual economic reports of each county and district. The main research variables include:

GDP (Gross Domestic Product): The total economic output of the counties and districts, which is the core indicator of economic growth.

Real Estate Investment: Total investment in real estate development and construction by county, reflecting the activity of the real estate market.

Fixed Asset Investment: Including infrastructure construction, industrial investment, etc., representing the level of infrastructure construction of the county economy.

Total Retail Sales of Consumer Goods: Consumption level in each county, reflecting market demand and consumption capacity.

Disposable income per capita: represents the level of income of the population and affects consumption and investment capacity.

3.2 Data processing

Before conducting Granger causality test, it is first necessary to ensure that all variables are smooth. For this purpose, the paper used the ADF (Augmented Dickey-Fuller) test to test the smoothness of each time series data. The results of the test show that the variables of GDP, real estate investment, fixed asset investment, and residents' income are not smooth, so these variables are differentiated to ensure that they meet the requirements of Granger causality test.

After the data were smoothed, this paper used a Granger causality test model to explore the causal relationship between the variables. The model setup of this paper is as follows:

where represents GDP, and represents other key variables (e.g., real estate investment, fixed asset investment, etc.). The selection of lags is based on AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion), and robustness tests with multiple lags are conducted to ensure the robustness of the results.

3.3 Model Setting and Testing

In this paper, a Granger causality test model is used to test whether the variables have a causal effect on GDP. The core assumption of the model is that real estate investment is considered "Granger-caused" to GDP growth if the past value of real estate investment significantly improves the predictive power of GDP. In addition, in order to verify the robustness of the model, a placebo variable (Placebo) is introduced and a sub-sample analysis is conducted.

4. Empirical findings

4.1 Data Smoothness Test

Before conducting Granger causality test, this paper first conducted a smoothness test for all variables. The results show that the time series of GDP, real estate investment, fixed asset investment, and residents' income are not smooth in their original state. This means that the mean and variance of these variables vary over time, and thus need to be differentiated before applying the Granger causality test. Specifically, this paper performs first order differencing on these variables in order to make them smooth time series. The results of the smoothing test

show that after the differencing process, the variables meet the smoothing criterion (p-values of the ADF test are less than 0.05).

4.2 Results of Granger causality test

After smoothness is assured, the paper tests the Granger causality between the variables and GDP. The results are as follows:

Causality of Real Estate Investment (Real Estate Inv) on GDP

Lag 1: The results of the Granger causality test show a significant causal relationship between real estate investment and GDP (F-statistic = 185.11, p-value < 0.01), indicating that an increase in real estate investment is an effective predictor of GDP growth in the next period. This result supports the theory that real estate investment acts as a short-term economic growth driver in the county economy.

Lag 2: When the lag period is 2, the causality of real estate investment on GDP is no longer significant (F-statistic = 1.12, p-value > 0.05), which suggests that the impact of real estate investment is mainly manifested in the short term, and its predictive ability on GDP is weakened in a longer time span.

Causality of Fixed Inv to GDP

Lag 1: The test results show that there is no significant Granger causality of fixed asset investment on GDP (F-statistic = 0.000396, p-value > 0.05), which suggests that fixed asset investment has a limited direct impact on county economic growth in the short term.

Lag 2: The results of Lag 2 are consistent with Lag 1. Fixed asset investment is still not a significant predictor of GDP (F-statistic = 0.908, p-value > 0.05). This result may be related to the long payback period of infrastructure investment in the county economy.

Causality of disposable income per inhabitant (Income) on GDP

Lag 1: The test results show that there is no significant Granger causality of residents' income on GDP (F-statistic = 0.104, p-value > 0.05). This result indicates that although residents' income is an important determinant of consumption, its increase does not directly lead to rapid economic growth in the county in the short run.

Lag 2: The results of the Lag 2 test are consistent with Lag 1, with residents' income not being a significant predictor of GDP (F-statistic = 0.168, p-value > 0.05). This may indicate that the impact of residents' income on economic growth may take longer to manifest itself.

5. Conclusions and recommendations

Although this study reveals the short-term causal relationship between real estate investment and county economic growth, there are still some limitations. First, the data of the study covers only some counties in Jiujiang City, and the results may not be fully representative of other regions. Second, the Granger causality test mainly applies to the analysis of linear relationships and may fail to capture the nonlinear relationships between variables.

Future studies can expand the sample scope to include county data from more regions for a broader empirical analysis. In addition, future studies can try to use other causal analysis methods, such as vector autoregressive (VAR) models or nonlinear models, to reveal the complex relationship between real estate investment and economic growth more comprehensively.

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