Analysis of the Impact of Real Estate Price on GDP——Based on VAR Model

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Abstract

The contribution rate of real estate to GDP is very high, and real estate affects GDP to a large extent. As an important indicator of the real estate industry, if the price increase is too high, consumers will strategically reduce the purchase of real estate, which will cause GDP to fall. This paper collects annual data from 1987 to 2018, and uses tools such as VAR model, cointegration model and impulse response function to deeply analyze the relationship between real estate price and household consumption rate. It can be known that in the short term, the change in GDP is affected by the price of real estate, but it is gradually slowing down in the medium term and tends to be stable in the long run. Analysis of the Granger test shows that real estate prices affect GDP.

Keywords

Commercial housing sales; GDP; vector autoregressive model.

1. Introduction

As one of the main sources of China's economy, the real estate industry has a positive impact on the development of GDP. As one of the main indicators for evaluating the real estate industry, the price of real estate can represent the development of the real estate industry to a large extent. Therefore, real estate prices are the main target, explaining the relationship between real estate prices and GDP. Can give guidance on the regulation of the real estate market. Gelain, Lansing & Mendicino believes that rising real estate prices will have a negative impact on the economy. Real estate prices will fluctuate drastically, which will not only promote economic development, but will also affect consumers' reaction to price signals, resulting in lower consumption and affecting economic growth. [1]. In response to the relationship between real estate prices and GDP, many scholars have conducted in-depth discussions. Beatrice D. Simo-Kengne believes that the increase in wealth can increase spending power, but the short-term rise in real estate prices will inhibit consumer spending levels [2]. In 2015, Fraser and Mc Alevey explained that macroeconomic shocks will affect real estate price movements. The study shows that the impact of interest rates and GDP will affect house price changes in a certain period of time [3]. In 2016, Mohsen and Seyed explored the relationship between real estate prices and economic fundamentals. The study clarified that regardless of the length of time, fluctuations in economic fundamentals will have an asymmetric impact on house prices [4]. Then, from the analysis of actual data, will the rise in real estate prices promote GDP or hinder GDP? In the long run, what will be the impact of this? This is the question that this paper will explore. .

The real estate industry has greatly promoted China’s economic process, which affects GDP. Berger D (2015) proposed that the increase in real estate prices affects consumers' consumption levels. When real estate liquidity is reduced and leasing is allowed, its model reviews the impact of real estate price increases on household consumption [5]. This paper establishes a VAR model to explain the relationship between real estate prices and GDP. First, it is found by Johansen that there is a cointegration relationship between the two; based on the

VAR model, the relationship between house price and GDP is used by using impulse response and variance decomposition. The research; and in the variance decomposition of GDP, the contribution rate of housing prices has shown a rising trend, explaining that the impact of housing prices on GDP will become more apparent over time. Real estate prices are an indicator of the real estate market conditions, while commercial housing sales can show the sales of the real estate industry, while GDP can also be a good illustration of China's economic development.

2. Theoretical Model

The traditional econometric model is a model that explains the relationship between variables based on economic theory. However, economic theory sometimes does not fully express the dynamic relationship between variables, and the uncertainty of endogenous variables makes the estimation and inference of models more complicated. Therefore, this paper constructs a VAR model to analyze the relationship between real estate prices and gross domestic product in China. The VAR model is formed on the basis of statistical data. The VAR model establishes a model by using each endogenous variable in the system as the hysteresis value of all other endogenous variables in the system, thus evolving the univariate autoregressive model to A vector autoregressive model consisting of multiple time series variables. The VAR theoretical model is as follows:

$Yt=A1Yt-1+A2Yt-2+\ldots+ApYt-P+BXt+\mu t$

Among them, the Yt vector represents an endogenous variable, the Xt vector represents an exogenous variable, the matrix A1,..., Ap is a matrix of coefficients to be estimated, the number of samples is t, P is a lag order, and μ represents an impact vector. In the VAR model, GDP is used as the explanatory variable, and real estate price is used as the explanatory variable.

3. Empirical Analysis

(1) Sample and data processing

This study aims to study the relationship between commercial housing sales and GDP. In the selection of real estate prices, this paper selects commercial housing sales as an indicator of real estate prices. The current price of GDP is selected as a measure of GDP. The annual data from 1987 to 2018 was selected as a sample, with a total of 32 sets of data. The data comes from publicly available data on the National Bureau of Statistics website. The impact of real estate prices on GDP is mainly reflected in the two aspects of price level and economic growth. The VAR model of this paper consists of two variables. The independent variable in the model is real estate price and the dependent variable is GDP.

(2) Stationarity test

This paper explores the impact of real estate prices on GDP by constructing a VAR model. The stability of the test data is performed on the time series, that is, the unit root test is performed on the time series data, and the related statistical test should be based on the fact that the data is a stationary sequence. The unit root test results show that if there is a unit root, the data is an unstable sequence. Based on the detection, if there is no unit root, that is, the data is unstable, and the original data is rendered non-stationary, the data needs to be differentially processed and the unit root is checked again. The Eviews7 software should be used to verify the unit root of the time series. The sequence is non-stationary. After the first-order difference, lnGDP and lnFJ become a stable time series.

Table 1. ADF test results

	sequence	Statistics	1% threshold	5% threshold	10% threshold	P value
GDP	Original sequence	3.521586	-3.724070	-2.986225	-2.632604	1.0000
	lnGDP	-2.199241	-3.711457	-2.981038	-2.629906	0.2112
	First order difference	-3.216200	-3.711457	-2.981038	-2.629906	0.0304
FJ	Original sequence	2.396158	-3.679322	-2.967767	-2.622989	0.9999
	lnFJ	-2.194820	-3.679322	-2.967767	-2.622989	0.2123
	First order difference	-5.574380	-3.679322	-2.967767	-2.622989	0.0001

(3) Determination of optimal lag order

The determination of the lag order plays a crucial role in the establishment of the VAR model. The reason for the lag period is that it cannot respond to external changes immediately, resulting in hysteresis. This paper uses Eviews7 software to determine the optimal lag order of the model. According to the results, the six rules of Logl, LR, FPE, AIC, SC and HQ are combined to judge that the optimal lag order of the constructed VAR model is 1, as shown in Table 2:

Table 2. Optimal lag order under each criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	44.03412	NA	0.000152	-3.113638	-3.017651	-3.085096
1	66.44816	39.84718*	3.90e-05*	-4.477641	-4.189678*	-4.392015
2	70.03607	5.846977	4.05e-05	-4.447117	-3.967177	-4.304405
3	72.41180	3.519588	4.64e-05	-4.326800	-3.654884	-4.127004

(4) Construction of VAR model

The vector autoregressive (VAR) model is based on a statistically-formed data formation model. The VAR model is used to evaluate the interaction between joint endogenous variables without constraints. The modeling idea is to construct the function by determining the hysteresis value of the endogenous variable, which is often used to analyze the dynamic impact of the random disturbance term on the variable system, and further explain the impact of the impact of the economy on the variable.

After determining the optimal lag period, it can be determined that the lag model of the VAR model is 1st order, that is, VAR(1) establishes the VAR model of the LNGDP1st and LNFJ1st variable lag phase one. The results are as follows:

LNGDP1ST = 0.64156108*LNGDP1ST(-1) + 0.15375449*LNFJ1ST(-1) + 0.01212926

LNFJ1ST = 0.31872969*LNGDP1ST(-1) - 0.09520327*LNFJ1ST(-1) + 0.21367290

(5) Johansen cointegration test

The cointegration test is based on the constructed VAR model to clarify whether a temporary equilibrium relationship can be formed between variables. The Johansen test of the data can explore the long-term dynamic relationship between variables. The results show that there are two cointegration relationships between the sequences at a 5% significance level. This shows that there is a long-term balance between real estate prices and GDP, as shown in Table 3.

Table 3. Johansen cointegration test results

Hypothesized		Max - Eigen	0. 05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.526041	26.99995	15.49471	0.0006
At most 1*	0.195592	6.094160	3.841466	0.0136

It can be seen from Table 3 that the trace statistic of the "None*" cointegration test is 26.99995, which is greater than the critical value of 15.49471 (at the 5% significance level), while the P value is 0.0006, less than 0.05, so the rejection of "LNFJ" The null hypothesis that there is no cointegration relationship with LNGDP. Then the original hypothesis of "At most 1*" is "the long-term cointegration relationship between LNFJ and LNSPI". The trace statistic of the cointegration test is 6.094160, which is less than the critical value of 3.841466 (at the level of 5% significance), and the P value is 0.0136, less than 0.05, indicating that the null hypothesis should be rejected.

(6) AR root test

Here, the AR root test is used to analyze the AR root of the robustness of the VAR model. The reciprocal of all unit root moduli of the VAR model constructed in this paper is located in the unit circle, so the established VAR model satisfies the stability condition. At the same time, the calculation of the AR characteristic polynomial shows that all the roots of the characteristic polynomial fall within the unit circle, that is, the reciprocal of all unit roots of the VAR model is less than 1, which indicates that the established VAR(1) model is robust. The test results are shown in Figure 1.

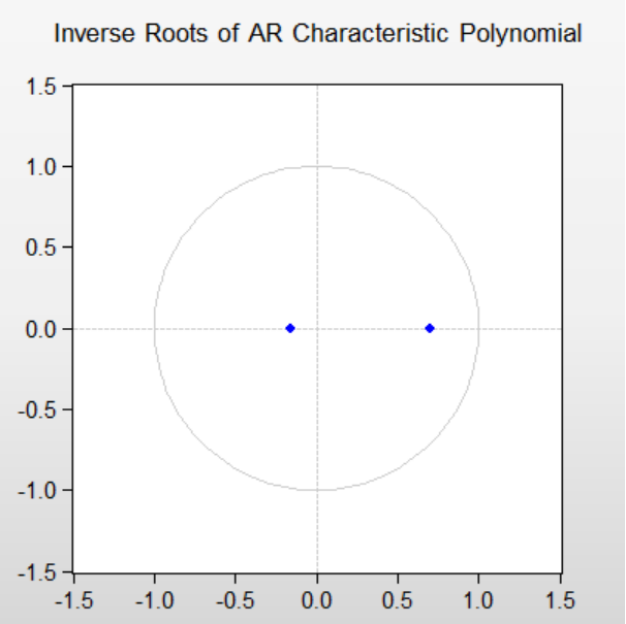


Figure 1. Distribution of unit roots

(7) Granger causality test

The VAR method is just a reduced form analysis. It does not clarify the causal relationship between variables. Therefore, it is necessary to verify the Granger causality between variables. The Granger causality test is performed on these variables. The test results are as follows. The table shows.

Table 4. Granger causal test results

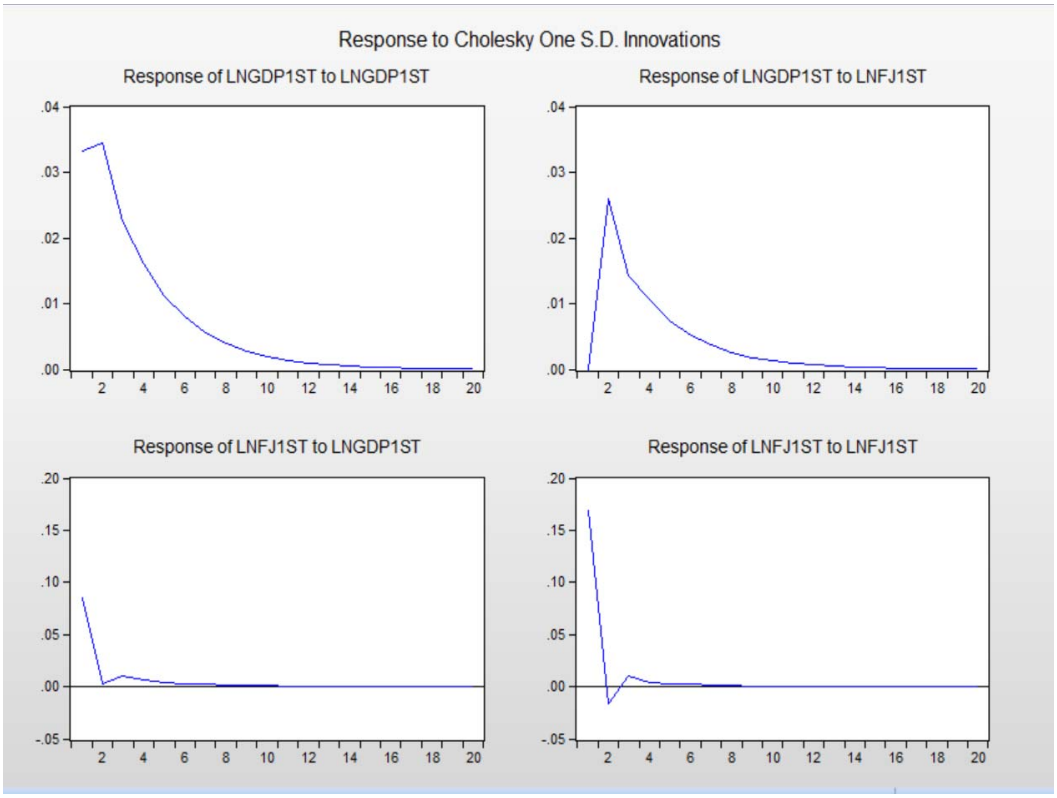
Null hypothesis	F value	P value	in conclusion
GDP does not Granger Cause FJ	5.99870	0.0211	accept
FJ does not Granger Cause GDP	0.39858	0.5331	Refuse

The Granger causality test for VAR is below the 5% significance level. Gross domestic product (GDP) cannot cause Granger to cause changes in real estate prices (fj), that is, accept the null

hypothesis; at the same time, real estate prices (fj) can be caused by Granger Changes in gross domestic product (GDP), ie rejecting the null hypothesis, accept alternative hypotheses.

(8) Impulse response function analysis

The impulse response function reflects the effect of random perturbations from one unit of endogenous variables on the current and future values of each endogenous variable. The horizontal axis represents the number of lag periods of the impact action in monthly units, the vertical axis represents the detailed value of the residual variable response except the shock variable, and the solid line depicts the trend of the impulse response function.

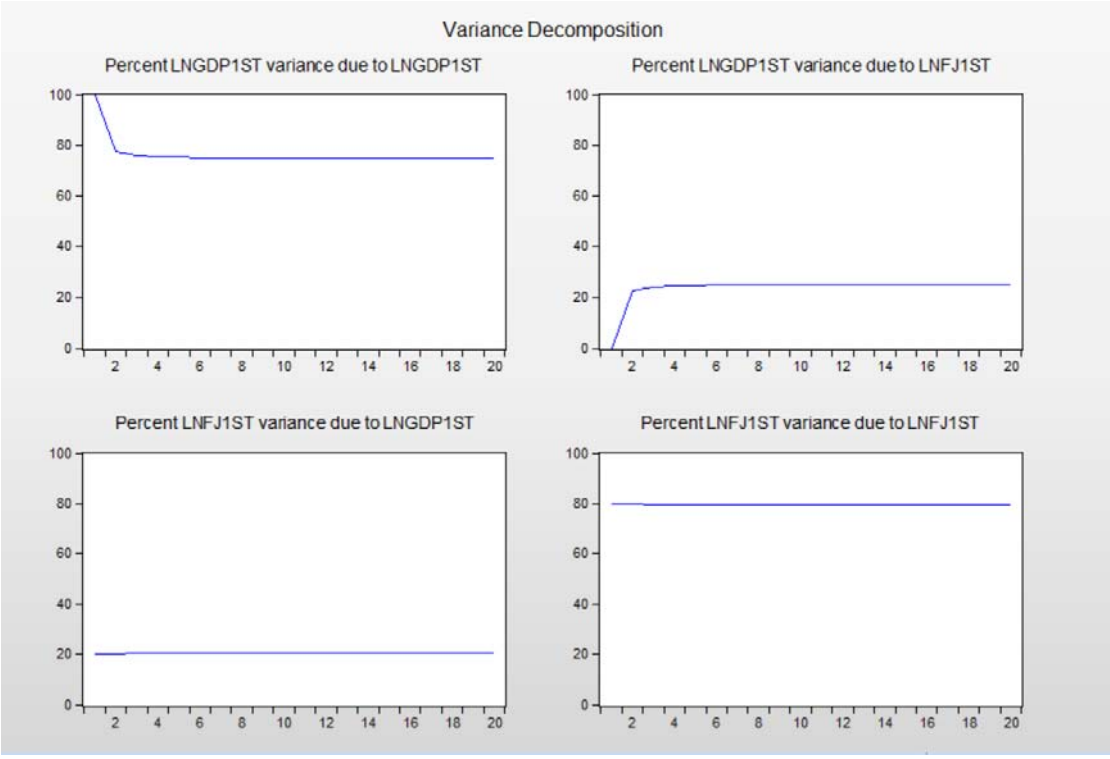


It can be seen from the graph that the gross domestic product (GDP) and real estate price (fj) have their own impacts on GDP. Before the second period, GDP has an upward trend, but it has declined rapidly. The first two periods of real estate prices are presented. A downward trend and a negative value. However, the real estate price basically maintained a flat form in the fourth period, and the change in GDP showed a stable state in the fourteenth period.

The analysis of the impulse response of GDP to real estate prices, when using positive pulses for real estate prices, has shown a gradual upward trend in the first two periods. The reason for the change should be that real estate prices can promote GDP growth, and soon There is a downward trend, then it will slowly decline and finally maintain balance after the fourteenth period. This shows that the real estate price has no end effect on GDP, and after a certain role, it will present a state of equilibrium.

In the figure, the impulse response of real estate prices to GDP shows that comparing the second and third small maps in the graph, we can basically see that the opposite is the opposite. After the real estate price used a positive impact on GDP, the first two periods saw a decline, followed by an upward trend, which was basically flat after the sixth period.

(9) Variance decomposition



The meaning of variance decomposition is that the prediction variance of variables at different time points can be decomposed into parts of different impact interpretations. When N is large, it can be understood as the contribution of shock to variable fluctuations. As can be seen from the first picture and the second picture, there is no other factor affecting GDP in the first period, the second period is affected by the real estate price of about 10%, and the third period is 20%, and then gradually tends to be flat. As can be seen from the third and fourth figures, the first phase of real estate prices did not respond to other factors, and then slightly fluctuated to external changes, but in general the real estate prices were not affected by GDP.

4. Research Conclusions And Recommendations

From the above test results, it can be seen that in the short term, real estate prices will have a positive impact on GDP, but in the medium term, it will gradually slow down and stabilize in the long run. The Granger test between variables shows that real estate prices affect GDP.

This paper establishes a VAR model to analyze the relationship between commercial housing sales and GDP, mainly to explain the impact of real estate prices on GDP, based on 1987-2018 time series data, using VAR The model, cointegration model and impulse response function are deeply analyzed, and the following conclusions are drawn:

The sales of commercial housing is directly determined by the relationship between market supply and demand. GDP is only indirectly affected by its rise and fall. When the national economic situation is good, the income and psychological expectations of residents increase, which indirectly causes the consumption and investment demand in the real estate market to increase rapidly. Due to the certain lag in supply, the price of real estate has risen.

In the framework of vector autoregressive analysis, this paper investigates the impact of real estate prices on GDP in China using cointegration test, impulse response function and variance decomposition. Co-integration test found that there is a certain cointegration relationship between real estate prices and GDP. Through the impulse response function, it is found that GDP has a positive response to the positive impact of house prices and will not decay to zero in the short term. Through the variance decomposition, it is found that the fluctuation of house

prices will have a greater impact on the economy, and the impact will continue for a long period of time, indicating that the real estate industry will have a positive impact on economic development, and the house price itself has a certain development inertia, in the long run Its impact on GDP will be more obvious, but the impact of housing prices on GDP shows a non-linear characteristic.

References

[1] Gelain P. K. J. Lansing, C. Mendicino. House Prices, Credit growth and excess volatility: implications for monetary and macroprudential policy [J]. International Journal of Central Banking, 2013 (9): 219-268.

[2] Beatrice D. Simo-Kengne, Rangan Gupta, Manoel Bittencourt. The impact of house prices on consumption in south Africa: evidence from provincial-level panel VARs [J]. Housing Studies,2013.

[3] Patricia Fraser, Lynn Mc Alevey. New Zealand Regional House Prices and Macroeconomic Shocks. Journal of Property Research, 2015, 32(4):279-300.

[4] Mohsen Bahmani-Oskooee, Seyed Hesam Ghodsi. Do Changes in the Funamentals have Symmetric or Asymmetric Effects on House Prices? Evidence from 52 States of the United States of America. Applied Economics, 2016, 48(31):2912-2936.

[5] Berger D, Guerrieri V, LorenzoniG, et a1. House prices and consumer spending [R]. National Bureau of Economic Research,2015.