Irrational Fluctuation of Real Estate Price Based on Co-Integration Test

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Abstract

At present, with the emergence of the voice of destocking, the price of real estate market, especially the first-tier cities, is also rising rapidly, so what is the factor that makes real estate with the flourishing development trend in this round of destocking cycle? On the basis of the relevant research of domestic and foreign experts, based on the changes of real estate market financial polices of China, this paper sets up the measurement model between the variables such as real estate price, bank credit, interest rate, GDP and relevant variables. Through the analysis of the relevant data of 1998-2018 in China's real estate market, we can found that there is a long-term equilibrium relation between the real estate price, bank credit, interest rate and GDP, and there is an obvious co-integration and Granger causality between the variables. However, the historical inventory of real estate does not have a significant impact on the real estate price. Therefore, under the premise of ensuring destocking, this paper proposes that relevant management departments should take a series of strong regulatory measures to prevent the irrational rise of the real estate price stimulated by the easy credit environment.

Keywords

Real estate, irrational, bank credit.

1. Introduction

Since the implementation of the real estate reform system in 1997, the market operation of the real estate industry has promoted its price to skyrocketing. However, the real estate market has experienced unprecedented development difficulties from 2013, and the high inventory has become the biggest bottleneck hindering the real estate market, and since then, the call to destocking has been growing. So in this round of destocking cycle, the real estate market regulation policy whether can make immediately effect, and what hidden risks behind the immediate effect, many questions need to be addressed. Especially the most direct means of regulation in the real estate market, such as bank credit and interest rate, what role should they play in the recent round of destocking cycle and what impact will they have on the fluctuation of the real estate price? Based on this perspective, this paper empirically analyzes the correlation between the real estate market price, the completed area of real estate, the loan amount of real estate, the interest rate of real estate loan, Gross Domestic Product (GDP) and other relevant factors, and then puts forward relevant suggestions to slow down the frequent fluctuations of real estate price under the premise of ensuring effective destocking.

2. Literature Review

At present, most scholars mainly focus on the mechanism of real estate supply and demand, bank credit and the accelerating effect of financial instruments on real estate price.

Some scholars consider that one of the reasons of irrational price fluctuation in the real estate market lies in the imbalance of supply and demand mechanism of real estate. Wu Jing et al (2009) through the dynamic simulation of real estate prices in 35 large and medium-sized cities in China (such as Beijing, Shanghai et al) for more than ten years, suggested that the elastic supply mechanism of real estate price in China was one of the important reasons for the frequent price fluctuations. Li Tao et al (2012) studied the impact of housing supply and demand imbalance on irrational price fluctuations of real estate from the perspective of the supply-demand ratio of housing completion and sales area in the real estate market.

While some scholars analyzed the reason of irrational fluctuation of the real estate market price mainly from the perspective of credit expansion of the real estate market. Krugman (1999) argued that the huge investment by banks was one of the root causes of the housing bubble. Bernanke et al (2001) found that the price change of real estate and other assets would have an impact on the credit scale of banks. While Ariccia (2008) stated that the relaxation of housing credit standards had directly led to the increase of bank credit and mortgage loan and the sharp rising of real estate price. Tao Changgao's research (2005) showed that credit expansion in the real estate market was one of the direct reasons for its price rise, and the soaring price in the real estate market was also the reason for the credit expansion of financial institutions. Hu Haozhi (2010) empirically analyzed the relationship between real estate market price and credit scale basing on the monthly data from 1999 to 2009 of China, and found that there were significant dynamic correlation between real estate price and credit scale, monetary policy and other macroeconomic variables, and the tightening of credit scale and interest rates can effectively stem housing price rising too fast to some extent.

And some scholars analyzed the interaction mechanism between housing price and credit scale from the perspective of financial accelerator. Chen Jian (2012) analyzed the monthly data of disposable income, consumption level, bank credit assets and other factors from 1998 to 2007 through co-integration analysis and found that the stability of the real estate financial market was conducive to avoiding frequent price fluctuations. Bertand (1996), Christopher (2011), Zeng Kanglin (2003), Fan Dalu (2016) and other scholars also studied the interaction mechanism the real estate price and credit scale from the perspective of the financial accelerator and their researching results generally showed that under the influence of the wealth expectation effect, the rising of housing price could boost the expansion of credit scale and the expansion of credit scale could further stimulate the rising of housing price under the boost of the financial acceleration effect, thus leading to the mutual promotion of housing price and credit.

Based on the correlation analysis of the factors influencing the fluctuation of the real estate price, this paper selects the real estate price, the completed area of real estate, the credit amount of real estate, the loan interest rate, the national income, the per capita consumption level and other variables to carry out relevant research from the two perspectives of supply and demand that affect the fluctuation of the real estate price.

3. Empirical Analysis of The Factors Influencing The Fluctuation of China's Real Estate Price

3.1. Equation Setting and Data Selection

Based on the relevant research experience of scholars, this paper selects the annual data of real estate price, housing completed area, real estate credit, loan interest rate, national income and per capita consumption level to construct the Vector Auto-Regression (VAR) model to study the influencing factors of real estate price from the perspective of supply and demand.

There are two reasons for selecting the annual data sample in this paper. Firstly, considering that the changes of real estate price and sales volume in the low and peak seasons in the same

year may be affected more by consumers' psychology than by economic factors such as loan amounts, loan interest rate and GDP, the information reflected in the monthly or quarterly data may be biased in the low and peak seasons. Secondly, this paper analyzes the trend of real estate price and its influencing factors from the perspective of long-term development trend, and the selection of annual data is also according to the basic law of development and changes of time series itself. So this paper selects the annual data, which can better reflect the impact of economic factors on real estate price, from 1998 to 2018 to make related research. All necessary data for the sample period are obtained from WIND database. At the same time, all variables are taken in their natural logarithms to avoid the problems of autocorrelation and heteroscedasticity and the empirical model is as follows:

$$price = \alpha_0 + \alpha_1 inventory + \alpha_3 loan + \alpha_4 rate + \alpha_5 gdp + \varepsilon_t$$

Where price is the average selling price in the real estate market, inventory is the inventory of commercial housing in the real estate market, loan is the credit balance in the real estate market, rate is the one-year lending rate.

3.2. Correlation Analysis

The real estate price of China has been rising significantly since the implementation of the real estate reform system in 1997. The real estate price showed a steady rising from 1998 to 2002 that was mainly because of general wait-and-see attitude of people when the housing reform system had just been implemented. From 2003 to 2016, the selling price of real estate market showed a straight upward trend, with almost 15% annual average. Until 2017, with the beginning of destocking cycle, the growth of real estate price has been curbed. Over the past 20 years, the annual average selling price of real estate market had been rising significantly in facing of the continuously rising supply and demand imbalance of the housing inventory. This rising is largely due to the financial acceleration effect of the credit stimulus in addition to part of the consumption stimulus caused by the increasing GDP.

At the same time, through the correlation analysis of each variable, we find that price have significant correlation with loan, rate and gdp, but not significant correlation with inventory, and the continuously increasing inventory in the real estate market does not significantly affect the trend of housing selling price. Table 1 reports the results of the correlation analysis of the main variables. Table 2 reports the results of regression analysis.

Table 1. Results of correlation analysis

	price	inventory	loan	rate	gdp
price	1.000				
inventory	-0.785	1.000			
loan	0.974	0.984	1.000		
rate	-0.979	-0.426	-0.475	1.000	
gdp	0.994	0.997	0.985	-0.404	1.000

The values of R2 and adjusted R2 are 0.989 and 0.987 respectively, both close to 1, indicating that this model has a high degree of fitting. The D. W. statistic is 2.203, significantly greater than the 5% critical value of D. W. Test with 4 variables. So it can be concluded that price have positive significant correlation with loan and gdp, while negative correlation with rate. To some extent, the empirical results show that: the increase of GDP stimulates people's consumption of the real estate market, which in turn raises the selling price of it; the credit balance of the real estate market also has a significant positive correlation with the selling price, which means that the tendency of credit policy in the real estate market is directly related to the trend of the selling price of the real estate. While the significant negative correlation between credit interest rate and selling price shows that: under the action mechanism of financial accelerator, the

looser the credit policy is in the real estate market, the higher the selling price will be, and vice versa.

Table 2. Results of regression analysis

Variable	Coefficient	S.D.	T-Statistic	S.E.
loan	-0.078	0.076	-1.023	0.322
rate	0.027	0.093	0.287	0.777
gdp	0.694	0.102	6.806	0.000
C	6.061	0.204	29.598	0.000
R2	0.989	Mean Dependent var		8.146
Adjust R2	0.987	S. D. Dependent var		0.442
AIC	-3.008	S. C.		-2.810
D. W.	2.203	F-Statistic		484.741

3.3. Unit Root Test

Through the above analysis, it can be found that there is a significant correlation between the fluctuation of selling price and the credit balance, GDP and the one-year lending interest rate in the real estate market. However, whether the correlation between these variables is stable, further stationarity test should be carried out for each related variable.

3.3.1. ADF Test

The present study uses Augmented Dickey-Fuller (ADF) unit root test to examine the stationarity of the data series. It consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms and optionally, a constant and a time trend. This can be expressed as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \alpha_2 Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \varepsilon_t$$

In this ADF procedure, the test for a unit root is conducted on the coefficient of Yt-1 in the regression. If the coefficient is significantly different from zero, then the hypothesis that Yt-1 containing a unit root is rejected. Rejection of the null hypothesis implies stationarity.

This paper tests the sationarity of all variables through ADF test and the results are shown in Table 3.

Table 3. Results of Augmented Dickey-Fuller Unit Root Test

Variables	ADF Statistic	Critical Value		
		1%	5%	10%
price	-2.818	-4.619	-3.711	-3.296
Δprice	-4.882	-4.731	-3.761	-3.322
loan	-1.673	-4.619	-3.711	-3.296
Δloan	-5.162	-4.731	-3.761	-3.322
rate	-3.348	-4.619	-3.711	-3.296
Δrate	-4.867	-4.731	-3.761	-3.322
gdp	-1.792	-4.619	-3.711	-3.296
Δgdp	-6.089	-4.731	-3.761	-3.322

It is clear from Table 3 that the null hypothesis of no unit roots for the time series of *price*, *loan*, *rate* and *gdp* are not rejected since the ADF test statistic values are greater than the critical values at 10, 5 and 1 percent levels of significances. While the null hypothesis of no unit roots for these time series are rejected at their first differences since the ADF test statistic values are less than the critical values at 10, 5 and 1 percent levels of significances. Thus, the variables are stationary and integrated into the same order, i.e., I(1). Therefore, through ADF test, it can be found that the correlation between varibles is stable at their first differences.

3.3.2. Cointegration Test

Once the unit roots are confirmed for data series, the next step is to examine whether there exists a long-run equilibrium relationship among the variables. This calls for cointegration analysis which is significant so as to avoid the risk of spurious regression. In general, if the original time series of each variables are non-stationary, while their first differences are stationary, it can satisfy the precondition of cointegration test, so the long-run equilibrium relationship among the variables can be verified by cointegration test. The resluts of cointegration test are reported in Table 4.

Table 4. ADF test results of residual sequence ε_t

ADF t-test	-4.892	1% Critical Value	-4.619
		5% Critical Value	-3.711
		10% Critical Value	-3.296

Table 4 shows that: the ADF t-statistic value of residual sequence ε_t from regression analysis model is -4.892, which is less than the critical value of -4.619 at the significance level of 1%, so it can be estimated that the residual sequence ε_t is a stationary. Therefore, it can be concluded that there is a long-term stable cointegration between price, loan, rate and gdp, and the varibles of loan, rate and gdp can well explain the changes of price.

3.3.3. Granger Causality Test

In economic time series, it is sometimes possible to calculate large correlation coefficients between time series with almost no correlation. Therefore, to exclude this possibility, Granger Causality Test is needed to eliminate false correlaiton between econoimc time series. Table 5 reports the resluts of Granger Causality Test when the lag period of variables is 2.

Table 5. Results of Granger Causality Test

Null Hypothesis	F-Statistic	Probability	Decision
Δ*price* does not Granger Cause Δ*inventory*	1.988	0.779	Accept
Δ*inventory* does not Granger Cause Δ*price*	8.436	0.505	Accept
Δ*price* does not Granger Cause Δ*loan*	0.023	0.976	Accept
Δ*loan* does not Granger Cause Δ*price*	8.264	0.001	Reject
Δ*price* does not Granger Cause Δ*rate*	0.023	0.976	Accept
Δ*rate* does not Granger Cause Δ*price*	8.264	0.001	Reject
Δ*price* does not Granger Cause Δ*gdp*	1.637	0.235	Accept
Δ*gdp* does not Granger Cause Δ*price*	8.129	0.005	Reject

The results in Table 5 indicate that: the associated probability of the null hypothesis that the selling price does not Granger-cause inventory in the real estate market is 0.779, so the test result accept the null hypothesis, that is the selling price does not Granger-cause inventory in the real estate market. Similarly, housing inventory does not Granger-cause selling price. The selling price does not Granger-cause credit balance, loan interest rate and GDP, while the credit balance, loan interest rate and GDP does Granger-cause the selling price in the real estate market.

Through the Granger Causality Test, it can be concluded that there is a false correlation between the housing inventory and selling price in the real estate market, that is the housing inventory in the real estate market does not have a direct impact on the fluctuation the selling price, which means that the current destocking cycle will not cause irrational fluctuation of the selling price, as long as the relevant departments grasp the degree of fiscal and monetary policies. While other variables (e.g., loan, rate, and gdp) have a significant impact on the selling price, but the selling price does not affect other variables in the real estate market. Therefore, the reason for the irrational fluctuation of the selling price lies more in the economic factors such as credit balance, loan interest rate and national economic development. Fundamentally speaking, it is the loose monetary policy of China rather than the destocking cycle that causes the fast rising of the house selling price, especially in these two years.

3.4. Impulse Response Analysis

The above analysis shows that all the empirical models are relatively stable, which take the selling price as endogenous variable and credit balance, one-year lending interest rate and GDP as exogenous variables. While the impulse response analysis is needed to further study how and to what extent will the credit policy, national income and consumption level affect the selling price in the real estate market. The impulse response analysis is mainly to measure the impact of one standard deviation shock of the random disturbance term of exogenous variables on the current and future values of endogenous variables. So this paper mainly analyzes the impact of exogenous (e.g., loan, rate, and gdp) on the endogenous variable (the selling price) by using the impulse response analysis. The transmission paths of impulse response are shown in Figure 1.

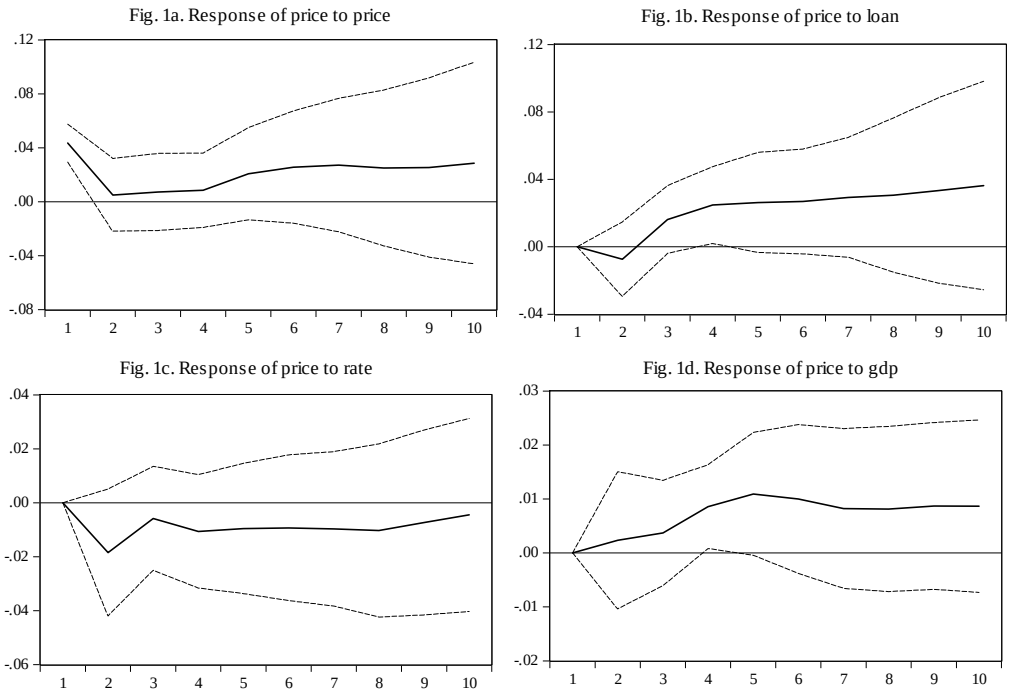

Fig. 1 Impulse response functions for VAR model of *price*

As shown in Fig. 1a, the response of price to its own One S. D. Innovation is 0.043 in the first period, then decreases to 0.01 in the second period, and gradually stabilizes to 0.02 after the third period, which means that the selling price of real estate in China has a strong inertia rising momentum and mainly affected by its' previous period price. Fig. 1b plots the impact of One S. D. Innovation of credit balance on price. It can be observed that the impact remains at about 0.03 from the fourth period, which is mainly due to the delay effect of bank credit scale on the housing price. Fig. 1c shows the impact of one-year lending interest rate on price, which is relatively weak, hovering around 0. That is due to the low level of interest rate liberalization in China. Fig. 1d shows the response of price to GDP which maintains 0.02 from the 5th period. This result suggests that GDP has a long-term positive impact on housing price in China.

4. Conclusion and Suggestion

Through the study of relevant sample data in China's real estate market from 1998 to 2018, this paper finds that there is a significant correlation between housing selling price, credit balance, one-year lending interest rate and GDP. However, there is a false correlation between housing selling price and inventory, which to some extent explains why the housing selling price is still increasing but not decreasing under the pressure of high inventory in the current real estate market in China. This paper also shows that: all relevant variables meet the stability test of empirical models, and the three independent variables also produce different degrees of impulse response to the dependent variable.

At present, with the increasing pressure of high inventory in the real estate market, the state has successively introduced a number of measures, such as encouraging migrant workers to buy real estate in cities, subsidizing the first house purchase, and reducing the loan interest rate. The fundamental purpose of these measures is to reduce the high inventory, reasonably guide residents' real estate investment, and thus achieve the balance development of supply and demand of China's real estate market. However, the implementation effect of real estate regulation policies in recent years is not satisfactory. The housing selling price in the real estate market, especially in the first- and second-tier cities, has been experiencing daily soaring under destocking cycle. Therefore, relevant departments should take reasonable measures to correctly guide the destocking and rationally treat the price fluctuation in the real estate market, so as to effectively deal with the contradiction between high inventory and soaring price effectively, and achieve a win-win situation of reducing inventory pressure and realizing housing price rationality return.

4.1. Formulating Housing Credit Policy According to Inventory Situation

We should appropriately relax the individual housing credit policies in the third- or fourth-tier cities with large inventory of commercial housing and formulate more reasonable and effective credit policies in order to promote the destocking of the real estate market. At the same time of strengthening destocking, relevant departments should also rationally treat the relaxation of individual housing credit policies. Meanwhile, relevant policies should to be introduced to avoid the occurrence of individual housing credit risks with the actively innovating individual housing credit products and services.

4.2. Actively Promoting Market Reform of Credit Interest Rate

The above empirical analysis of the impulse impact of interest rate on housing price shows that: the change of interest rate has less influence on the average price of China's real estate market, which is partly attributed to the low level of interest rate liberalization in China. The current low level of interest rate under control is difficult to achieve the balance of money supply and demand. The long-term low interest rate is also difficult to have a substantial impact on the real

estate market. Therefore, the market-oriented reform of interest rate should be actively promoted at present to achieve the balance between the housing selling price and the theoretical price in the real estate market.

4.3. Improving Supply and Demand Mechanism

From the perspective of supply and demand balance, the fundamental reason why the current real estate market has high inventory and housing price is still the imbalance of supply and demand mechanism. Therefore, in the real estate market, efforts should be made to improve its supply and demand mechanism, so as to realize the management with market micro-adjustment as the main and government macro-intervention as the auxiliary. Secondly, supporting measures, such as pricing mechanism, property tax, interest rate, land policy and financing, also should be improved. With the implementation of these measures, the supply and demand of real estate market can be effectively connected from the national macro level and the market micro level, so as to realize the double landing of high inventory and housing price in China's real estate market.

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