Potential Impact of Land Policy Change and Population Ageing on House Price Volatility

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Abstract: Based on the relationship between China's population aging, land policy changes and housing prices, as well as relevant domestic and foreign literature, this paper discusses the impact of China's population aging and land policy changes on housing prices, and constructs related variables and VEC models to further study the dynamic correlation between the three aspects. The empirical results show that in the long run, China's population aging and the increase in land finance will increase the risk of decreasing house prices. In the short term, the population aging has a negative impact on housing prices, which is more significant than the long-term impact, and the inhibitory effect of the land policy rise on housing prices in the short term will not appear.

***Keywords*:** population aging, land finance, VEC model

1. Introduction

A large number of existing studies have regarded speculative expectations and monetary policy as the main factors for the formation of real estate bubbles. Abraham and Hendershott (1994) [1] , Arthur and Andrew (2012)[2] believe that speculative expectations are one of the major causes for the real estate market bubble. Frappa and Mesonnier (2010)[3], Sommer et al. (2011) [4]expounded the direct impact and potential risks of credit funds on real estate bubbles from a monetary policy point of view. This paper carefully explores the causes of housing prices in China from the perspectives of land finance and population aging, and further analyzes the dynamic correlation between the three through the VEC model. This is an analysis of China's housing prices from a more comprehensive perspective, and the associations between housing prices, land finance and population aging based on the current situation China is facing. This is also a huge challenge that China will face now and in the future.

2. Data and Methodology

2.1 Type and Source of Data

This paper studies the housing prices in China. Considering the availability of data, housing prices are measured by sales price of commercial housing divided by area(unit: XX RMB per square meter), and the level of population aging is measured by the population aged 65 and above (10,000 people). Land policy is measured by the transaction price (10,000 yuan) of state-owned land. This paper selects the period from 2002 to 2017 as the sample period. The average price of commercial housing and the population aged 65 and above in the sample period are obtained from the relevant statistical data of the National Bureau of Statistics of China database, and the transaction price of state-owned land supply is obtained from the China Land and Resources Statistical Yearbook. In addition, this paper uses Eviews10.0 software , convert the annual data to semi-annual data to expand the sample size.

2.2 Modeling Process

This paper first uses cointegration test to examine the long-term equilibrium relationship between China's housing prices, population aging and land policy, and establishes the long-term equilibrium equation between the three as follows:

$$LNPRIC_t = \beta_1 + \beta_2 LAND_t + \beta_2 OLD_t + \varepsilon_t \quad (1)$$

where β_1 are constants, β_2, β_3 are the influence coefficients of land policy and population aging on housing prices, respectively, ε_t is the residual term.

To study the short-term fluctuations between population aging and housing prices and land policies, this paper constructs the VEC model as follows:

$$\triangle Y_t = \alpha ECM_{t-1} + \sum_{i=1}^{\rho-1} \theta_i \triangle Y_{t-i} + \dot{o}_t \quad (2)$$

where $\triangle Y_t = \begin{pmatrix} DLNPRIC_t \\ DLAND_t \\ DOLD_t \end{pmatrix}$, p is the optimal lag period.

ECM_{t-1} is the so called the error correction term,α is the speed at which the relationship between the response variables that deviate from the long-term equilibrium are adjusted to the equilibrium state, θ_i is the short-term effect of variable volatility on explanatory variables. Equation (2) shows that the short-term fluctuation of housing prices depends not only on the fluctuation of land policy and the level of population aging, but also on the degree of deviation of housing prices from equilibrium.

2.3 Statistical Techniques and Methods

2.3.1 Unit Root Test

The data selected in this paper are all semi-annualized time series data. In order to avoid invalid results caused by "pseudo regression", the ADF method should be used to test the stationarity of the data first. Null hypothesis is rejected by ADF. AIC, SC and HQ values corresponding to the model are tested, in all three cases,and the case with the smallest number is selected. The values are the smallest, so the series is a second-order difference stationary time series. Similarly, the available housing price data and land policy data are also time series data with second-order difference stationary.The comprehensive ADF unit root test results of the three groups of data on housing prices, population aging and land policy can be seen in Table 1.

Table 1. ADF unit root test results

Variable	ADF statistic quantity	1% threshold	5% threshold	conclusion
LNPRIC	-2.5628	-3.6999	-2.9763	unstable
OLD	4.4023	-3.6793	-2.9677	unstable
LAND	-2.5535	-4.2967	-3.5683	unstable
Δ^2LNPRIC	-4.9900	-2.6569	-1.9544	stable
Δ^2OLD	-5.9323	-2.6501	-1.9534	stable
Δ^2LAND	-3.4589	-2.6649	-1.9557	stable

Note: Δ^2 means second order difference

2.3.2 Cointegration Test

According to the established econometric model (Formula 1), the Johansen cointegration analysis method was used to test the cointegration relationship among the three variables of LNPRIC, LAND and OLD.

The Johansen cointegration test shows that there is a cointegration relationship among the three variables of LNPRIC, LAND and OLD.

Therefore, the results of this paper are as follows:

$$LNPRIC = 2.349179 - 0.20747 LAND - 0.725767 OLD \quad (3)$$

2.3.3 VEC

We set the VEC model on the basis of the Johansen test, and the final result of the VEC model is:

$$\begin{pmatrix} DLNPRIC \\ DLAND \\ DOLD \end{pmatrix} = \begin{pmatrix} -0.104682 \\ 1.216664 \\ 0.060626 \end{pmatrix} ECM_{t-1} + \begin{pmatrix} 0.352958 & 0.029486 & 0.184083 \\ -1.347083 & 0.881205 & -14.92820 \\ -0.031458 & 0.007871 & 0.405858 \end{pmatrix} \begin{pmatrix} DLNPRIC_{t-1} \\ DLAND_{t-1} \\ DOLD_{t-1} \end{pmatrix} + \begin{pmatrix} -0.609801 & -0.069814 & -1.268013 \\ -0.053344 & -0.529572 & 8.893658 \\ 0.001659 & 0.009009 & -0.525308 \end{pmatrix} \begin{pmatrix} DLNPRIC_{t-2} \\ DLAND_{t-2} \\ DOLD_{t-2} \end{pmatrix}$$

$$+\begin{pmatrix} 0.079794 & 0.024933 & -0.133314 \\ -0.879743 & 0.432174 & -23.03926 \\ -0.035943 & 0.005924 & -0.039172 \end{pmatrix}\begin{pmatrix} DLNPRIC_{t-3} \\ DLAND_{t-3} \\ DOLD_{t-3} \end{pmatrix}+\begin{pmatrix} 0.071675 \\ 0.601849 \\ 0.021426 \end{pmatrix}$$

The above VEC model reflects the short-term fluctuations between housing prices, land policies and population aging levels, which are not only affected by the error term (short-term deviation from equilibrium), but also by changes in housing prices, land policies, and population aging levels themselves.

3. Data Analysis and Results

From Table 1 above, the ADF statistics of the three variables LNPRIC, LAND, and OLD are all greater than the critical value of their respective significance levels, indicating that the original series data of housing prices, land policies and population aging levels are not stationary. , but after the second-order difference, the three time series are all stationary series. Therefore, housing prices, land policies and population aging levels are second-order single integration, and cointegration analysis can be performed. Through the Johansen cointegration test, it can be found that there exists a long-term equilibrium relationship between the three variables of house price, land policy and population aging level (Equation 3). In the long run, the impact of land policy and population aging level on housing prices is in the same direction, and the impact of population aging level on housing prices is greater than the impact of land policy on housing prices. Specifically, an increase in the level of population aging by one unit will cause housing prices to drop by 0.725767 units, which shows that as the level of population aging increases in the future, the risk of housing price declines in China will increase. And one unit increase of land policy will cause the housing price to drop by 0.20747 units, indicating that the rise of China's land policy will restrain the rise of housing prices.There is also a negative correlation between land policy and housing prices, indicating that land policy is not the decisive factor in rising housing prices. In the VEC model, specifically, the error correction coefficient of house prices in the VEC model is -0.104682, and the negative value in accordance to the reverse correction mechanism, reflecting that if short-term fluctuation of house prices deviates from the equilibrium, the dynamic relationship between the three variables will adjust the unbalanced state back to the balanced state with modifying strength of -0.1. The influence of the aging level of lag 2 and lag 3 on housing prices is negative, which is consistent with the long-term influence trend, and the modulus of the coefficient of the second lag is greater than modulus of the influence coefficient at the long-term equilibrium, reflecting that population aging will increase the risk of falling house prices, and the risk is more significant in the short term than in the long run. The reason may be that there are too many factors affecting housing prices. In the long run, the impact of aging on housing prices is not that great. The land policy with lag 1 and lag 3 has a positive impact on housing prices, and the elastic coefficients are 0.029486 and 0.024933, which are opposite to the long-term influence coefficient of -0.20747, and the absolute values of these two elastic coefficients are also lower than the long-term influence coefficient. The absolute value shows that the impact of land policy changes on the decline in housing prices will not appear in the short term, and there is no significant long-term effect. In the VEC model of land policy and aging level, the coefficients of the error correction terms are 1.216664 and 0.060626 respectively, both of which are positive, which do not conform to the negative feedback mechanism, so the short-term fluctuation cannot be pulled back to the long-term equilibrium state.

4. Conclusions

This paper selects the relevant statistical data of housing prices, land policy and population aging in China from 2002 to 2017, adopts cointegration test, constructs VEC model and other methods to examine the long-term relationship between population aging, housing price and land policy. In the short-term relationship, the following conclusions are drawn: (1) from a long-term perspective, there exists a equilibrium relationship among housing prices, population aging and land policy. The aggravation of aging will increase the risk of housing price declines, and the increase in land policy will only increase to a certain extent. To a certain extent, it will restrain the upward trend of housing prices. The impact of population aging on housing prices is greater than the impact of land policies on housing prices. (2) In the short term, the dynamic relationship between the three variables will bring the non-equilibrium state back to the equilibrium state with an adjustment strength of -0.1. Short term impact of population aging on housing prices is negative,and the short-term effect is more significant than the long-term effect. In the short term, the impact of land policy on housing prices is positive, which shows that the impact of land policy changes on housing price declines will not appear in the short term, and there is no significant long-term effect.

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