

# An Empirical Study on the Influence of Price scissors of $M_1$ - $M_2$ Growth on House Prices

Shuguo Zhang<sup>a,\*</sup>, Min He<sup>b</sup>

Department of Economic Management, North China Electric Power University, Baoding, China.

<sup>a</sup>13930865901@163.com, <sup>b</sup>1364543274@qq.com, \*Corresponding author

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**Abstract.** This paper analyzes the impact of China's money supply  $M_1$ - $M_2$  growth rate and interest rate on real estate sales price with VEC Model and Impulse Response Function. The study was based on 48-quarter time series data from 1999 to 2010 in China. The results show, the growth rates of  $M_1$  and  $M_2$  have a fast and significant impact on the real estate sales prices, in the second and fourth period to achieve positive significant. And there is a time lag in the impact of interest rates on house prices.

## Introduction

At present, continuing to rise in the money supply, cutting deposit and lending interest rates and the sharply rising of housing sales price levels, link between monetary policy and housing sales price has become the focus of attention. Due to the uniqueness of the real estate industry, it highly connects with Banks and other financial institutions. From twentieth Century 70's to 90's the instance of real estate bubble caused by the improper monetary policy is not in the minority, such as Japan, America, southeast Asia, etc. In recent years, the rise of China's real estate prices is significantly accelerated and in some areas the increase is even more alarming. From the historical data, the money supply and the housing price growth index has a long-term and stable relationship. In recent years, inevitably the rise of housing prices at high speed and high rates of our country money supply has a certain relationship.

Based on the valid data that the national commodity house average sales price index for HP and interbred lending interest rate  $R$ ,  $M_1$ ,  $M_2$  rose index difference from 1999 to 2013, this paper study the influence of the money supply of  $M_1$ - $M_2$  growth differential on the house prices. For the rate of change of  $M_1$ - $M_2$  growth rate difference and house price have the empirical research of the delay. The papers also investigate the effects of the changing of interest rate  $R$ ,  $M_1$ - $M_2$  growth rate differential on house prices. Based on these it provides reference and suggestions to the real estate information users.

## A Review of the Literature

The current foreign scholars about the research on the effects of monetary policy on prices more focus on the real estate credit channel selection influence on prices. Matteo and Raoul (2003) used the method of vector auto regression (VAR) from the angle of credit channel impact on prices, analyzing the real estate market of Germany Finland, Norway and other countries. It is concluded the conclusion that the structure characteristics of the real estate market, financing efficiency and the form of the lenders and the validity of the credit transmission channels of the country has a close correlation.

Domestic research on the relationship between monetary policy and the real estate market can be roughly classified into three aspects: the first is the relationship between credit channels with house price fluctuations; The second aspect is the relationship of loan, interest rates and house prices. The third area from the angle of comprehensive researches on relationship that between monetary policy and the house price. Xie Chi, Zheng Lan from the three aspects of the monetary policy transmission theories, research methods and researchers from all over the world for financial policy evaluation summarize and evaluate monetary policy impact on housing prices. Hui-ming zhu uses

co-integration and error correction method to study the long-term equilibrium relationship of the money supply growth and inflation rate from 1994 to 2004 finding that there is a cointegration relationship between money supply growth of different levels and the rate of inflation. The growth rate of M2 has closer relations with the rate of inflation. Ma Xing (2013) has began from the delay of the rate variation of the broad money supply and house prices using autoregressive model confirmed that the money supply growth impact on house price growth has a lag period of 10 months. And the change of house price growth rate for a month before on the influence of the month has the highest correlation. YuKangZe, Yu Zeting (2007) by using 2003-2007 quarterly data on prices and monetary policy and using the impulse response function to analysis the monetary policy and house prices, it is concluded that monetary policy impact on housing prices lag for 3-4 months. And the variance decomposition shows that the ability of monetary policy on prices regulation is limited. The interest rate tool is better than that of monetary policy tools. The effect of interest rate policy as time delay will show itself. Cheng Yuting, Gengqiang. From 2006 to 2009 China's monetary policy changes as the research background. From three major monetary policy tools analyze the effect of monetary policy on prices. It is concluded that real estate consumer loans has obvious effects on house prices and mild interest rate adjustment has little effect on house prices. The changing of significant policy exist also a lag period of five months or so.

To sum up, scholars makes a deep analysis and research on the relationship between the money supply and house prices and also research the delayed. But few of these studies from the angle of the M1-M2 growth difference consider time lag and fluctuations that monetary policy impact on house prices. In this paper, combined with M1 year-on-year rate of change, considered that the M1, M2 growth is not flat, the corporate demand deposits and time deposits did not change under the condition of synchronization. The paper research what the change rates of money supply growth money supply impacts on that house prices.

### **Data Selection and Quantitative Analysis**

**Data Selection .**This article embarks from the Keynesian monetary transmission mechanism theory. Through in two ways that the monetary policy impact on housing prices: the one is the relationship between money supply and interest rates, namely liquidity preference theory; the second is the relations between interest rate and investment ,namely interest rate elasticity approach. According to the theory of Keynes, the money supply is greater than demand for money and the supply is relative excess, lower interest rates to stimulate investment when the money supply increases. Generally, compared with the current deposit interest rate, interbank lending rates is more sensitive to accurately reflect the changes in the money market situation. So interbank lending rates R is selected as one of the monetary policy variables. Previous studies have shown that money supply changing of different levels have varying degrees impact on house prices. And there is a long-term equilibrium relationship. Therefore, there is no doubt that money supply is the best choice of the monetary policy intermediary goal. In addition, from the monetary liquidity, investment demand heat and consumption terminal market activity and so on factors to consider,  $M_1$  and  $M_2$  growth rate difference are selected, namely "price scissors of  $M_1$ - $M_2$  growth rate" as a economic variables that monetary policy affect the house price. Different from the growth changes of  $M_1$  and  $M_2$  per year amount, it reflects the differences in  $M_1$  and  $M_2$  growth. It shows that change of total amount of the money supply at the same time also shows the changes in the structure of money supply. Due to the restriction of data acquisition, housing sales price index HP has been able to reflect amplitude of fluctuation and change trend of sales price variations in a certain period of time. So the hp is selected as the indicators of the amplitude of the price changes. Because of the national bureau of statistics has decided to take effect anew prices statistical system from 1 January 2011.After 2011, the data is not comparable, so the range of commercial housing sales price index is for the 1 quarter of 1999 to the 4 quarter of 2010. In order to eliminate the influence of seasonal fluctuations and heteroskedasticity, the above numerical selects the growth rate rather than the absolute value.

In this paper, data is obtained by the related original data which is arranged according to the Chinese academy of social sciences financial statistic database's official website, the national

bureau of statistics web site, site of the people's bank of China economic information network, and China financial yearbook, the people's bank of China statistics quarterly, the Chinese real estate industry analysis report.

**Data Econometric Analysis. Stationary Test** .In order to avoid spurious regression between time series problems, before you build an analysis model, the stationary test was carried out on the selection of variables to examine time trend of the sequence. This paper uses Augmented Dickey Fuller (ADF) to test the stationary of data. Test results show that  $M_1$ ,  $M_2$ , R, HP are all under the confidence level of 1% first-order difference stationary. Namely ADF statistics of the variables in the case of first order difference sequence is less than the critical value of 1% the confidence level. Test results obtained from EViews6.0.By AIC information criterion and SC information rules to determine lag item is 3. The specific data of ADF test is shown in the table below.

Table 1 Augmented Dickey-Fuller Unit Root Test

Content	Test critical values			t-Statistic	Prob.*
	1% level	5% level	10% level		
D(hp)	-4.192337	-3.520787	-3.191277	-6.373983	0.0000
D( $M_1$ - $M_2$ )	-4.186481	-3.518090	-3.189732	-4.943739	0.0013
D(R)	-4.170583	-3.510740	-3.185512	-5.025197	0.0009

Test results show that HP,  $M_1$ ,  $M_2$ , R first order difference are stable under 1% confidence level. They exist co-integration relationship. Namely there may be a long-term stable relationship between them.

**Co-Integration Test.** Co-integration test is used to depict the steady relationship of two or more than two sequences. Basic idea is that if two or more than two time series is non-stationary, but some linear combination of them is smooth. These variables exists co-integration relationship or long-term equilibrium relationship. The concrete can be divided into two kinds: one is co-integration test based on the regression coefficients such as Johansen co-integration test; the second is the test based on of the regression residuals such as CRDW inspection, DF, ADF test. Here, due to lack of ADF test under the precondition of each of the variables with order smoothly, by using the method of Johansen test, was carried out co-integration test the on relevant variables. By AIC information criterion and SC information rules to determine lag item is 3.Results showed that the group variable has rejected the original hypothesis under the confidence level of 5% and there is 3 co-integration equations. Namely there is a long-term stable relationship between the above variables.

Table2. Johansen Co-integration Test

Series: D(hp) D ( $M_1$ - $M_2$ ) D(R) ;Lags interval (in first differences): 1 to 3				
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.656269	73.66957	29.79707	0.0000
At most 1 *	0.369957	27.75006	15.49471	0.0005
At most 2 *	0.167550	7.885448	3.841466	0.0050
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You can get co-integration relationship:

$$ecmt-1=HP(-1)+1.85*(M1-M2(-1))-2.07*R(-1))-100.27$$

**Using The VEC Model.** Combining co-integration and error correction model by Engle and Granger, Vector error correction model is established.VEC vector error correction model can be regarded as a VAR model with the co-integration constraint and many applications and non-stationary time series with co-integration relationship modeling. It does not contain mathematical equations with exogenous variables.

$$\Delta y_t = \alpha ecmt_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t$$

$ecmt_{t-1}=\beta'y_{t-1}$  is the error correction reflecting the long-term equilibrium relationship of variables. When the coefficient vector alpha reflects that the equilibrium relationship between variables

deviate from the long-term equilibrium state, it should be adjusted to the adjustment speed of equilibrium.

VEC model is established based on the above sequence. As follows:

$$\begin{bmatrix} D (hp) \\ D (M1 - M2) \\ D (R) \end{bmatrix} = \begin{bmatrix} 0.46 & 0.23 & -0.26 \\ 0.71 & 0.22 & 0.34 \\ 0.05 & -0.001 & 0.19 \end{bmatrix} \times \begin{bmatrix} D (hp)_{t-1} \\ D (M1 - M2)_{t-1} \\ D (R)_{t-1} \end{bmatrix} + \begin{bmatrix} 0.24 & 0.14 & 0.74 \\ 0.34 & 0.53 & -0.05 \\ -0.02 & 0.017 & -0.19 \end{bmatrix} \times \begin{bmatrix} D (hp)_{t-2} \\ D (M1 - M2)_{t-2} \\ D (R)_{t-2} \end{bmatrix} + \begin{bmatrix} -0.2 & 0.27 & -0.24 \\ 0.12 & 0.47 & 1.23 \\ 0.01 & 0.018 & -0.09 \end{bmatrix} \times \begin{bmatrix} D (hp)_{t-3} \\ D (M1 - M2)_{t-3} \\ D (R)_{t-3} \end{bmatrix} + \begin{bmatrix} -0.16 \\ -0.50 \\ 0.001 \end{bmatrix} \times vecm_{t-1} + \begin{bmatrix} -0.07 \\ -0.5 \\ 0.01 \end{bmatrix}$$

**Impulse Response Function Analysis.** In order to better interpret the connotation of the VEC model, here with the help of impulse response function analysis the relationship of  $M_1$ ,  $M_2$  growth rate, interest rate R with HP. Impulse response function can measure the influence a standard impact from a random disturbance on endogenous variable current and future value. Which is a thought using time series model to analyze the relationship of influence and consider that the influence of the disturbance is how to spread to each variable. According to the criterion AIC and SC information to determine the best lag period is 3. The result of the impulse response analysis is the diagram below. The horizontal axis represents the lag period of impact (unit: quarter) and the vertical axis said commercial housing sales price index for HP. The solid line represent the degree of response that price index impact on monetary policy variable  $M_1$ - $M_2$ , R.

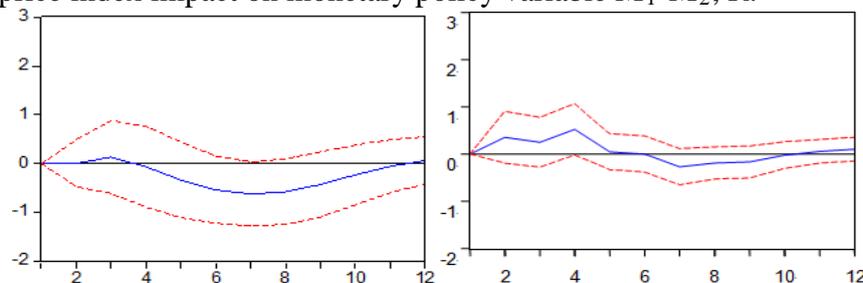


Fig.1 Response of DHP to R Fig.2 Response of DHP to  $M_1$ - $M_2$

As can be seen from the impulse response in the figure the dynamic process that commercial housing sales price index impact on the interest rate R and the growth difference of the money supply  $M_1$ - $M_2$ . As can be seen from the figure 1 that interest rates go up to a negative impact on housing prices in general. The first two quarters has little effect, but there is a slight positive influence in the short-term. As time goes on, commercial housing sales price index have more and more obvious negative influence on the interest rate. In the seventh quarter reached negative significantly. That is to say that with lower interest rates, commercial housing sales price index has rose and house prices has also rose. But the effects of interest rate policy on prices have the lag of 2 quarters. From the impulse response figure of commercial housing sales price index for  $M_1$ ,  $M_2$  money supply growth can be seen that the response commercial housing sales price index for the  $M_1$ ,  $M_2$  growth difference in stage 2 and 4 were positively significant into a negative response after the fifth period.

A comprehensive view of the result of impulse response analysis is that money supply  $M_1$  and  $M_2$  growth difference has a speed and significantly impact on commercial housing sales price and

the impact of interest rates on house prices exists delay problems.

### **Conclusion and Analysis of the Causes**

**The Interpretation of the Interest Rate R.** Overall, the interest rates on house prices are a negative impact but there were slight positive influence in the short term. That is to say that a rise in interest rates in the short term will make house prices rose. This result is consistent with the research of Gao Bo (2009). When the demand of the real estate market is vigorous, even if the rising of interest rates suppresses the real estate enterprise loan, but personal housing loan can't effectively suppressed. The influence of interest rate policy to house prices is not obvious and influence is significantly after phase 2. So the control of rates on house prices exist a certain lag.

**The Interpretation of the  $M_1$ - $M_2$  Growth Rate Difference.** Through a lot of scholars research on relationship between money supply and prices shows that the change of monetary policy and the change of the structure of supply will cause the corresponding change of economic operation. So when we judge the impact of money supply to house prices, we can start from another level by observing the structural change in the money supply. Namely by comparing year-on-year growth of  $M_1$  and  $M_2$ . It is concluded that price scissors of the growth rate of  $M_1$ - $M_2$  make predictions about the future economic development of the real estate market movements. Determining real economy investments, consumption terminal activity and willingness to spend in the future, to predict the future development trend of housing prices. We can know the difference between the  $M_1$  and  $M_2$  growth rate changing will produce the corresponding volatility of house prices.

Price scissors difference of the growth rate of  $M_1$ - $M_2$  is selected as indicators to measure the money supply structure. Not only can effectively eliminate all kinds of diameter of autocorrelation of the relationship between money supply data and seasonal factors and accidental factors can also eliminated. It directly shown the difference of the change speed between  $M_1$  and  $M_2$ . And for the calculation caliber of the  $M_2$  includes  $M_1$ . So the  $M_1$ ,  $M_2$  growth difference at the same time also shows that in the process of the change of the total amount of the money supply the structure of money supply changes and its development trend. When the price scissors of the growth rate of  $M_1$ - $M_2$  is positive value show that  $M_1$  growth is greater than  $M_2$  growth rate. That is to say, when enterprises deposits grow larger, the structure of money supply is gradually demanded. On the other hand it shows the money supply structure gradually on a regular basis. That absolute value of the growth difference is greater between them which shows the degree of the change of the structure of money supply is higher and the change trend is more significant.

When the price scissors of the growth rate of  $M_1$ - $M_2$  is positive value and the amount is gradually expanding, the currency of social will tend to flow into the consumer market to promote the consumption and investment demand, capacity increase and economic development. However, with the rise of consumption and the demand of investment it takes some time to increase of production capacity. So in a period of the future consumption and investment market is in short supply. The price of consumer goods and investment products will continue to rise. People predict that the next price will rise. So that consumers don't want to hold money, but with the money buy the assets that value is added or the value remains the same. Real estate as a special product that is added or the value remains the same was becoming popular with consumers. A lot of money flow into real estate investment market and house prices also rose.

When the price scissors difference of the growth rate of  $M_1$ - $M_2$  is negative value and the amount is decreasing, currency will gradually drained to the banking system and the terminal of consumption reduce the activity. The willing of consumption and investment will shrink. The demand of consumer will reduce and the activity of real economy is decreased. Prices will be falling in the future for a period of time. People are more inclined to deposit their money in the bank to reduce the demand for investment. The real estate prices as the investment will fall. But generally, demanding the money supply structure influence on the economy is higher than a regular basis. Namely when the absolute value of  $M_1$ - $M_2$  growth difference is same, if  $M_1$  growth rate is greater than  $M_2$  the role in promoting prices is more obvious.

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