HOW THE MONETARY POLICY AFFECTS THE REAL ESTATE PRICE? – EVIDENCE FROM CHINA

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ABSTRACT. *In this paper, we use the NARDL (nonlinear auto-regressivedistributed lag) model to analyze how monetary policy affects the real estate price. The results show that there not only exists the long-run asymmetry relationship, but also the short-term relationship between monetary policy and the real estate price, raising money supply would boost the price of real estate, and reducing money supply could not influence the real estate price significantly, in the short run, we find both positive and negative money supply can affect the house price obviously.*
Keywords: Monetary policy, Real estate price, NARDL model

1. **Introduction.** Since the government of China carried out the comprehensive house reform in the late of 1990s, the housing market enters into a "golden" period, and at the same time, the real estate price rises rapidly. From 1998 to 2015, the average price of real estate in China has increased more than 200%, and the house price income ratio has exceeded about 15 times, some first-tier cities' house price income ratios are as high as 50 times, the house has been the most important asset for the urban citizens, so the real estate price becomes one of the core social problems in China, which would affect economic growth and social stability.

In order to control the price of real estate, the government of China has issued several acts in the past years, which monetary policy adjustment is usually involved. From the point of the results, the monetary policy usually could limit the real estate price growing in the short run; however, the price of real estate does not decrease in the long term. So many scholars consider monetary policy may play the critical role in raising the real estate price. In this paper, we use NARDL (nonlinear auto-regressivedistributed lag) model to analyze how the monetary policy affects the real estate price, and the results may provide the theoretical evidence on how to regulate the real estate market through the monetary policy.

2. **Literature.** Our work builds on the related literature on the effects of monetary policy on house price. Some scholars think that the central bank should carry out the proactive policy to prevent the excessive fluctuation. In the work of [1], they consider that the abnormal fluctuations of the price may change the investment and consumption behavior, and it leads to the alternation of inflation and deflation, economic cycle fluctuation will appear, so the central bank should intervene in the real estate market to smooth the economic cycle. However, some other scholars disagree with this idea, and they argue that the central bank should not focus on the real estate price before the bubble burst. Bernanke and Gertler [2] consider the central bank should not focus on the fluctuation of house price, but on the price stability.

In the area of empirical research, most of the scholars use VAR (VectorAutoregression) family models to study the effect of monetary policy on house price. In the work of [3], the reference uses the VAR model to analyze how the monetary policy affects the real estate price in Europe, and the results show that there exists the causal relationship between the interest rate and the real estate price. Wang and Guo [4] find that changing money supply could influence the real estate price in the long term, and raising the interest rate can limit the house price in the short run. As the VAR model cannot estimate the simultaneous effects among the variables, some scholars use the SVAR (Structural VAR) model to study this issue. We refer readers to [5] and the reference shows monetary policy could affect the real estate price, and the price of real estate market could also influence the level of interest rate. In the work of [6], the paper suggests that increasing money supply and currency appreciation could lead to a higher level of real estate price in China; however, the interest rate could not significantly affect the real estate price. Some others obtain the similar results by using the FAVAR (Factor-Augmented VAR) model, such as VargasSilva [7].

In addition, some scholars study this question from the point of asymmetric effects of monetary policy. We refer readers to [8], and the authors reveal that the tight monetary policy could reduce the volatility of the real estate market in U.K.. Simo-Kengne et al. [9] argue that monetary policy in South Africa is not neutral, and compared with the recession period, monetary policy could play a more important role in the prosperous period. Zhang and Liu [10] argue that the loose monetary policy does not make a significant effect on real estate market in China. Phiri [11] uses the threshold error model to find raising the level of interst rate could control real estate price inflation. These authors do not distinguish the long- and short-term asymmetric effects of monetary policy on the real estate price. Fortunately, NARDL model can not only capture the long-term asymmetric effects between the relationship of money supply and the real estate price, but get the speed of upward and the downward adjustment, which is rare in previous literature. So, in this paper, we use NARDL model to analyze how the monetary policy affects the real estate price in China.

3. **Methodology.** In this paper, we use NARDL model to analyze how monetary policy affects the real estate price, which is built by Shin et al. [12]. The linear form ECM specification without asymmetry in short- and long-run dynamics is as follows:

$$\Delta y_t = \mu + \rho_y y_{t-1} + \rho_x x_{t-1} + \sum_{i=1}^{r} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{s} \beta_i \Delta x_{t-i} + \varepsilon_t \tag{1}$$

where y_t is the dependent variable, x_t is the independent variables, Δ is the first difference operator, ρ_y and ρ_x indicate the long-run coefficients, α_i and β_i represent the short-run coefficients, r and s are the lag orders of dependent and independent variables, and ε_t is the error term.

The NARDL model can investigate the short- and long-term cointegration relationship between dependent variable and independent variable, and the methodology employs the decomposition of independent variable into the positive Δx_t^+ and negative Δx_t^- partial sums for increases and decreases such as:

$$x_t^+ = \sum_{j=1}^{t} \Delta x_j^+ = \sum_{j=1}^{t} \max(\Delta x_j, 0), \quad x_t^- = \sum_{j=1}^{t} \Delta x_j^- = \sum_{j=1}^{t} \min(\Delta x_j, 0) \tag{2}$$

If we introduce the short- and long-run asymmetries into the ARDL model, and the model turns to the nonlinear ARDL model, the form is like Equation (3):

$$\Delta y_t = \mu + \rho y_{t-1} + \rho_x^+ x_{t-1}^+ + \rho_x^- x_{t-1}^- + \sum_{i=1}^{r} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{s} \left(\beta_i^+ \Delta x_{t-i}^+ + \beta_i^- \Delta x_{t-i}^- \right) + \varepsilon_t \tag{3}$$

In Equation (3), the long-run asymmetry is determined by ρ_x^+ and ρ_x^-, and the long-run coefficients are calculated as $L^+ = -\rho_x^+/\rho_y$ and $L^- = -\rho_x^-/\rho_y$. In the NARDL framework, the null hypothesis is $\rho = \rho_x^+ = \rho_x^-$, and the asymmetry is tested by the standard Wald test. For the short-run asymmetry, the null hypothesis is $\beta_i^+ = \beta_i^-$, and we also use the standard Wald test to confirm whether there exists a short-run asymmetric effect.

Finally, the asymmetric responses of the dependent variable to independent variables are respectively captured by cumulative dynamic multiplier, a unit change in x_t^+ and x_t^- on y_t could be derived as follows:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial x_t^+} \text{ and } m_h^- = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial x_t^-} \tag{4}$$

where $h \to \infty$, m_h^+ and m_h^- will eventually reach the equilibrium L^+ and L^-, and we can observe the dynamic adjustment process from the starting point to the new equilibrium.

4. **Research Design.** Generally, the central bank can regulate the macroeconomy through the monetary policy, and the monetary policy tool could be divided into quantitative monetary policy tools and price monetary policy tools. In China, quantitative monetary policy is gradually replaced by price monetary policy. However, compared with price monetary policy, quantitative monetary policy still plays a more important role in the real economy. So, in this paper, we use M2 as the indicator of the quantitative monetary policy. The price of new commercial residential building is used as the house price indicator, which is calculated by the sales per month divided by the sales area. All the indicators are from January 2004 to December 2016, and the data are all from the CEIC database. Table 1 shows the descriptive statistics of the data.

TABLE 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
M2	156	740798.2	405894.4	225101.9	1550067
house	156	5.084731	1.516984	2.605345	7.679514

Shin et al. [12] suggest the lag periods of NARDL model should be set as long as possible, in this paper, we follow the suggestion of Shin et al. [12], p and q are set to 12 and 5 respectively, and then we delete those variables, which are not significant at 5% level. Before estimation, we use Wald test to examine whether there exists the asymmetric effect in the model, and the results are reported in Table 2.

TABLE 2. Asymmetric test

Variable	W_{LR}	W_{SR}	Conclusion
M2-house	0.000***	0.000***	long-run Asymmetry short-run Asymmetry

Notes: W_{LR} and W_{SR} indicate the long-run and the short-run asymmetric effects of monetary policy on real estate price respectively. The null hypotheses of W_{LR} and W_{SR} test whether $\rho = \rho_x^+ = \rho_x^-$ and $\beta_i^+ = \beta_i^-$. *** means the rejection of the null hypotheses of short- and long-run symmetry at the 1% levels.

In Table 2, we find the tests reject the null hypotheses, and it suggests there is an asymmetric effect both in the long term and in the short term firmly. Next, we analyze how M2 influences the real estate price.

Table 3 reports the estimation results. We reject the null hypotheses of no cointegration according to t_BDM and F_PSS. The test results suggest there is a long cointegration

TABLE 3. Empirical results

Variable	Coefficient
house_{t-1}	-0.440*** (-6.19)
$\Delta\text{M2}^{+}_{t-1}$	0.021*** (5.56)
$\Delta\text{M2}^{-}_{t-1}$	0.120*** (3.69)
$\Delta\text{house}_{t-10}$	-0.247*** (-3.50)
$\Delta\text{house}_{t-11}$	-0.225*** (-3.22)
$\Delta\text{M2}^{+}_{t-1}$	0.091*** (3.65)
$\Delta\text{M2}^{+}_{t-3}$	-0.088*** (-3.63)
ΔM2^{+}_{t}	0.372*** (3.54)
C	1.476*** (6.30)
Long-run effect [+]	0.047 $[0.000]$
Long-run effect [−]	-0.271 $[0.000]$
t_BDM	-6.192
F_PSS	12.889

Notes: *, ** and *** mean significance at the 10%, 5% and 1% levels, respectively. ( ) indicates t statistic, [ ] indicates P-value, and C represents the intercept. Δ is the first difference operator. The null hypotheses of t_BDM and F_PSS are no cointegrations among the variables. The critical values of t_BDM and F_PSS are 3.22 and 5.73 respectively at the 5% level significance.

between M2 and house price. In Table 3, we find M2 affects real estate price in an asymmetric manner from the point of long term, the positive impact coefficient of M2 on real estate price is 0.021 at 1% level significance, and it indicates that increasing money supply could lead to the boost of the price of real estate market. The negative impact coefficient of M2 on real estate price is 0.12 at 1% level significance, moreover, we find the negative impact coefficient is bigger than the positive impact coefficient, and this suggests that compared with loose monetary policy, the tight monetary policy is more effective.

In the short term, the lag 1 period and the lag 3 period of positive M2 have a significant impact on real estate price, and the coefficients are 0.091 and 0.088 respectively. The current period of negative M2 has the significant impact on real estate price, the coefficient is 0.372, which is much bigger than positive coefficient, and it indicates the central bank should use tight monetary policy to limit the house price.

5. **Conclusion.** In this paper, we use NARDL model to analyze the impact of monetary policy on real estate market, and as shown in the results, the asymmetric effect both exists in the long-term and short-term firmly. The tight and loose monetary policy could both have a significant effect on real estate price in the long run. In the short run, the lag 1 and lag 3 period of loose monetary policy have a significant effect on the real estate

market, and the current period of tight monetary policy could influence the real estate price.

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