Monetary Policy, House Prices, and Consumption in China: A National and Regional Study

Zan Yang¹
Tsinghua-Hang Lung Center for Real Estate Studies, Department of Construction Management
Tsinghua University
Address: Tsinghua University, Haidian District, Beijing, China
Post code: 100084
Phone: (8610) 62794059
Email: zanyang@tsinghua.edu.cn

Shuping Wu
Tsinghua-Hang Lung Center for Real Estate Studies, Department of Construction Management
Tsinghua University
Address: Tsinghua University, Haidian District, Beijing, China
Post code: 100084
Phone: (86) 13269953395
Email: wsp14@mails.tsinghua.edu.cn

Yanhao Shen
Tsinghua-Hang Lung Center for Real Estate Studies, Department of Construction Management
Tsinghua University
Address: Tsinghua University, Haidian District, Beijing, China
Post code: 100084

¹Corresponding author: Zan Yang; Institute of Real Estate Studies, Department of Construction Management, Tsinghua University; Tsinghua University, Beijing, China. 100084. (8610) 62794059, Email: zanyang@tsinghua.edu.cn.
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Abstract: This paper studies the links among monetary policy, house prices, and consumption in China from both national and regional perspectives. Using a Panel VAR model and a counterfactual simulation method, we find that monetary policy has a significant effect on consumption but with a regional pattern, in terms of magnitude and the housing wealth channel. It is found that in the middle-southern region and the western region, monetary policy has strong effect on consumption while the house prices make little contribution in the monetary policy transmission to household consumption. By contrast, in the first-tier region and the eastern region, house prices play a more important role in monetary policy transmission; even household consumptions are less sensitive to the changes of monetary policy.

Key words: Monetary Policy; Housing Price; Household Consumption; VAR; Chinese Regional Market

JEL: R3; G18; C23

1. Introduction

Despite the notable economic achievements in China since the end of the 1980s, the effort to achieve a sustainable pace of growth still faces great challenges. At the heart of these challenges is the need to effectively stimulate aggregated demand and to cope with lackluster consumption and investment. In 2012, the household consumption rate in China reached its lowest level and contributed to the amount of output by only 36%. This level was not only much lower than those in OECD countries, but was also much lower than the two other large developing countries, India and Brazil, with respective level 71% and 80% in 2008. In the 1990s, the Chinese government called for a rebalancing of the economy towards a greater reliance on consumption and away from the investment and foreign trade that had been favored in recent years. The Chinese monetary authority thus faces new challenges to manage household consumption to realize sustainable economic growth.
However, such a structural economic adjustment is currently under pressure from increasing house prices and the inflation rate. According to the Chinese Statistical Yearbook, from 2004 to 2010, the average transaction price of new apartments in urban China rose by 10.71% annually, which is about 3.92 times higher than that from 1998 to 2003. The share of net value of housing assets to total net wealth of household rose to 73.44% in 2010.\textsuperscript{2} At the same time, the inflation rate in China has continued to climb since 2008. It reached its highest level since 2000 when it jumped to 5.9% in 2008. In response to increasing pressure from inflation as well as from liquidity flow abroad, China’s central bank, the People’s Bank of China (PBC), has declared a shift from the “moderately loose” monetary policy that has helped the Chinese economy recover from the global financial crisis to a “prudent monetary policy.”\textsuperscript{3} Therefore, to assess the scope for private consumption in China using monetary instruments, it is important to examine the correlation among monetary policy, house prices, and consumption.

China’s monetary policy has several features that render it different from those of other countries. It has multiple objectives, including maintaining price stability, promoting economic growth, maximizing employment and balancing international trade payments.\textsuperscript{4} In the past, China’s monetary authority applied the monetary supply alone as a policy instrument, whereas more recently, it has also employed the interest rate as a target instrument. Instruments of both quantity and price are, therefore, combined in China’s monetary transmission mechanism. This has prompted numerous papers

\textsuperscript{2} Tsinghua University research on China’s consumer finance and Citigroup Investor Education Research.
\textsuperscript{3} Officers’ announcement at a meeting of the ruling Communist Party’s Politburo in December 2010.
\textsuperscript{4} Zhou Xiaochuan’s speech at the “2009 China Financial Forum.”
addressing the effectiveness of monetary policy based on its relationship with inflation (Liu et al., 2009); its effects on the real economy (Dickinson and Jia, 2007); its relevance to household consumption (Zhang and Wan, 2002). However, there is no assessment in the current literature of the links among monetary policy, house prices and household consumption from a regional perspective. This paper aims to fill this gap. 

What’s more, the spatial diffusion of monetary policy is important in the Chinese context because of the significantly divergent and segmented regional house prices and household consumption. This suggests that the correlation among monetary policy, house prices, and household consumption may be heterogeneous across regions. Although monetary policy does not target regional economic performance, the spatial pattern of monetary policy is relevant to an evaluation of the efficacy of monetary policy at the national level. The aggregate effects of monetary policy depend on the distribution of regional market sensitivities to such a policy. Therefore, changes in the configuration of heterogeneity can produce significant changes in aggregate effect. An accurate estimation of the effect of monetary policy and an assessment of the role of the housing market in monetary transmission at the regional level are both critical to the formulation of an appropriate housing policy in China.

The objective of this paper is to understand the monetary policy transmission mechanism and to capture the role of the housing market in the effect of monetary policy on household consumption from both national and regional perspectives in China. In this paper, a panel VAR model is applied to capture the impact of monetary policy on household consumption for the whole nation and for the different regions,
characterized by different house prices. A counterfactual simulation method by removing the estimated effect of house prices on consumption is used to capture the role of house prices in monetary policy transmission. Robustness of the study is carried out by the re-estimation of the model with monetary supply. We find that household consumption responds to changes in monetary policy in a heterogeneous manner and through different channels in different regions in China. The regions with higher household debt are more sensitive to monetary policy, but housing price is not an important channel in monetary policy transmission in these cities. Instead, house prices tend to play a key role in monetary transmission in the high-price regions. This study contributes to an estimation of the effectiveness of monetary policy by analyzing the monetary transmission mechanism and its spatial patterns. It also contributes to an understanding of the role of the housing market in the economy and offers insights into appropriate political responses to regional development.

The remainder of the paper is organized as follows. Section 2 offers a literature review and theoretical suggestions. Section 3 briefly describes monetary policy and China’s regional housing market. Section 4 provides the model used in the study and a description of the data. Section 5 presents the results, and Section 6 concludes.

2. Literature Review: Monetary Policy, Houses Prices and Consumption

Maclennan et al. (1998) indicate that there are both direct and indirect channels by which monetary policy influences household consumer spending. The direct effect, which is the neo-classical effect, is through outstanding debt by way of the interest
payment burden. Changes of interest rate directly influence household consumption and thus their roles depend on the development of mortgage market (Elbourne, 2008). Quantitatively, however, the direct effects appear to be less important than the indirect ones (Maclellan et al., 1998).

One important indirect effect of monetary policy on household consumer spending is via house price (Maclellan et al., 1998). The indirect role of housing in the monetary transmission in principle includes two stages: monetary policy affects the value of housing wealth; and then changes in housing wealth influence consumption.

In the first stage of indirect effect, the effect of monetary policy on housing prices can be modeled in life cycle mode using the concept of user cost of capital. Expectations of a rise in interest rates may quickly push up the user cost of capital by lowering the expected real rate of appreciation of residential prices. This mechanism is well-discussed as neo-classical interest rate channel and is argued important for monetary policy transmission (Taylor, 1995). Moreover, changes of interest rate may changes in arbitrage cost between financing housing and other assets and then impact on housing prices (Poterba, 1984; Miles, 1994; Yang et al., 2010). Shocks in the expected interest rates may enhance the risk premium of house consumption, initially inducing households to rearrange and diversify their portfolios away from housing (Kearl and Mishkin, 1977) or renting a dwelling. In addition, houses can be used as collateral, against which households borrow to finance housing consumption and investment. In this view, monetary policy can be transformed via “credit channel” by the level of house prices. Changes in house prices deduced by the changes of interest rate will change the
ability of potential buyers to borrow and then in turn further change the conditions for the house price formation. Along this channel, the effect of an interest rate change is likely to be amplified in the property market (Aron and Muellbauer, 2000; Muellabuer and Murphy, 2008).

In the second stage of indirect role of housing in the monetary transmission, this “credit channel” is also suggested to be important. The study on linkage between housing wealth and consumption has been focused on western countries that stimulated by the life-cycle model of Modigliani and Brumberg (1954). The researchers put efforts on understanding impact of housing prices on consumption, as well as the channel through which housing prices might influence consumption from both macro and micro perspectives (Attanasio and Weber, 1995; Poterba, 2000; Ludwig and Sløk, 2002; Yao and Zhang, 2005; Campbell and Cocco, 2007). Ludwig and Sløk (2002) identifies realized and unrealized wealth channels as well as substitute effect through which housing price impact on consumption. They further identifies “credit channel” as the most important channel and it has been widely provided in the western market (Aron and Muellbauer, 2000; Muellabuer and Murphy, 2008). In China, residential property is the most important asset in household wealth, but households have rather limited debt (Liao et al., 2010). Pan and Tao (2006) have discussed the limited effect of the “credit channel” from the regulatory bank system in monetary policy in China. In the limited Chinese studies, substitute effects in the short run are commonly found at national level in China (Wei and Zhang, 2011; Yang and Zhao, 2014).

At the national level, a small number of studies have examined the role of the monetary
policy in household consumption by combining the two stages outlined above. Based on a VAR model, Giuliodori (2005) finds a significant role for house prices in the transmission of monetary shocks to consumer spending in several European counties, particularly in Sweden, the U.K., and Finland. He indicates that financial liberalization in most countries amplifies the role of the housing sector in monetary policy transmission. Calza et al. (2007) study monetary policy in 11 countries and explore how the credit market can influence the sensitivity of housing and consumption to monetary shocks. Elbourne (2008) uses a structural VAR (SVAR) model in the U.K. economy and empirically estimates the links between house prices and consumption in the monetary transmission mechanism. He finds that changes in house prices explain about one-seventh of the fall in consumption caused by interest rate shocks. Several previous Chinese papers have found the significant role of monetary policy on household consumption but the low role of housing prices in the transmission of monetary policy. Jing (2006) makes an empirical analysis on the regional effect of monetary policy among China by Structure VAR model, and finds different impact of monetary policy and lag time between different regions. Koivu (2012) adapts a Structural VAR model and further identifies the contribution of asset price including housing price and stock price, in Chinese monetary policy transmission. He finds that a loosening of monetary policy leads to higher residential prices and increasing household consumption in China. At the regional level, significant heterogeneous in housing price and household debt level across regions would suggest the spatial distribution of the effect of monetary policy as well as the heterogeneous role of housing price in monetary transmission
(Yang et al., 2010). The regional level studies of monetary policy, however, are still limited, particularly in the areas of house prices and household consumption. In terms of the monetary policy transmission channel, several studies have examined the heterogeneity of regional market performance in response to monetary shocks in many countries, for example, Schunk (2005), Ashton and Gregoriou (2014) in the United States, Fraser et al. (2014) in Australian, Georgopulos (2009) in Canada, Rodríguez-Fuentes and Dow (2003) in EMU, and Dow and Montagnoli (2007) in UK. On the property market, study is rather rare, such as Negro and Otrok (2007) in USA, Yang et al. (2010) in Sweden and, Liang and Gao (2007) in China. Yang et al. (2010) point out that regional effect of monetary policy can be caused from both the demand and supply side of housing market. Understanding the heterogeneous spatial effects of central government monetary policy, local governments can effectively respond to the monetary policy, and politicians can successfully address the effects of their decisions. If the effect of monetary policy on house prices presents a regional pattern, and the response of consumption to house prices varies across regions, then we would expect a spatial pattern within the monetary policy-household consumption transmission process. The regional effect of monetary policy on household consumption in China is an important issue to study, in view of the increasing concern about regional discrepancies in the economy, the real estate market (Zhao and Tong, 2000; Wang, 2009). Capturing the regional effect of the links among monetary policy, house prices, and consumption will enrich our understanding of the effectiveness of policy decisions and their effect on the economy.
3. Institutional Background: Monetary Policy and the Regional Housing Market in China

3.1 Monetary Policy in China

There is general consensus that monetary policy is formulated by central banks with a view to maintain a low inflation rate and reducing output volatility. Accordingly, central banks aim to maintain stability in both macroeconomics and the financial system. In recent decades, asset booms and busts have been important factors underlying macroeconomic volatility (Bernanke and Gertler, 2001). In China, the PBC functions as the central bank with the power to control monetary policy and regulate financial institutions in China. According to the Law of the PBC, which became effective in 1995, the objective of monetary policy is to maintain the stability of the currency and promote economic growth (http://pbc.gov.cn/english/huobizhengce/objective.asp). However, PBC Governor Zhou Xiaochun emphasized that, in the transitional period of economic reform, the bank’s monetary policy has multiple objectives, including low inflation, economic growth, high employment, and the balance of international payments. To achieve these goals, the PBC’s primary instruments of monetary policy, like those of most advanced central banks, include open market operations and changes in the discount rate and reserve requirements, but the PBC also provides “window guidance” to banks on their lending operations. In 1994, the PBC defined and announced three layers of money supply indicators, M0, M1, and M2. In 1996, the PBC formally treated money supply as an intermediary target, and, in 1998, credit ceilings were eliminated, leaving money supply (M1 and M2) as the single intermediate target. Dai (2002), the
director of the monetary policy department of the Chinese central bank in 1994, pointed out that M1 is mainly related to the short-run growth of output, while M2 is more related to that of long-run inflation and economic growth. The difficulties and ineffectiveness of quantity rule in monetary policy in China has been widely discussed (for example, Dickinson and Jia, 2007; Liu et al., 2009; Zhang, 2009). Conclusions on the link between monetary policy and prices, however, are mixed (Jun, 2009; Liu et al., 2009).

Figure 1 plots the quarterly growth rate of M2 in China from 2003 to 2010. As we can see, the country’s monetary policy remained relatively stable from 2003 to 2008. Later in 2008, in response to the global financial crisis and subsequent shocks in the domestic economy, the Chinese authorities announced an enormous stimulus package and introduced credit relaxation and several interest rate cuts. The country’s M2 increased by more than 10% year-on-year from 2008Q4 to 2009Q1. The “moderate loss monetary policy” played a significant role in bolstering the country’s economy and such monetary policy prevailed until 2009. Since then, China has begun a normalization of policy as its recovery has gathered steam. The banks’ reserve requirements were raised four times and interest rates were lifted once. In addition, restrictions have been placed on bank lending in response to the pressure of increasing inflation and an overheated economy. As a consequence, the pace of credit growth has slowed down in 2010.

In addition to the market orientation of the national economy and globalization of the financial market, the PBC started to apply indirect instruments, such as required reserve ratios and interest rates, in adjusting macroeconomics. In China, the interest rate is still regulated by the PBC, but the slow progress has made towards liberalization. Interest
rates in the money market have not been used as benchmark interest rates; instead, the 1-year deposit rate administered by the central bank is widely used as a benchmark interest rate in China. Figure 2 plots the trend of interest rates for both the 7-day CHIBOR rate and the benchmark 1-year lending rate. These two rates present similar dynamic trends.

(Figure 1)

(Figure 2)

3.2 The regional housing market in China

Like the global trend in spatial disparity, the pronounced income and wealth inequality across the regions is one important pattern of regional inequality in China (Gustafsson et al., 2008), and it has become an important policy issue (Meng, 2004). The purchasing power of households varies significantly across the regions (Fan et al., 2008). Widening differences in regional economic growth and house investment have created a volatile context for local house prices. Social transmission in China, in particular the privatization of public housing in the 1990s, further enhanced the disparity in housing wealth across the regions and may have indirect effects on this disparity. The most traditional way to study the regional market in China is based on the country’s division into eastern, middle, and western regions. However, an increasing number of current studies suggest that, in such a classification, disparities in house prices are

5 During the housing reform of the 1990s, the central government vigorously promoted the sale of the existing public sector to existing tenants at considerably high discounts. However, the formal tenants’ access to housing resources was firmly linked to their working organizations or occupational ranks. Employees in the state-owned enterprises and institutions had more opportunities to obtain privatized public housing at a lower price. The regions with a different scale of state-owned enterprises, institutions, and government departments may have been differently affected by the housing privatization reform, resulting in regional disparity in terms of the initial home ownership rate.
significant within the eastern cities (Yu et al., 2008). Moreover, the highest price-level cities, that are usually called first-tier cities, tend to have much a higher price level than other cities. They are, however, placed in a different division in the traditional classification. In this study, we divide China’s 35 large and major cities into five categories, called northern, eastern, middle and southern, and western, first-tier cities. Classification of five groups is shown in Table 1. The most important motivation to classify the regions in this study is to identify the homogeneous subgroups to minimize within-group variation in house prices. Disparities in house prices have been regarded as an important factor in the regional effect of monetary policy (Yang et al., 2010).

(Table 1)

Figure 3 presents the real house prices (deflated by city-specific consumer price index (CPI)) and Figure 4 presents the real living expenditure per capita (deflated by city-specific CPI), in the five clustered regions from 2003 to 2010. As shown in Figure 3 and Figure 4, the regional pattern is significant. Compared to the middle southern and western regions, the first-tier and eastern cities are characterized as having higher housing prices and living expenditure per capita. In general, the regional housing price pattern is consistent with the regional distribution of living expenditure per capita.

(Figure 3)

(Figure 4)

According to the Survey of Chinese Consumer Finance and Investor Education (SCCFIE) in 2008, Liao et al. (2010) indicate that the mean value of the total assets held by households in east China is US$105,400, which is twice the amount owned by
those in the west and the northeast. However, only 8.8% of households in the eastern cities (including the cities in the first-tier regions) have liability ownership, whereas this ratio is 16.6% and 12% in the central and northeast regions, respectively. This suggests that a household’s consumption depends, to a large extent, on salary or other incomes, but fewer depends on debt in the eastern cities and first-tier regions. Therefore, theoretically, we would expect that household consumption is less sensitive to the changes of monetary policy in these two regions. But this does not equal to say that housing price is not the important channel through which monetary policy impact on consumption. We notice that in 2008, more than 71% of household wealth is housing wealth (US$75,000) in the eastern and first-tier regions, which is much higher than the other two regions. This might indicate that key role of housing wealth in monetary policy transmission in the eastern and first-tier regions. These assumptions will be tested by empirical studies below.

4. Empirical Method and Data

4.1 Methodology and Hypothesis

Studies of the monetary transmission mechanism have focused on the VAR model proposed by Sims (1980) and the structure VAR model developed by Cooley and LeRoy (1985) and Blanchard and Quah (1989). The advantage of structure VAR over VAR is that it identifies a set of independent disturbances by means of restrictions provided by economic theory. It can capture the contemporaneous effects of endogenous variables and relax partial identification for Choleski decomposition (Elbourne, 2008). However, the orthogonality restriction, which is fundamental in Structural VAR, is likely to be
fairly restrictive, due to the low dimension of Structural VAR (Leeper et al., 1996). Moreover, ripple effects among regional markets may also increase the theoretical difficulty in imposing restrictions in Structural VAR (Wang et al., 2009). In this study, we use a panel VAR method in the analysis, which combines the VAR approach with the panel-data approach in order to control unobserved individual heterogeneity and regional correlations. This method was initiated by Chamberlain (1983) and further developed by Pesaran and Smith (1995), and McCoskey and Kao (1998).

The most general form of the multi-country VAR model can be written as

$$Y_i = \beta_0 + \beta_i Y_{i(t-1)} + \ldots + \beta_p Y_{i(t-p)} + f_i + \epsilon_i,$$

Where $Y_i$ is a K x 1 vector of variables of each the I region $i=1\ldots I$. $\beta_i$ would be (K x I) matrix of coefficients. The disturbances $\epsilon_i$ have zero means and a regional specific variance. $f_i$ is the fixed effect in the model. $K$ includes the 7-day CHIBOR (Rate) used to measure policy instruments, house prices (HP), household income (IN) and household consumption (CON) in this study. It is used to allow for “individual heterogeneity” in the levels of variables. Because the fixed effects are correlated with the lags of the dependent variables, we use a forward mean-differencing procedure, referred to as the “Helmert procedure” (see Arellano and Bover, 1995), to avoid biased coefficients. This process preserves the orthogonality between transformed variables and lagged regressors. We can thus use lagged regressors as instruments and estimate the coefficients by the system GMM.

To analyze the impulse responses function, we essentially decompose the structural errors ($\epsilon_i$) into components caused by the unexplained contemporary reduced-form
shocks. We use the Cholesky decomposition (Hamilton, 1994) to impose a recursive structure on the model with the order: consumption (CON), household income (IN), house prices (HP), 7-day CHIBOR (Rate) or M2. This ordering is determined by the assumption that innovations of monetary policy are orthogonal to other variables in the system. A similar ordering is used by Giuliodori (2005). In this ordering, monetary policy is regarded as the most exogenous variable in the model.

In the empirical test, we calculate the base line model: responses of consumption to monetary policy; and the counterfactual model: responses of consumption to monetary policy when the housing market is shut off. That is, we re-run the impulse response function with the restriction that the cross correlations between consumption and house prices is zero in the consumption equation. By comparing the different levels founded by these two models, we can identify the role of house prices in monetary policy transmission. Since the VAR used in the paper is structure model, the identification problem due to the restricted VAR to shut down the housing price channel is limited.

4.2 Data

A number of indicators have been used as a measure of the stance of monetary policy, such as the short-term interest rate (Sims, 1992 and Carlino and DeFina, 1998); the index of the Federal Open Market Committee (FOMC) (Romer and Romer, 1989); the monetary aggregation (Kajanoja, 2003) and the Monetary Conditions Index (MCI), (Freedman, 1995; Alexius and Holmlund, 2008). There is no consensus on the best measure of monetary policy. In Chinese studies, given the unique monetary system, both M2 (Zhang, 2009) and the interest rate (Dickinson and Jia, 2007; Zhang and Wan,
2002) have been used.

In this study, we use interest rate measured by the 7-day CHIBOR rate. However, as we point out, due to the unique attribute of monetary policy, M2 is also an important variable in monetary policy in China. We thus also run panel VAR model with M2 as robust tests shown in section 5.3. Using the 7-day CHIBOR rate as monetary policy is due to three reasons. Firstly, as we can see from Figure 2, the 1-year lending rate and the 7-day CHIBOR Rate have common trends and we can choose one to represent the general level. Secondly, in the studies of Elbourne (2008) and Lettau et al. (2002), the interbank rate is used as a measure of monetary policy. This may enable us to compare our results with theirs. At last, due to a too short period, it is difficult to capture the regime of monetary supply in 2009 mentioned above\(^6\). However, compared to M2, 7-day CHIBOR rate on the other hand is not significantly dynamic but only with a smoother decrease.

The study is based on the quarterly data from 2004 to 2010. Real values deflated by the national CPI and respective regional CPIs are used in the model. The average house price per square meter for each city is obtained from the China Price Index Research Institute and adjusted as the quality-consistent price. The housing price is transaction based and is designed to take into account the quality variations in the sample. Thus, they are currently the best available price data in China’s housing market. Disposable household income and living expenditure per capita are used. Details of living expenditure are collected from the National Statistics Bureau and respective regional

\(^6\) To capture the potential effects of global financial crisis, we tried to include the dummy variable. However, it is not significant in the model.
statistics bureau. Housing related expenditures including rental, mortgage service and maintenance costs are excluded from the living expenditure indicator. Retail sale as an alternative indicator has been used to measure consumption in the previous Chinese studies. However, it contains a large proportion of government consumption in China dataset. It is not thus used in the study. The seasonal effect on household income and consumption is removed by the X-11 method. The descriptive statistics for variables used in the paper for each region is shown in Table 2.

(Table 2)

5. **Empirical Results**

Before we estimate impulse response functions for the national and regional markets, we first test the order of our time series and cointegration ranks. Panel unit roots tests, with the Levin-Lin-Chu (2002) (LLC) test, confirm that all series are integrated of order one. We also find a long run relationship between the variables at both the national and regional levels (the results are not shown here). Sims *et al.* (1990) point out that the system’s dynamic can be consistently estimated in a VAR model, in levels, if counteraction among the variables exists. In this paper, therefore, we incorporate the levels of those variables into the model.

### 5.1 National Results

Figure 5 presents the impulse response of household consumption (CON) to a shock of 7-day CHIBOR rate (RATE) at the national level. A VAR model is estimated with one lag for all of the variables suggested by the Akaike Information Criterion (AIC) and the Schwarz Criterion (SC). The significance of the results can be interpreted, based on the
reported 95% confidence intervals (dashed lines in the figures).

Firstly, we look at the responses of consumption to the interest rate via property price, which are shown by solid lines in Figure 5. In line with the expectation of economic theory, the negative response of consumption to the interest rate appreciation is found to be statistically significant at the 95% level. Following the increase in the interest rate, consumption falls immediately and reaches its lowest level of 0.27% at two quarters. The effect of the interest rate on consumption tends to disappear in six quarters. No long-run effect between the interest rate and consumption is found in the impulse response function.

Secondly, we look at the dotted lines in Figure 5, which displays the responses of consumption to the shocks of monetary policy if the housing market effect is shut off. That is, we re-run the impulse response function with the restriction that the cross correlations between consumption and house prices is zero in the consumption equation. This is called the counterfactual impulse response. We can see that in this model, the response of consumption is still significant and with a slightly different pattern compared with the above baseline impulse response. They both arrive at the same peak level and then present a slightly different pace during two to four quarters.

By measuring the difference between the two effects, we can get the contribution of the housing market in monetary transmission. We find that, at national level, this difference is tiny, which indicate the role of house prices in interest rate transmission is quite low.

(Figure 5)

5.2 Regional Results
In terms of the impulse response functions of the five regions, with the exception of the northern region, we find that the interest rate has significant effects on consumption\(^7\). We also find a noticeable spatial pattern in the correlation among monetary policy, house prices, and consumption. The results for the four significant groups are shown in Figures 6.

(Figure 6)

Firstly, we compare the role of the interest rate on consumption. We find that in the first-tier cities, interest rate shocks have significant effects on consumption with expected signs, but with low level. The average effects of the interest rate on consumption are at a level of 0.2% - 0.3%. This is similar to that in the eastern region but with a slight higher average level at 0.15-1%. But in the middle southern region and the western region, consumption is more sensitive to interest rate and the highest level of responds of consumption to interest rate for the respective region is 2.5% and 1.7%.

To understand the role of house wealth channel in the monetary transmission process, we first calculate the difference level between the results from the baseline impulse responses and from counterfactual impulses responses, and then we estimate the ratio between the difference level and baseline impulse responses for each year. It is found that in the first-tier cities, the average ratio is about 91.25%, which indicates that more than 91.25% of the interest rate is transferred via house wealth, and this level is more than 51.88% in the Eastern City. Similarly, we can calculate the ratio and find that in

\(^7\) The confidence intervals for impulse responses are calculated for each region. The response of consumption to interest rate (monetary supply as well) is not significant at 5% for the Northern region. So the further estimation of the role of housing is not carried out for Northern region.
the western part and the middle and southern part, the role of housing in monetary policy is rather lower with 13.7% and 5.8% of effect of monetary policy is transferred by the respective local housing price. All these can be referenced by Figure 6. This could due to the highly diversified level of housing wealth across regions as we pointed out above.

In addition, we find in the first-tier cities, the middle southern region, and the western cities, the counterfactual response is slightly larger than response in the baseline effect. This indicates the negative effect of house wealth on consumption, which is defined as the “substitute effect”. In the eastern area, we find quite different pattern, that the counterfactual responses are lower than those in the baseline model. A significant positive effect of household wealth on consumption is suggested, which indicates a “wealth effect” of house prices on consumption. In our another study, regional effect of housing price on consumption is explained by the consumption function integrated with the due role of housing consumption and investment (Yang and Zhao, 2014). Besides, household debt heterogeneity we mentioned in Section 3.2, could be another potential explanation to the regional heterogeneity, since the collateral effect is also an important channel of monetary policy transmission to consumer spending (Aladangady, 2014).

Ramcharan et al. (2015) argue that the debt rigidity would reduce what the households benefit from effectiveness of expansionary monetary policy.

5.3 Robustness Tests

In this section, we will rerun the panel VAR with M2 to test the robustness of the results. Developed by John Keynes, the supply of money interacts with liquidity-preference
curve to determine the level of interest rate at which the quantity of money demanded equals supply. In China, as we mentioned above, the correlation between monetary supply and interest rate is not straightforward as that in other western countries.

Figure 7 presents the impulse response of household consumption on M2 for national and four regions. Compare to the response to the interest rate shown above, we also find same “substitute effect” of housing price on consumption for the three regions except for the eastern regions. The highest role of housing in M2 transmission is found in the middle and southern regions, and 20% of M2 is transferred by housing wealth.

(Figure 7)

Since the interest rate refers to the monetary price while the M2 refers to the monetary volume, adverse direction of impulse responses of consumption to interest rate and M2 can be seen in Figure 6 and Figure 7. It is not our objective in this study to compare the relative effect of the interest rate and monetary supply in China’s economy. However, our results indicate that housing wealth effect tends to be more evident in a price-based monetary policy, such as the interest rate.

6. Conclusion and Political Implications

This study analyzes the effect of monetary policy on the household consumption via the housing market using a panel VAR from both national and regional perspectives. The effects of the interest rate on consumption are estimated in the national market and the regional markets that are clustered into five groups, according to regional prices and economics. The role of house prices in the monetary transmission mechanism is also estimated for the respective markets.
Based on the quarterly data from 2004 to 2010, we find that monetary policy instruments, such as the benchmark 1-year lending rate, and M2 used in this study, have significant effects on households’ private expenditure, but with a noticeable regional pattern. In particular, we find that the impact of the interest rate on consumption, with the exception of the northern region, is significant both at the national and regional levels, but has considerable heterogeneous magnitude across the regions. The strongest effect of monetary policy, measured by the interest rate, on consumption is found in the middle southern region and in the western region. However, only a small part of these effects are transferred via housing price. That is to say, the propagating contribution of house prices in the monetary transmission to household expenditure is lower in these two regions. Instead, house prices in the first-tier region and the eastern region play a more important role in monetary policy; even household consumptions are less sensitive to the changes of interest rate.

The heterogeneous regional effect found in the paper highlights the importance of understanding the mechanism by which monetary policy propagated through various regions. Monetary policy is generally found to have an important role in a household’s decision-making, and particularly important in interest – sensitive regions, in our case are the southern and western regions. Our finding on regional effect of monetary policy is consistent with the facts found in Sweden (Yang et al., 2011), and USA (Fratantoni and Schuh, 2003). A loss monetary policy would serve to stimulate the household consumption, and it can be an effective instrument targeting private consumption in those regions. However, for the first-tier cities and the eastern cities, the relative low
effect of monetary policy on consumption is propagates dominantly through housing market, thus a loss policy would lead to a higher level of housing price and higher affordability burden. The higher housing wealth in the first-tier cities however cannot be successfully propagated to private consumption due to the substitute effect discussed above. Monetary policy cannot be an effective tool in stimulating private consumption and might cause welfare loss and increase inflation pressure.

It is important to further investigate the magnitude of the welfare costs of deviating from an ideal result of nation – specific optimal monetary policy. This is far beyond the current study. However, the study suggests that a wisdom targeting monetary policy depends on its welfare effects. When monetary policy is endogenous in macroeconomic system, such as under hard exchange rate pegs, other macroeconomic policies need to aid and to improve the monetary transmission mechanism. Furthermore, monetary authorities need to track household wealth developments and to compensate the most vulnerable households or regions for taking on the risk of their policies.
References


<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier-1 City</td>
<td>4</td>
<td>Beijing, Shanghai, Guangzhou, Shenzhen</td>
</tr>
<tr>
<td>Northern City</td>
<td>8</td>
<td>Tianjin, Shijiazhuang, Taiyuan, Hohhot, Shenyang, Changchun, Harbin, Dalian</td>
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<td>7</td>
<td>Nanjing, Hangzhou, Ningbo, Fuzhou, Xiamen, Jinan, Qingdao</td>
</tr>
<tr>
<td>Middle and Southern City</td>
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<td>Haikou, Nanning, Hefei, Nanchang, Zhengzhou, Wuhan, Changsha</td>
</tr>
<tr>
<td>Western City</td>
<td>9</td>
<td>Chongqing, Kunming, Guiyang, Chengdu, Xi’an, Lanzhou, Xining, Yinchuan, Urumqi</td>
</tr>
</tbody>
</table>
**Table 2. Descriptive statistics for variables used in the paper for each region**

<table>
<thead>
<tr>
<th>Region</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First-tier City</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>140</td>
<td>357,629</td>
<td>153,801</td>
<td>158,737</td>
<td>690,931</td>
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<td>140</td>
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<td>1.93</td>
<td>0.95</td>
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<tr>
<td>IN</td>
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<td>2.969</td>
<td>8.823</td>
</tr>
<tr>
<td>HP</td>
<td>140</td>
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<td>2.164</td>
<td>4.126</td>
<td>12.276</td>
</tr>
<tr>
<td>CON</td>
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<td>954</td>
<td>2.275</td>
<td>6.014</td>
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<td><strong>Northern City</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>280</td>
<td>357,618</td>
<td>153,980</td>
<td>163,330</td>
<td>697,430</td>
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<tr>
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<td>1.047</td>
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<td><strong>Eastern City</strong></td>
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<tr>
<td>M2</td>
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<td><strong>Middle and southern City</strong></td>
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<td>153,569</td>
<td>162,329</td>
<td>690,930</td>
</tr>
<tr>
<td>M2</td>
<td>245</td>
<td>357,138</td>
<td>153,569</td>
<td>162,329</td>
<td>690,930</td>
</tr>
<tr>
<td>RATE</td>
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<tr>
<td>CON</td>
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<td>2.056</td>
<td>549</td>
<td>1.045</td>
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<td><strong>Western City</strong></td>
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</tr>
<tr>
<td>M2</td>
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<td>356,992</td>
<td>153,236</td>
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<td>531</td>
<td>1.117</td>
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</tbody>
</table>

Notes: M2 is the monetary supply; RATE is the 7-day CHIBOR rate; IN is the household income; HP is the house prices; CON is the household consumption. All are real values deflated by the CPI.
Figure 1. Quarter-on-quarter growth rate of M2 in China (2003Q1–2010Q4)

Figure 2. One-year lending rate and 7-day CHIBOR rate (2004 Q1-2010 Q4)

Source: PBC website and authors’ calculation

Note: Both rates are at nominal level.
Figure 3. Real housing price in five regions (2003Q1 – 2010Q4)

Source: China Price Index Research Institute

Note: The housing prices are deflated by city-specific consumer price index (CPI). The classification of each group can be found in Table 1.
Figure 4. Real living expenditure per capita in the five regions (2003Q1 – 2010Q4)

Source: National Statistics Bureau of respective regional statistics bureau.

Note: Housing related expenditures are excluded from the living expenditure indicator and figures show the trend before removing the seasonal effects.
Figure 5. Impulse response of consumption to a shock from interest rate via property prices at national level

Note: Interest rate is the 7-day CHIBOR.
Figure 6: Impulse response of consumption to a shock from interest rate via property prices in four regions

Baseline scenario          Housing price effect shut down          Baseline Error Band

First tire region

Baseline scenario          Housing price effect shut down          Baseline Error Band

The eastern Region

Baseline scenario          Housing price effect shut down          Baseline Error Band

The middle south region
The Western Region

Note: 1. Interest rate is the 7-day CHIBOR.
2. To examine the role of housing in interest rate transformation, we can calculate the difference between the results in the curve of “baseline scenario” and results in the curve of “housing price effect shut down” for each time period. The higher average level of the difference, the role of housing tends to be higher.
Figure 7: Impulse response of consumption to a shock from the monetary supply via property prices, at national level and in 4 regions

Baseline scenario          Housing price effect shut down          Baseline Error Band

National

Baseline scenario          Housing price effect shut down          Baseline Error Band

First Tire Region

Baseline scenario          Housing price effect shut down          Baseline Error Band

The Eastern Region
Note: 1. M2 is used to measure monetary supply.

2. To examine the role of housing in interest rate transformation, we can calculate the difference between the results in the curve of “baseline scenario” and results in the curve of “housing price effect shut down” for each time period. The higher average level of the difference, the role of housing tends to be higher.