DETERMINANTS OF HOUSING PRICES IN METROPOLITAN CHINA: EVIDENCE FROM BEIJING AND SHANGHAI FROM 2005 to 2012

by

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A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics

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ABSTRACT

This study investigates the determinants of housing prices in Chinese metropolitan cities Beijing and Shanghai from Jan, 2005 to Oct, 2012. The determinants include factors from monetary policy, land prices, the stock market, the real economy and purchase limitation policy. The methodology employs Johansen cointegration analysis, generalized forecast error variance decomposition (GFEVD) and generalized impulse response functions (GIRF) to vector error correction models (VECM). The study found that bank credits and the real economy significantly impacted housing prices. In contrast to prevailing beliefs, land prices had little impact on housing prices. The study also found that purchase-restriction policies had a significant effect on curbing housing price appreciation, while disposable income and interest rates had an insignificant impact on housing prices. These effects are of different magnitudes in the two cities due to differences in their policies. Finally, I conclude with a number of policy recommendations for developing a rational and healthy housing market in metropolitan China.

Chapter 1

INTRODUCTION

1.1 Motivations

Real estate development is important to the macro-economic development of a country. Real estate growth generally enhances economic development. Nevertheless, huge appreciation potential of housing properties may cause large capital flow into real estate market from consumers, investors and speculators, resulting in a real estate market bubble. A modest bubble is likely to promote growth of the national economy. However, if the bubble inflates too fast or goes out of control, a serious economic crisis may take place once the bubble bursts. Some un-forgettable examples had shown the tremendous negative effects of real estate bubbles, for instance, the early 1990s real estate bubble in Japan, the late 1990s Asia economic crisis, and the most recent 2009 subprime mortgage crisis in the United States.

In China, due to the reform of housing policy in the early 2000s and accelerating urbanization, real estate development grew fast over the past decade. Housing prices trended upwards rapidly, especially in metropolitan cities. Many scholars assessed the health of the Chinese real estate sector and its development. Most existing research concluded that there is a housing market bubble in metropolitan cities that deserves serious attention. Nevertheless, the quantitative analysis on the dynamic relationship between housing prices and other macro-economic factors is limited.

This dissertation investigates the determination of housing prices in two Chinese metropolitan cities Beijing and Shanghai, from Jan, 2005 to Oct, 2012. The dynamic causal relationships between housing prices and relevant determinants are quantified. Compared to previous research, this dissertation considers a broader array of housing price determinants, including monetary policy, land prices, the stock market, price positive feedback, the real economy, and purchase-restriction policies. The dissertation provides a detailed and insightful description of housing price dynamics in metropolitan China during a relatively recent period. The study's conclusions allow policy makers and the public to better understand the dynamics of housing prices in metropolitan China. They can help policy makers design more effective policies in managing the housing markets. They can also help entrepreneurs and residents make more rational decisions regarding real estate investments.

Beijing and Shanghai are the two largest metropolitan cities in China. These two cities have the highest housing prices. They also have the largest total housing sales as measured in both total area and RMB revenue. The housing properties in the two cities are not only durable consumer goods, but also attractive assets for investment with capital gains and rental income. In addition to solid demand due to population growth and migration, investment and speculation demand was also strong because of the intensive investment capital from local and surrounding areas. Monetary and economic adjustment policies were usually first implemented in the two cities to impact the housing markets. Thus, Beijing and Shanghai are good candidates for studying the housing price dynamics in metropolitan China. In addition, city level data of the two cities are easier to obtain, and are relatively more accurate and reliable.

This dissertation is organized as follows. The rest of Chapter 1 introduces the history of China's housing and land markets. Chapter 2 reviews the existing relevant research and introduces the scope of this dissertation in relation to previous research. Chapter 3 describes variable selection and data. Chapter 4 describes the methodologies employed. Chapter 5 presents empirical results and discussion. Chapter 6 presents the final conclusions.

1.2 History of China's Housing and Land System

China's housing system has changed dramatically in the past 30 years because of the great economic transformation from a planned economy to the "Chinese Style" market economy. Numerous fundamental elements of the Chinese housing market are different from those in western countries. The next chapter provides a historical background of the housing and land system in China.

1.2.1 Housing reform[1]

In the People's Republic of China (PRC), urban residential housing units were owned by the state (the central government) at its foundation in 1949. In the following 30 years, the state determined the national economic plan and was the only provider of housing. During this period, the private housing market was non-existent. State-owned housing developers built housing units from annual state budgetary funding. The state-owned enterprises (SOEs) then allocated these housing units to their employees at

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[1] The historical review of Chinese housing market reform here is following the lines of Wu, Gyourko & Deng (2012).

very low rent prices. Urban residents were not allowed to buy or sell their housing units.

In the late 1970s, China started a series of economic reforms. The state's monopoly of urban residential housing system started to change. From 1979 to the early 1980s, a trial privatization of state-owned residential housing began in several coastal cities, such as Shenzhen, Shanghai and Nanjing, and soon expanded to more cities. The private housing market, called "commodity housing", started to emerge in China from then on. The first private housing developer was found in Shenzhen in 1980. However, during this early stage, the development of commodity housing sector mainly targeted foreigners and non-SOEs employees. Thus, it was very limited in scope and grew slowly.[2]

An important change occurred in 1988. The passage of the 1988 Constitutional Amendment provided the legal foundation for the development of a private housing sector. According to the amendment, government still retained ultimate ownership of urban land; however, it permitted individual companies to purchase the right to use the land for urban residential purposes for up to 70 years, for urban industrial purposes for up to 50 years, and for urban commercial purposes for up to 40 years. Subsequently, in the 1990s, the central government issued a series of housing reform policies to accelerate the development of private housing markets. Urban residents were encouraged to purchase the housing units in which they resided from their SOE employers at below-market prices. The SOEs were required to gradually phase out the direct housing allocation system, under which they formerly provided housing to their

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[2] Wu, Gyourko & Deng (2012), Regional Science and Urban Economics 42, 533.

employees.[3] Up to the mid-1990s the reform of the urban housing system underwent several critical stages. The nationwide establishment of an urban Housing Provident Fund facilitated the transition of housing from a welfare item to a commodity. After 1995, most of cities instituted the urban commercial housing transaction market.

The 23rd Decree issued by the State Council in 1998 marked a milestone in China's housing reform. SOE employers were no longer allowed to develop new residential housing for their employees in any form. Instead, they had to integrate housing benefits into an employee's salary. Individual urban residents had to buy or rent their residential housing units in the private housing market. Residents were also allowed to sell or rent out their housing units.

Most scholars take this to be the start of the modern marketization of the private housing market in China. Private housing built as a percentage of the total annual housing built more than doubled from about 13% in 1986 to 72% in 2006, as stated in Wu, Gyourko & Deng (2012). The annual private residential housing space supplied increased from about 25 million square meters in 1980 to nearly 5000 million square meters in 2007. According to the Chinese National Census[4], in 2005, 16.3% of urban households in China lived in purchased private housing units. The rate in 2010 was 38%.

Besides the development of commercial private housing, the central government required municipal governments to build a certain amount of public housing units for low- and mid-income households. Low-income household can either

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3 Wu, Gyourko & Deng (2012), Regional Science and Urban Economics 42, 533.

4 Source: Chinese National Census 2005 and 2010.

rent low cost units or purchase price controlled units. Mid-income households were eligible for subsidies to rent public rental units or purchase the "special affordable" units at highly subsidized prices from local governments. However, the construction of such public housing stayed relatively limited in scope from 1998 to 2010, since it required considerable municipal government spending that caused low incentives for municipal governments.

1.2.2 The urban land supply and land market

There is no private ownership of land in mainland China. All land is owned by government or conglomerates (typically state-owned enterprises). Chinese land policy is made up of two components: the land reserve system and the land use right granting system. Both systems have undergone many changes over the last two decades.

Land reserve system

The urban land reserve system refers to municipal governments reclaim land use rights from existing owners through various methods such as acquisitions, repurchases, and exchanges. Then, governments complete a series of pre-development tasks on the land and put it back on the market in compliance with the overall urban land use and development planning policies (Du, Ma & An (2011)).

China started to establish its urban land reserve system at the national level in 2001. In 2007, the Ministry of Land & Resources, Ministry of Finance and People's Bank of China (PBC) jointly announced the "Land Reserve Regulations" and brought them into effect. It was an indication that the current land reserve system was fully developed. The system enables municipal governments to monopolize the primary land market and to reduce the quantity of land use rights traded in the secondary land market. As a result, municipal governments have complete control of the urban land supply in China.

Land granting system

There were three major periods where China experienced rapid development of policies governing the land granting system: prior to 1988, 1988-2002, and 2002 to current.

Prior to 1988, companies and organizations could acquire non-transferable land use rights from governments through non-market-oriented land allocation. Companies that were able to acquire these use rights were mostly SOEs.

Article 10 of the 1988 Constitutional Amendment provided the legal foundation for the current land supply system. The article rules that the government still retains ultimate ownership of urban lands. However, it allows companies, organizations and individuals to purchase the right to use land for a certain amount of time-- 70 years for residential use purposes, 50 years for industrial or mixed use purposes, and 40 years for commercial use purposes. As a result, municipal governments could lease land parcels to land developers for private residential housing developments. Developers typically should pay off the 70-years lease within the first year after purchasing the land use rights. Then developers build housing units on the parcels, and sell them to residents during the leasehold period. Because it has been only 26 years since the constitutional amendment, what will happen with ownership of the land and of the attached housing units when the leasehold expires is unclear at present. The secondary land market also began at the same time, but on a much smaller scale. Although the first land auction was held in Shenzhen in 1987, even before the 1988 constitutional amendment, thereafter, most land parcels were not sold publicly via auctions or bids. Instead, the developer would contact the municipal government about a land parcel in which it was interested, and negotiate over its price. Many such deals were made at unreasonably low prices. The non-transparent negotiation process was publicly criticized for its vulnerability to corruption.

Consequently, in 2002 the central government issued the State Council 55th Decree that required all urban land slated for residential and commercial uses be transacted through public auction or the bidding IAL (Invitations to tender, Auction and Listing) system. With the new system, developers could acquire land use rights through fair competition in the market.

The complete adoption of this land granting IAL system in 2004 marked a significant turning point in Chinese real estate market. The total number of real estate developers increased from about 37,123 in 2003 to 59,242 in 2004, according to the China Statistical Yellow Book (2007). The developers in the land market were also much more diversified than before. Many more privately owned and foreign companies entered the market.

The land reserve system was established three years before the IAL system was fully adopted in 2004. Most of the land in the market was under the control of municipal governments at the time. The size of the secondary land market was negligible. In other words, municipal governments were the monopoly provider of land leases. Revenue from the land market through land auctions and bidding became the most important off-budget income source for municipal governments. Data from the Chinese National Bureau of Statistics and the Ministry of Land and Resources showed that revenue from land sales accounted for 28.4% of the gross revenue of municipal governments in 2002. In 2008, the proportion was 33.5%. In 2009, it was 48.8%. In 2010, it increased to 76.6%.

1.3 China's Housing Market in the Last Decade

Since China's housing reform in 1998, the housing market has been directly affecting the real economy. During the last decade, infrastructure investment has been one of the three key drivers of China's economic growth, along with consumption and export. As pointed out by Wu, Gyourko & Deng (2012), the private housing sector in 2008, accounted for about 40% of the buildings constructed in the construction industry and about 6% of the Chinese GDP, employed 14.3% of all workers in urban areas, and consumed about 40% of all steel and lumber produced in China. Data from the International Monetary Fund showed that the rates stayed at about the same level from 2009 to 2012. In 2013, there were about 100 trillion RMB worth of the residents' wealth in the housing properties, which accounted for about three quarters of the total residents' wealth in China.[5] Thus, China's private housing sector has a substantial impact on the real economy, financial stability and even social stability of China.

During the last decade, the Chinese housing market can be divided into three phases that closely followed the central government's macro-economic policies. (Housing prices in Beijing and Shanghai are illustrated in Figure 3.1 in Chapter 3.1.)

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[5] This was an estimate by Daokui Li during a television interview in July, 2014 on the CCTV. Li is a Professor in Tsinghua University and Committee Member of the Monetary Policy Committee of China.

From 2003 to 2008, investment boosted both the real economy and the housing market. They also positively affected each other. In the meantime, the large foreign trade surplus and the large short-term international capital inflow led to a rapid increase of base money and money supply[6] despite the relatively tight monetary policy.

Then, during the most recent global financial crisis in November 2008, China launched an aggressive 4 trillion RMB (US $586 billion) stimulation package and instituted an accommodating monetary policy to lead its economy out of the slowdown that started with falling exports. By allocating funds for housing projects as well as manufacturing, education and industrial development, the stimulus package focused on massive infrastructure spending to boost China's domestic demand and consumer spending. As stated in Wu, Gyourko & Deng (2012), gross capital formation contributed over 90% of China's GDP growth in 2009. Direct investment in the private housing sector accounted for 15.1% and 13.2% of total investments in urban areas in 2008 and 2009, respectively.

In early 2010, in order to control soaring housing prices and reduce the risk of a real estate bubble, the Chinese State Council announced many critical policies. For instance, on the demand side, the minimum down payment and mortgage rates for a non-primary house unit has been raised[7]; and housing unit purchase limitations were

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6 China's Money Supply M0 and M1 from Jan, 2005 to Oct, 2012 are shown in Figure B.11. The data are from the People's Bank of China.

7 The down payment rate was raised from 30% to 40% on Jan, 2010, and to 60% on Nov, 2010. The mortgage rates were raised to no lower than 110% of the central bank's benchmark loan rate after Nov.2010.

implemented in some metropolitan cities. On the supply side, banks tightened the bank credit loans issued to real estate developers. These policies to some extent curbed the effects of housing price appreciation in the first several months. However, from 2010 to late 2012, housing prices continued to increase, especially in metropolitan cites. The demand for housing was still strong. The growing “shadow banking” system was suspected to have provided large cash flow to developers to offset the relatively tighten bank credit.

From 2003 to 2013, the housing markets were widely thought to have formed bubbles compared to pre-burst market statistics in other countries and regions. For example, the S&P Case-Shiller national price index for the United States shows that from Jan 2000 to July 2006 which is the historical peak, the annual compound appreciation rate of nominal home prices was about 9.9%. Price appreciation was more pronounced in some cities such as Las Vegas where the annual compound rate was 14%. Thereafter, in the 3rd quarter of 2010, the S&P Case-Shiller national index suffered a decline of 53% from its peak. The decline in Las Vegas was more than 58%. In Hong Kong, from the beginning of the 1990s to its peak in 1997, nominal housing prices grew by 296%. After subtracting the substantial inflation during the period, Hong Kong’s real housing prices increased by 113% to yield a compound average annual growth rate of 15%. The nominal prices then fell by nearly 65% from that peak to a trough in 2003. In comparison, price appreciation in major Chinese cities has been much faster since 2003. From 2003 to 2010, Beijing’s annual compound growth rate of nominal prices was almost 20%, while Shanghai’s and Hangzhou’s were about 16%. Even the slower movers such as Tianjin, Wuhan and

Xian had annual appreciation rates around 7% according to Wu, Gyourko & Deng (2012)[8].

According to calculations by the Institute of Real Estate Studies at Tsinghua University, the housing price-rent ratio in Beijing and Shanghai increased by about 73% and 35% in the 5 years from 2007to 2011, respectively. In 2007, the ratio of Beijing and that of Shanghai were 26 and 33, respectively. By 2010, the ratios of both cities increased to 45. The global urban area average price-rent ratio was about 25 in 2010. Although personal income growth has been strong in urban China in the last decade, the housing price appreciation in coastal cities and Beijing strongly outpaced income growth. The housing price-income ratio also kept increasing during the last decade, to about 27 in Beijing, which is about 5 times as much as the global average.[9]

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8 The monthly average Year-over-year CPI in urban China is about 3.2% from 2008 to 2012 according to data from the National Bureau of Statistics of China.

9This is based on a newspaper article, "An affordable home for every family, Chongqing official promises" in Global Times, on 2009-09-08, by Xu Shenglan.

Chapter 2

LITERATURE REVIEWS

In this chapter, I review previous studies on housing markets and on the dynamic relationship between the movement of housing prices and other relevant macro-economic factors in mainland China and in other parts of the world.

Was China's housing market development healthy in the last decade? Was there a housing price bubble in China's metropolitan cities? How similar is the situation in China to those in other parts of the world that have also experienced housing price appreciation? The following studies attempted to address these questions.

Limitations of previous research on China's housing market dynamics are outlined along with a preview of how this dissertation addresses these areas.

2.1 Housing Market Dynamics in Mainland China

Housing Bubbles

During the last decade or so, the following six studies found evidence that housing bubbles existed in major cities of China.

Ning and Hoon (2012) analyzed the effects of speculation on real estate bubbles in Beijing and Shanghai by using data from 2001 to 2010. They implemented ratio analysis and regression analysis on the price equation they constructed according to the positive feedback mechanism. By respectively examining the speculation levels and bubble levels in the two cities, they found that speculation is an important reason for a real estate bubble in both cities. The severity of the real estate bubble in Beijing was higher than that in Shanghai and the bubble had an overall expansion tendency. The speculation level in Shanghai was higher than that in Beijing.

Wu, Gyourko and Deng (2012) found that price-to-income ratios are at their highest levels ever in Beijing and other cities. Much of the increase in price occurred in land value. They used data from local land auction market in Beijing to produce a yearly constant quality land price index for that city. They found real constant quality land value has increased by nearly 800% since the beginning of 2003, with half of that rise occurring in 2008 and 2009. State-owned enterprises controlled by the central government have played an important role in this increase. They paid 27% more than other bidders for an otherwise equivalent land parcel.

Ren, Xiong and Yuan (2012) applied the theory of rational expectation bubbles proposed by Blanchard and Watson (1983) to the Chinese housing market. Based on data from 35 cities in China from 1999 to 2009, they found that the hazard rate of positive returns in China's housing market is not a decreasing function of duration. Local economic fundamentals such as the GDP growth rate, unemployment rate and population growth, did not significantly affect the local expected return of houses. Since capital can flow freely across different regions, capital flow from rich regions becomes the major reason for the high housing prices rather than local economic fundamentals. They also found evidence that, in China's housing market, investment purpose purchasing dominates self-dwelling purpose purchasing.

Hui and Yue (2006) estimated the extent of the bubble in Hong Kong from 1990 to 2003 and investigated whether there was a housing price bubble in Beijing and Shanghai in 2003. They implemented granger causality test and generalized impulse response analysis to quantify the interaction between housing prices and economic fundamentals such as household disposable income, local GDP, stock price index and stock of vacant new dwellings in the three cities. They also estimated regression models on housing prices by using economic fundamentals as regressors. They estimated the regression models by using data from 1990 to 2002, then made a prediction of housing prices in 2003. Based on the differences between actual and predicted housing prices, they found that similar to the case of Hong Kong housing prices in Shanghai seem to have interacted abnormally with economic fundamentals. They concluded that there appeared to be a 22% price bubble in Shanghai in 2003; however, there was no sign of a bubble in Beijing in the same year.

Hou (2010) examined whether housing price bubbles existed in Beijing and Shanghai by establishing a regression model of real estate prices with economic variables and building an econometric model to measure the speculation bubble. By using monthly data from Jan, 2000 to Dec, 2008, he showed that Beijing appeared to have been on the way of forming a housing price bubble between 2005 and 2008. He also showed that a housing bubble perhaps existed in Shanghai from 2003 to 2004.

Yan and Ge (2012) tested the existence of a backward-bending housing supply relationship in China, and estimated price elasticity of new housing supply for 35 major Chinese cities. Based on a panel data model of 35 cities from 1999 to 2008, they found the response of housing supply was relatively insensitive to price change in China. Beijing and Shenzhen are shown to have negative elasticities and backward-bending housing supply curve (higher price, less supply) in year 2008. While, in Shanghai and Hangzhou, supply elasticities are reported to be close to zero. The major reasons for the inelasticity of housing supply were found to be insufficient land supply, government-related reasons and speculative land hoarding by real estate developers with expectation of future housing and land price appreciation.

Macroeconomic factors on housing prices

Several research papers focused on the relationship between housing prices and macro-economic factors in mainland China during the period from 1998 to 2010.

Xu and Chen (2012) examined the impact of key monetary policy variables, including the long-term benchmark bank loan rate, money supply growth, and an indicator of mortgage credit policy on the housing price growth dynamics in China. They used quarterly data from 1998 to 2009 and monthly data from July 2005 to February 2010. Their regression analysis indicated expansionary monetary policy tends to accelerate the subsequent housing price growth; while, restrictive monetary policy tends to decelerate the subsequent housing price growth. They also found that hot money flow (from foreign countries) does not have a significant impact on the housing price growth. Also, a bullish stock market tends to have positive impact on housing price growth.

Yao, Luo and Loh (2011) investigated the dynamic relationship between monetary policy and asset price in China by using monthly data from June 2005 to Sep 2010 and a vector auto-regressive model (VAR). The country level housing price index, M2, stock index and interbank loan interest rate were used as endogenous variables. Their results show that expansionary monetary policy could indeed push up house prices. However, credit control and interest rate adjustments have a weak effect on the housing market due to a number of special economic and social characteristics including the lack of investment channels, market imperfection and cultural traditions.

Zhang, Hua and Zhao (2012) investigated determinants of housing prices in China over the period of 1999 to 2010. By using monthly data, they implemented a nonlinear autoregressive moving average with exogenous variables (NARMAX) approach combined with the vector error correction model (VECM). They found that inflation (PPI), money supply (M2), mortgage rate and real effective exchange rate, have significant impacts on housing prices at the national level. GDP, exports and the stock index may have impacts on housing prices in the long-run, but only if linked to monetary and inflation variables. Nevertheless, they found that personal disposable income has no explanatory power on the housing prices at all.

Zhou (2008) examined the relationship between housing price increase and bank credit loan growth in China from 1998 to 2008 by using Grange causality test and variance decomposition analysis. He found that there existed a positive feedback effect in China's housing prices and that bank credit growth greatly contributed to the rise of housing prices. He argued that the rise of housing price and strong expectation of price rise convinced banks that credit loans to real estate developers and housing mortgages to home owner were good loan assets. They raised incentives to increase such loans. Also, the increase of housing prices contributed to the increase of local industrial production and to government revenue. Thus, municipal governments also had incentives to raise the selling price of land. The increase in bank credit loans and raised land prices caused a positive feedback on the housing price.

Liang and Cao (2007) investigated the relationship between real housing property prices and three macro-economic factors including real GDP, real total bank lending and real interest rate. They estimated a VECM by using quarterly data from 1991Q1 to 2006Q2. They found a complementary long-term equilibrium between real property prices and real GDP. Results of the Granger causality tests indicated that GDP positively impacted property prices in the short-run; while, bank lending and interest rate had no significant impact on property prices.

Wei and Yuan (2008) analyzed the financial factors that caused the rapid rise of housing prices in China from 1998 to 2007 by using a VECM. They found, in the long term, land prices and bank loans to real estate developer were the main reasons for the rise in housing prices; speculative expectation and bank loans to households were also assignable reasons; while personal disposable income and interest rate have insignificant influence on housing price.

Kuang (2005) examined the relationship between land prices and housing prices in China from 1999 to 2005 by using a VECM. He found that there exists a scarce supply of land, and insufficient housing supply in China. Granger causality test demonstrated that housing prices positively interacts with land prices in the short run and land prices are the Granger cause of housing prices in the long run.

Chen, Guo and Zhu (2009) applied a VECM to investigate the relationship between asset wealth and household consumption in urban China from 1999-2007. Their results suggested that there was a unique long-run relationship among consumption, disposable income, financial wealth and housing wealth. Disposable income was the main driver on the long-run movements in household consumption. Housing wealth was the only factor that restores the long-run equilibrium relationship if the equilibrium was interrupted by external shock. They also found that financial and housing wealth positively impact household consumption.

Huang, Zhou and Li (2010) applied a VECM to examine the ripple effect of housing price fluctuations among nine Chinese cities from the first quarter of 1999 to the third quarter of 2008. Empirical analysis indicated that the housing prices in first layer cities Beijing and Shanghai as representatives of municipalities directly controlled by the central government have a strong influence on the prices in other cities. Housing prices in Beijing and Shanghai are relatively independent. Housing prices in cities of the second layer can transmit fluctuations in prices to other second layer and third layer cities. Housing prices in cities of third layers can interact with prices in the same layer and be influenced by the prices in the previous two layers.

Du, Ma and An (2011) examined the impact of the land market on the housing market over the past decade. They used a panel dataset from 2001 to 2009 of Beijing, Shanghai, Tianjin and Chongqing. Their VECM results suggested that there was bidirectional Granger causality between housing and land prices in the long run. Both housing prices and land prices react to adjustments in disequilibrium between them. Housing prices reacted more quickly than land prices. They also found that the new land granting system that was fully implemented in 2004 had lowered the rate of adjustment towards the equilibrium in both markets.

2.2 Housing Market Dynamics in Other Parts of the World

Gerlach and Peng (2005) studied the relationship between residential property prices and bank lending in Hong Kong from 1982 to 2000 by specifying a VAR model. The real GDP, real domestic bank credit and real housing prices are used as endogenous variables. They found that the contemporaneous correlation between bank lending and residential property prices is large. They also found that property price determines bank lending, while bank lending does not influence property prices. The finding indicates excessive bank lending is not the root cause of the boom and bust cycles of the residential property market in Hong Kong.

Lai and Wang (1999) used regression analysis to examine the relationships among developers' housing-supply strategies, the government land-supply decision and public housing policies from 1973 to 1997 in Hong Kong. They found that increase in land supply by the Hong Kong government may not be an effective solution to the perceived shortage of housing supply, since they assumed that developers' housing supply is independent from the amount of land provided by the government. They found evidence that developers' profit maximization behavior examines economic conditions to make housing supply decisions by adjusting the land hoarding.

Peng and Wheaton (1994) analyzed how changes in the supply of developable land affect housing prices and housing output in Hong Kong from 1965 to 1990. They used a modified stock-flow model which takes the segmented public-private housing market into account. They found that in where the supply of new land is under strict government control, supply restrictions in Hong Kong have led to higher housing prices but not lower housing output. They argued that the higher prices result directly from the capitalization of expected higher rents.

Chen and Patel (1998) quantified the dynamic causal relationship between housing prices and its five determinants including household income, interest rate, stock price index, construction cost, and housing completions in Taipei's new dwelling housing market. VECM techniques were applied to quarterly data from 1973 to 1994. They found that all five determinants were Granger causal to housing prices, but only housing prices and stock price index have a bilateral feedback effect. The forecast error variance decomposition suggests that the disturbances originating from current housing prices account for about 66% of the error variance of future prices. 10% of the error variance can be explained by the supply side, including the construction costs and housing completion. The remaining 24% error variance can be explained by the demand side, including interest rates, household income and the stock price index.

Chen, Tsai and Chang (2007) investigated the equilibrium relationship between housing prices and household income and what causes disruptions in equilibrium between them. They used data from 1973 to 2001 in Taipei to implement the VECM techniques and the stochastic break test. They found an equilibrium relationship between them. They also found that housing price to income ratio had shifted. They argued that deviation of housing prices and income was caused by a short-term increase in investment induced by increased money supply; the structure change in the price to income ratio was also related to increase of money supply.

Coleman, LaCour-Little and Vandell (2008) investigated the impact of macroeconomic fundamentals and credit loans on housing prices in twenty metropolitan areas in the USA. They specified and estimated regression models by using quarterly cross-sectional data from 1998to 2006. The results suggest that, before 2004, market fundamentals, such as size of the MSA (metropolitan statistical area), population growth, per capita income, and the unemployment rate, drive the housing prices in an intuitive direction. They found that there was a significant credit regime shift took place in late 2003, where the GSEs (government sponsored enterprises) were displaced by private issuers of new mortgage products. It resulted in a record increase in total mortgage lending volume after 2003. The market fundamentals became insignificant in affecting the housing prices thereafter, and price-momentum conditions characteristic of a "bubble" were created. They found that originations of non-owner occupied investment loan and the jumbo loan have significant positive impact on housing prices in the short-run, especially in the period 2004-2006; while, subprime lending *per se* has an insignificant impact. They also found mortgage rates and the WRLURI (Wharton land use regulatory index) did not significantly impact housing prices; however, the latter did impact housing prices in the highest one third of the market.

Baffoe-Bonnie (1998) analyzed the dynamic effects of four key macroeconomic variables on housing prices and the stock of housing sold on national and regional levels in the USA. The macroeconomic variables are: mortgage rates, CPI, employment growth and money supply. He divided the country into four broad regions: Northeast, Midwest, South and West. He estimated VAR models by using quarterly data from 1973Q1 to 1994Q4. The impulse response analysis found that, at the national level housing prices and the amount of houses sold were very sensitive to shocks to employment growth and mortgage rates. Money supply and CPI have a moderate impact on housing prices and the stock of housing sold. The directions of these impacts were all consistent with intuition. The extent and significance of the macroeconomic influence were different from region to region. It seemed that these macroeconomic variables could not fully explain the fluctuations of housing prices in some regions.

Bredthauer and Geppert (2010) used VEC models to examine the rapid rise in housing prices between 1996 and 2007 in the U.S. housing market. They integrated housing price, real GDP, default premium and 30 year mortgage rates to capture the historic relationships between these variables. They showed that a cointegrated system exists. The model predicted that an increase in housing prices would have occurred based upon fundamental factors, rather than via a speculation bubble. They argued that subprime lending, the creation of derivatives, the promotion of housing by policy makers and incestuous credit rating practice probably provided an impetus for increased demand. However, to a large extent, the increase in housing prices during the period is because of economic fundamentals.

Mahalik and Mallick (2011) examined the causal relationship between housing price and five factors - real income, short-run real interest rates, real stock price index, real effective exchange rate and real non-food bank credit loans from 1996 to 2007 in India. By using VECM techniques, they found that in the long run, real income significantly and positively influences housing prices, while real non-food bank credit loans adversely influences it. Other factors have insignificant influence. They explained that the negative impact of real non-food bank credit loans is because that a major proportion of these bank credit loans has been allocated to real estate developers for investment in constructing a large number of houses. Doing so extends the housing supply so that it outweighs existing demand for housing, rather than boosts consumption demand for housing.

Iacoviello and Minetti (2008) tested credit channel of monetary policy (especially a bank-lending channel) in the housing market in four countries (Finland, Germany, Norway and the UK) from 1978 to 1999. They used a VECM approach that includes variables such as real GDP, CPI, money market rate, real housing prices, housing loan from banks, total loan from banks, mortgage rate- benchmark rate spread, rates on non-bank/total housing loan. They suggested that, despite the process of economic integration, residual heterogeneity characterizes European housing markets and the transmission mechanism of monetary policy. They found that bank-lending channel is present for Finland and the UK; balance-sheet channel for Germany; and no evidence of a credit channel for Norway.

Oikarinen (2009) examined the casual relationship between housing prices, stock prices and household borrowing in Helsinki, Finland. He implemented a VECM approach for the period (1975Q1- 2006Q2). He found a significant positive two-way causality between housing prices and household borrowing; however, there was no similar relationship between stock prices and credit to house households. The cointegration analysis suggested that the long-run relationship between real housing prices, real income and loan-to-GDP ratio has remained stable despite the credit market deregulation that took place during the sample period. He argued that household borrowing reveals significant information that relates to both short and long run housing demand that is not included in the income and user cost variables. He also found housing prices adjust towards their long-run equilibrium sluggishly and notably depending on backward-looking elements.

Iacoviello (2000) used a SVAR approach to identify the main macroeconomic factors that are expected to influence housing prices in six European countries (France, Germany, Italy, Spain, Sweden and UK) from 1974-1999. The factors were GDP, money supply, inflation rate and interest rates. He found that monetary shock had significant effects on housing prices in both short and long run, but had no effect on output.

Égert and Mihaljek (2007) investigated determinant dynamics of conventional fundamental factors and of some transition-specific factors on housing prices in eight central and eastern Europe (CEE) and nineteen OECD countries. Conventional fundamental factors considered included GDP per capita, real interest rate, housing credit and demographic factors. Transition-specific factors considered included institutional development of housing markets and housing finance and quality effects. They implemented a mean group panel dynamic OLS estimator to allow for cross-country heterogeneity in both short-run and long-run housing prices with respect to their determinants. They found per capita GDP, interest rates, credit growth demographic factor and the labor market all impacted housing prices significantly. The magnitude of impacts is different from CEE countries to OECD countries. They also found that the development of housing markets and housing finance institutions had a fairly strong positive impact on real housing prices in CEE countries.

Goodhart and Hofmann (2008) assessed the links between money, credit, housing prices, interest rates, GDP and CPI in 17 developed countries. They estimated fixed-effect panel VAR models by using quarterly data from the 17 countries from period 1970 -2006. They found significant multidirectional links between housing prices, monetary variables, and macroeconomic variables. In general, GDP and housing prices positively influenced each other. Interest rates negatively impacted housing prices. Money supply positively impacted credit and housing prices. Credit and housing prices positively influenced each other. The link between housing prices and monetary variables was found to be stronger over the sub-sample period 1985-2006. The influences of money and credit on housing prices were found to be stronger when housing markets were booming.

2.3 Scope of this Dissertation in Relation to Previous Research

As summarized in Chapter 2.1, representative papers have investigated past scenarios and determinates of residential housing prices in mainland China from 1998 to 2010. Discussed determinants include macro-economic factors such as GDP, bank lending, interest rates, exchange rates, disposable income, land supply, stock index, etc. However, previous research studies explaining determinants of housing price movements in China had some limitations. This dissertation attempts to fill in these gaps.

Firstly, most of the studies only included two to four factors[10] in their models which may have the "missing variable bias". The macro-economic determinants incorporated in the models of this dissertation are much broader than those considered in previous studies. For example, this dissertation is the first to examine the relationship between manufacturing industry conditions and housing prices in China using VECM systems with six endogenous variables and three exogenous variables each.

Secondly, the observation periods of previous research only extended to the end of 2010. This dissertation incorporates more recent period till Oct, 2012, to capture important policy changes such as purchase restrictions, tightening bank credit to developers, etc.

Thirdly, most of the previous research investigated housing prices at the national level rather than at a city level. Since housing markets can be very regionally specific, the main drivers of housing prices in different cities can be quite different

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10 Nevertheless, Zhang, Hua, Zhao (2012) included the up to five endogenous variables in their NARMAX model.

from each other. Thus, determinative relationships of housing price movements at a national level may not be able to represent housing market dynamics in Chinese metropolitan cities. This dissertation focuses on the investigation of housing markets in two representative cities Beijing and Shanghai to explore housing market dynamics in metropolitan China.

Fourthly, the causal relationship between housing prices and other determinants were not insightfully interpreted in many previous studies. This dissertation quantifies the casual relationship between housing prices and other determinants by interpreting in detail the results from Johansen cointegration analysis, generalized forecast variance decomposition (GFEVD) and generalized impulse response function (GIRF) techniques. It insightfully explains the economic and institutional rationale behind the quantified relationships by privately consulting experts in Chinese real estate companies, financial institutions and governments. Most of those information and opinions have rarely been discussed in previous studies as subjects of the "Chinese-style market-oriented economy". Some examples include how bank credits to the demand side entered the supply side; how bank credits to non-real-estate enterprises enter real-estate markets, etc. The "Chinese-style" patterns cause the housing market dynamics in metropolitan China to differ from those in other parts of the world.

Fifthly, sound policy implications and effective proposals to rationalize the housing markets in metropolitan China are hard to find in previous studies. With an analytical approach, this dissertation provides relatively detailed policy suggestions for a rational and healthy development of housing markets in metropolitan China.

Chapter 3

VARIABLE SELECTION AND DATA DESCRIPTION

This dissertation examines how housing prices in Beijing and Shanghai are affected by five categories of factors, including monetary policy, land supply, the stock market, the real economy and purchase limitation policy. Some of these are modelled to be jointly dependent, while others are assumed to be exogenously determined.

3.1 Housing

3.1.1 Housing Prices

The housing prices in the dissertation are the prices of new commodity private residential housing units. Under normal conditions of a market economy, commodity private residential housing units are built by legal real estate developers after purchasing land parcel usage rights, and sold to residents at market price without any government price intervention.

From 2005 to 2008, newly constructed commodity private housing units accounted for more than 60% of all the residential housing units built which include special affordable housing units, price controlled housing units and public rental units in Beijing and Shanghai. Since the end of 2008 until recently, the weighted share was still above 50%. On the other hand, China has a weak market for secondary housing units. For example, the ratio of secondary to new residential housing property transactions was only 0.26 in 2009. In metropolitan cities, the ratio may be slightly higher. Nevertheless, new residential housing sales still dominate secondary sales.

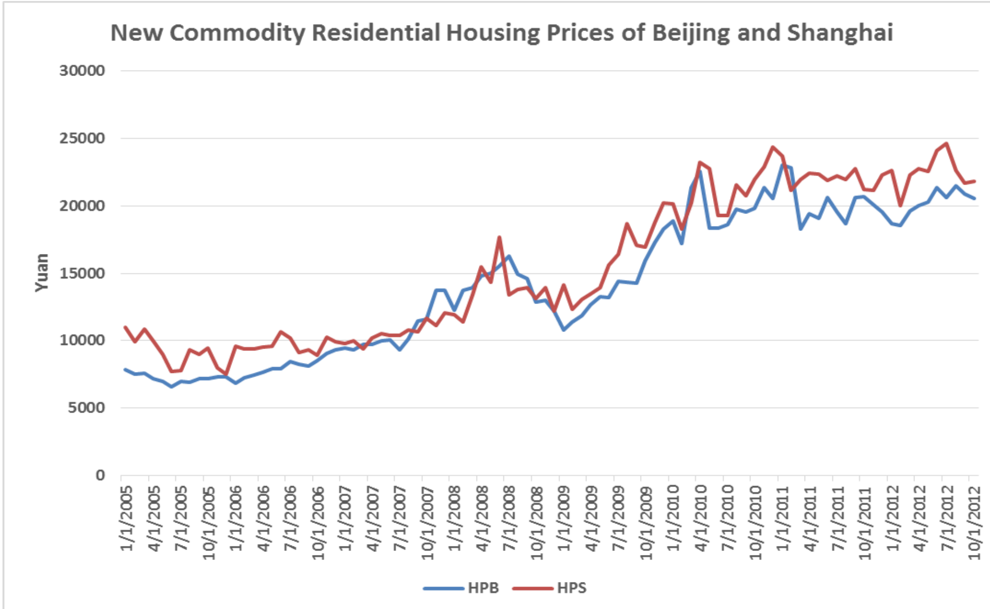
Thus, the prices of new commodity private residential housing units best represents housing market conditions in Chinese metropolitan cities.

3.1.2 Data Definition

Housing prices are the new commodity residential housing prices in Beijing and Shanghai. The prices are the average per square meter nominal prices of new commodity housing units sold in the city in a given month. The variable is calculated as: the total value of new commodity housing sold in a given month divided by the total square meters sold in that month.

$$Housing\ Price_t = \frac{\text{the total value (RMB) of new commodity housing sold}_t}{\text{total square meters sold}_t} \quad (1)$$

The housing price time series data are at a monthly frequency from 01/2005 to 10/2012, for both Beijing and Shanghai. The data source is the China Real Estate Index System (CREIS).



Note: HPB - Housing Prices of Beijing; HPS – Housing Prices of Shanghai.

Figure 3.1 Housing Prices of Beijing and Shanghai

3.2 Land

3.2.1 Land Prices

The relationship between land and housing is similar to flour and bread. Land purchasing cost is one of the major components of housing building costs. As described in Chapter 1, municipal governments sell land usage rights to the developer with the highest bid price. Because of rising housing prices and relative scarcity of land supply in metropolitan areas, developers have to offer very high land bidding prices in order to win.

During 2008 and 2009, under an expansionary monetary environment with high expected returns from housing sales, some capital-rich SOEs pushed the bid prices of land parcels to record high levels, such that so called “new land price king”[11] continued to emerge in Beijing and Shanghai. In addition, investment capital for land bidding came not only from bank credit to developers, but also from other sources including bank credit to non-real-estate enterprises, bank credit to residents and non-bank credits through various financing channels. More details about these channels are discussed in Chapter 5.5.2. Thus, land prices are expected to have a two-way causal relationship with housing price factors.

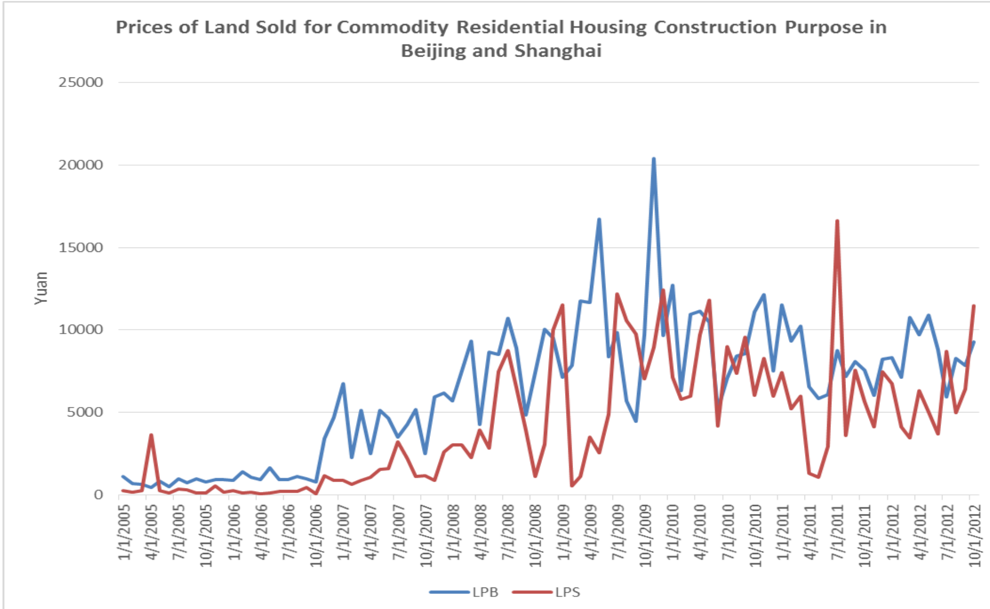
3.2.2 Data Definition

Land price is the average per square meter nominal price of land parcels sold for the purpose of commodity residential housing construction in a given month. It is given by: the total value of land parcels sold divided by the total square meters sold in a given month.

$$Land\ Price_t = \frac{total\ value(RMB) of\ land\ parcels\ sold_t}{total\ square\ meters\ sold_t} \quad (2)$$

The land price time series data are at a monthly frequency from 01/2005 to 10/2012, for both Beijing and Shanghai. The data source is the China Real Estate Index System (CREIS).

11 A land parcel that was bid to sell at an extremely high price



Note: LPB – Land Prices in Beijing; LPS – Land Prices in Shanghai.

Figure 3.2 Land Prices of Beijing and Shanghai

3.3 Monetary Policy

The Chinese central government adjusted its macro-economic policies frequently in the last decade, which had strong effects on the macro-economy and the housing market. Bank loans and interest rates are the two most important monetary instruments that could impact the housing market and its determinants. For bank loans, I use the PBC's (People's Bank of China) Total Loans Outstanding to Residential Sector (BCR) and the PBC's Total Loans outstanding to Non-financial Enterprises and Other Sectors (BCB). For interest rates, I use the PBC's 5-year RMB benchmark loan rate.

3.3.1 Bank Credit to Residents

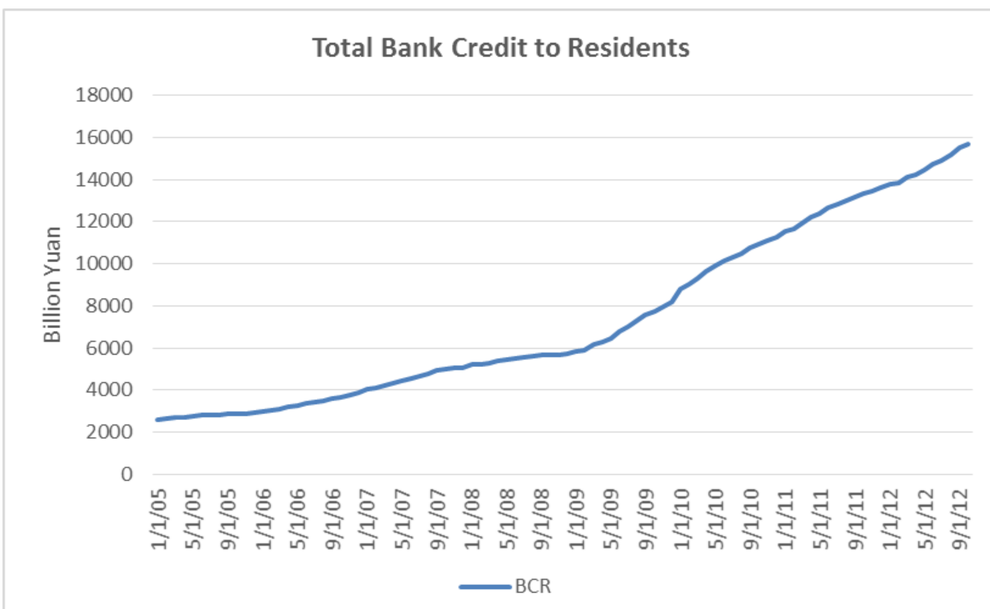
The PBC's Total Loans Outstanding to Residential Sector (BCR) contains both medium/long-term and short-term outstanding loans. It is not limited to mortgage loans, and it is measured at the country level rather than city level. This variable is selected for the following reasons.

First, in China, bank credit to residents not only can boost housing prices directly from the demand side; on the supply side, it also can help real estate developers raise funds through shadow banking channels. In the five years leading up to 2012, there was evidence that residents invested their bank credits into real-estate development. For example, employees in real-estate companies have used their bank credits to purchase corporate bonds issued by their employers that offered higher yields than bank loan interest rates. After 2009, government senior officials and SOE senior managers often invested their bank credits, a form of employment benefits, in banks' wealth management products. Then the banks invested most of such capital in real-estate corporate bonds through off-balance-sheet transactions. Bank credits could also go into the real-estate market through other shadow banking channels such as underground money shops, pawnshops, etc. In addition, bank credit to residents in other parts of the country was able to enter real estate development in Beijing and Shanghai.

Since the expected returns from direct housing price appreciation or investment in real estate development may differ, it would be ideal to separate the bank credit to residents according to whether they ultimately flowed into the demand side or supply side of the housing markets. However, time series data on residential housing mortgage loans are available at neither the city level nor the country level for the sample period.

Secondly, bank credit to residents in other parts of the country was able to enter the housing markets in Beijing and Shanghai. Before the enforcement of the housing property purchase restriction policies in 2011, a considerable share of housing units in Beijing and Shanghai were bought by non-city-residents. Some non-official sources claimed that more than 30% of the housing units in Beijing and Shanghai were bought by non-city-residents from 2007 to 2010. Even after the enforcement of the purchase restriction policies, data from the Beijing Bureau of Statistics indicate that 16% of the housing units in Beijing were bought by non-city-residents in 2011.

Thus, the PBC's Total Loans Outstanding to Residential Sector (BCR) is used. This variable is expected to affect both the demand and the supply sides of the housing markets in Beijing and Shanghai. The monthly time series data, as shown in Figure 3.3, are from 01/2005 to 12/2012.



Note: BCR - Bank Credit to Residents.

Figure 3.3 Bank Credit to Residents

3.3.2 Bank Credit to Enterprises

The PBC's Total Loans Outstanding to Non-financial Enterprises and Other Sectors (BCB) is not limited to bank credit to real estate developers. Like the BCR, BCB is measured at the country level rather than city level. This variable is selected for the following reasons.

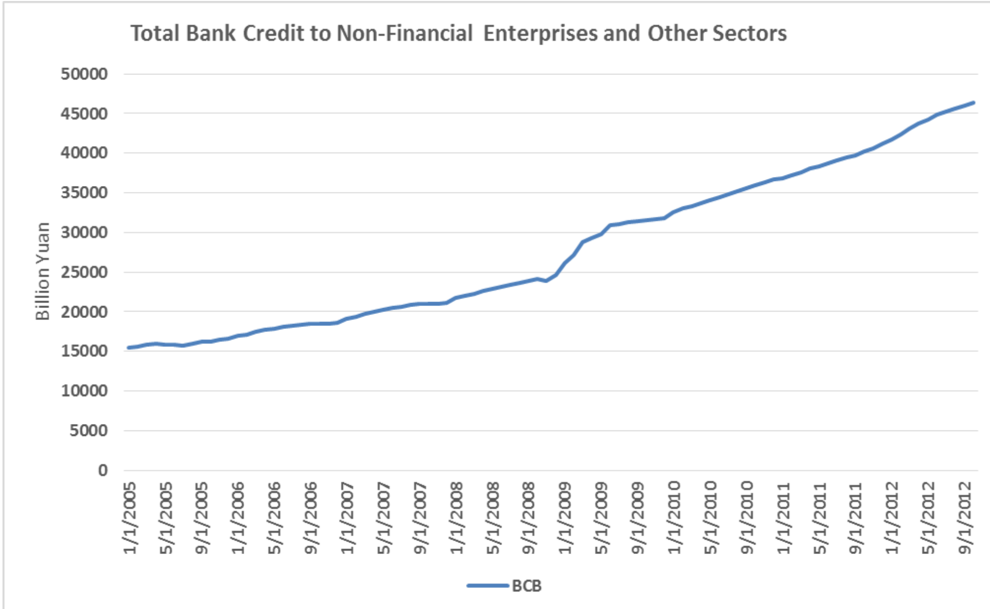
In China, real estate developers had various channels to obtain capital financing beyond bank credit to developers. Expansionary monetary policies from late 2007 to 2010 resulted in a tremendous increase in bank credit to real-estate developers. The increased bank credits allowed developers to bid up land prices and have sufficient cash flow to maintain asking prices of housing units at high levels. In order to curb the rapid climbing of housing prices, the central government tightened bank credit to developers since late 2010. However, the policies did not seem to be effective. In addition to non-bank credit financing, a considerable portion of the bank credit loans to non-real estate enterprises entered the housing market. For example, after 2008, the high expected return of the real estate industry attracted a lot of previously non-real estate enterprises to set up subsidiary real estate companies and move their bank credit loans into investment in the industry. After late 2010, although it became difficult for subsidiary real estate companies to obtain new bank credit loans, their parent companies could still use credit loans for their mainstream business to subsidize cash flow into their real estate subsidiaries. Also, a lot of non-real estate enterprises invested their bank credit loans into real estate companies' corporate bonds or other real estate related shadow banking channels. This is driven by the lower interest rates of bank credit loans compared to the expected return of real estate investments. As a result, the tightening of bank credit to developers had a limited effect on cash flow to real estate developers.

In addition, real estate developers located all over China were able to do business and invest in the housing markets of Beijing and Shanghai. As a result, city level bank credit to developers cannot give a complete picture of the overall bank credit capital flow into the supply side of housing markets in Beijing and Shanghai.

Furthermore, I obtained the data on city level bank credit to developers in Beijing and Shanghai from several data sources. However, the method used for constructing the data and data definitions are vague. Empirical results based on the data were counter-intuitive.

Thus, without restriction on the locality or industry category of bank credit receiving entities, the PBC's Total Loans Outstanding to Non-financial Enterprises and Other Sectors (BCB) is used. This variable is expected to affect the supply side of housing markets in Beijing and Shanghai.

The monthly time series data, as shown in Figure 3.4, are from 01/2005 to 10/2012. The data source is the PBC's (People's Bank of China) database.



Note: BCB – Bank Credit to Business.

Figure 3.4 Bank Credit to Enterprises

3.3.3 Interest Rate

In China, mortgage rates are based upon benchmark loan rates set by the central bank. Mortgage rates are normally in the range of 80% to110% of the benchmark rates. The actual rates depend on the housing market policies of the central government and individual obligor's credit history. Borrowing costs of real estate developers also relate to the benchmark loan rates.

In addition, in China, the borrowing rate of developers is fixed once a bank loan is issued. While, mortgage rates are not fixed for the entire term of the loan. If the central bank changes the benchmark rates, the mortgage rates will be adjusted on Jan 1st, of the subsequent year.

Changes in the benchmark borrowing rates affect the cost of capital for both the housing purchasers and the developers. Raising benchmark rates could influence both housing demand and supply negatively.

As data on individual or average mortgage rates are not available, PBC's 5-year RMB benchmark loan rate is used to represent both the mortgage rate and developers' bank credit cost. I use the time series data published by the PBC at a monthly frequency from 01/2005-10/2012, as shown in Figure 3.5.

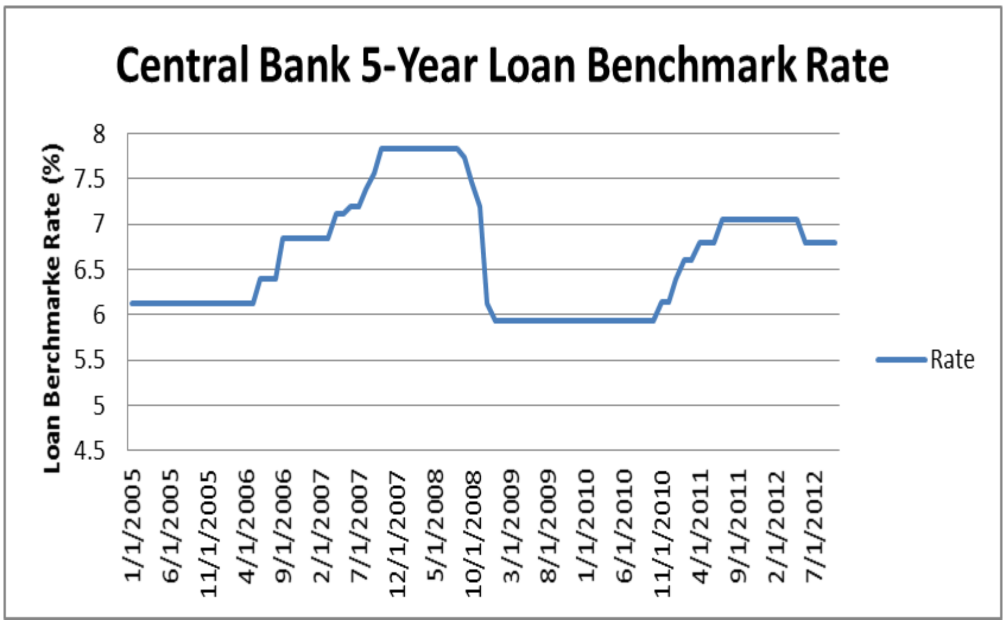


Figure 3.5 Central Bank Benchmark Rate

As discussed earlier, bank credits affect housing prices and other determinant factors. Through a feedback with macroeconomic policy, housing prices and other determinants can also influence the extent and availability of bank credit. Bank credits are therefore expected to have a two-way relationship with housing prices.

The interest rate level in China is mostly driven by central bank policy. In setting the benchmark rate, Chinese central bankers consider broad socio-economic factors rather than just the real estate sector. Therefore, interest rates are assumed to have only one-way impact on housing prices. I treat interest rates as exogenous in Chapter 5.

3.4 Investment Channels

3.4.1 Stock market

In a developed economy like the Unites States, the stock market and housing market are usually complementary. Their price levels change in tandem because of the wealth effect. In contrast, housing markets in Chinese metropolitan cities and the stock market appear to be substitutional during the sample period. Investment capital leaves a falling or stagnate stock market and enters a rising real estate market in the hope of better return. The reason for this difference in behavior might be that both the stock market and the housing market are less mature in China– they merely compete for liquid investment or speculative capital rather than represent fair asset prices that reflect macro-economic and business fundamentals.

Over the past decade, housing prices in China maintained a strong upward trajectory. In contrast, China's stock market lagged with gut wrenching high volatilities. Since bottoming out in the summer of 2005, the Shanghai Stock Exchange Composite has gained nearly 500% from the trough of just over 1000 to an all-time high about 6000 in October 2007. Then, it plunged below 2000 in 2008, recovered over 3000 in 2009 and oscillated between 2000 and 3000 afterwards for five years.

Since 2008, large amount of capital has fled the Chinese stock market. Investors have been reluctant to re-enter the casino-alike Chinese stock market. To many investors, the stock market was not considered to be a viable long term investment channel due to lack of informational integrity or reasonable expected risk-adjusted return.

Because of a lack of other investment alternatives, purchasing housing property in metropolitan cities seemed to be a better choice of investment. With soaring housing prices, residential real estate investments appeared to have high expected return and low volatility. The perceived risk for real estate investment is low for the Chinese. In traditional Asian cultures, people tend to be more comfortable with investments in real assets rather than financial assets due to the tangible utilities. Furthermore, the sharply increasing rental incomes, together with a lack of property tax make real estate investment more attractive. As a result, capital retreated from the stock market swarmed into housing markets in metropolitan cities.

3.4.2 Shanghai Stock Exchange Composite Index

The SSE composite index is the most prevalent stock index in mainland China. It is an index of all stocks (A shares and B shares) that are traded at the Shanghai Stock Exchange. I take the month-end index price over the period from 01/2005 to 10/2012, from the Shanghai Stock Exchange database, as shown in Figure 3.6.

Figure 3.6 Shanghai Composite Index

3.5 Real Economy

3.5.1 Manufacturing Industry Condition

In studying housing prices, GDP is often used as a measurement of the condition of the real economy. However, a large proportion of China's GDP is contributed by the real estate industry. For example, data from the National Bureau of Statistics indicate that real estate investment contributed 6.32%, 10.95% and 13.6% to the GDP in the years 1998, 2008 and 2013, respectively. The growth of the real estate industry accounted for 39.4% and 37.6% of the GMP (Gross Metropolitan Product) growth of Shanghai in the years 2009 and 2010, respectively. Therefore, I decided to use the PMI, a survey –based index that reflects the condition of Chinese real economy.

In China, the labor intensive manufacturing sector is one of the largest GDP contributing industry components. Data from the World Bank indicate that in terms of value, the manufacturing industry contributed roughly 33% to the GDP in the last decade, as illustrated in Figure 3.7. In general, a two-way complementary causal relationship is expected between the conditions of the manufacturing industry and the housing market. An improvement in the condition of the manufacturing industry, as a benign macroeconomic indicator, should have a positive impact on housing prices because of increased business profit, higher employment rate and higher income. On the other hand, a boom in the housing market should also positively impact the manufacturing industry, especially those real-estate related sectors, such as iron & steel, concrete, building materials, furniture and home appliances, etc.

However, some non-academic sources argued that in China, especially during the periods of macro-economic slowdown, deterioration in conditions in the manufacturing industry can lead to increased housing prices due to the alternative investment channel effect. They argue that from early 2008 to 2009, the manufacturing industry in China, especially the exporting– reliant private sector worsened. The sharp decrease in export demand caused by the financial crisis in developed countries and the appreciation of RMB resulted in close to zero manufacturing profits or even losses. Some private entrepreneurs closed their manufacturing plants and businesses, and reinvested the capital in the purchase of housing properties in metropolitan cities with the expectation of much higher returns than those of their former manufacturing industry. Some reports claimed that lots of these entrepreneurs purchased up to 10 or more above-mid-grade or luxury housing units in metropolitan cities. Nevertheless, the substitutional causal relationship lacks theoretical and empirical evidence. Even if the substitution existed, it was more likely a local and temporary phenomenon.

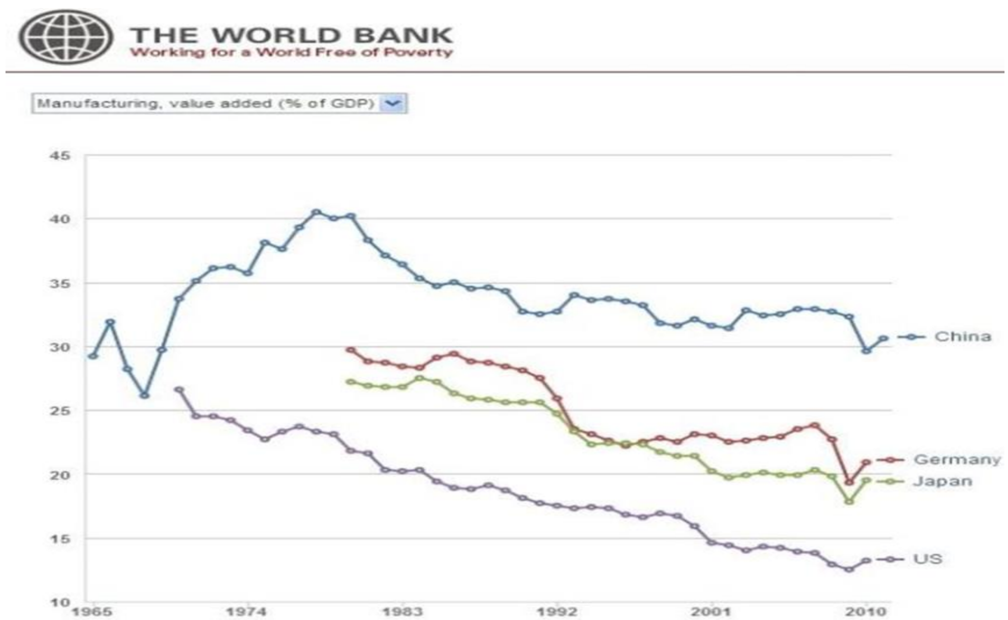


Figure 3.7 Contribution of Manufacturing Sector

3.5.2 HSBC/Markit Headline Manufacturing Purchase Manager Index

Purchase Manager Index (PMI) is an economic indicator derived from monthly surveys of companies. The HSBC/Markit Headline Manufacturing Purchasing Managers' Index is one prevalent PMI that measures Chinese manufacturing industry condition. It is based on data compiled from monthly replies to questionnaires sent to purchasing executives in over 430 Chinese manufacturing companies. Among these 430 firms, 40% are small companies, 31% are mid-size companies, and the remaining 29% are large companies. Compared to the CNBS (China National Bureau of Statistics) PMI that puts a larger weight on SOEs, the HSBC PMI gives much more weight to private companies. Thus, it can more effectively reflect the condition of the private manufacturing industry.

The HSBC/Markit Headline PMI is a weighed composite of five survey indices. Each index is given by:

$$INDEX = P_1 \times 100 + P_2 \times 50 + P_3 \times 0 \quad (3)$$

Where, P_1 =Percentage number of answers that reported an improvement

P_2 =Percentage number of answers that reported no change

P_3 =Percentage number of answers that reported a deterioration

The components and their weights are: new orders (0.3), output (0.25), employment (0.2), suppliers' delivery time (0.15), stock of purchases (0.1).[12]

Thus, a PMI of 50 indicates a neutral state of market condition that is no change compared to the last period; a PMI above 50 represents an improved market condition; while a PMI below 50 spells a worsening market condition.

The PMI time series data are at a monthly frequency, as shown in Figure 3.8, from 01/2005 to 10/2012. The data source is HSBC.

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12 Source: Markit PMI

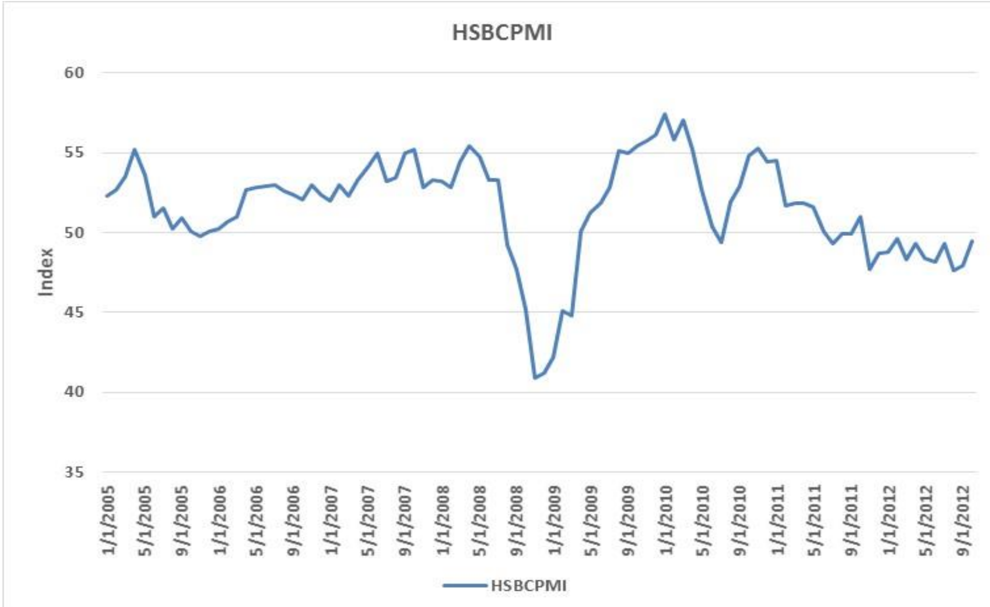


Figure 3.8 HSBC/Markit Heading PMI

The HSBC PMI measures the monthly change in the condition of the manufacturing industry. The data has an intercept of 50 which indicates no change.

Since other variables used in this dissertation are levels, it makes intuitive sense to measure the condition of the manufacturing industry in a similar fashion. Thus, the data used in the models are the cumulative de-intercept HSBC PMI. Each point of the data series is subtracted by 50, then cumulated up. The formula is:

$$CHSBCPMI_t = \sum_{t=t0}^{t=t}(HSBCPMI_t - 50), where\ t0 = 01/2005 \quad (4)$$

The $CHSBCPMI_t$ measures relative (cumulative) change of the manufacturing industry conditions since Jan, 2005, as shown in Figure 3.9.

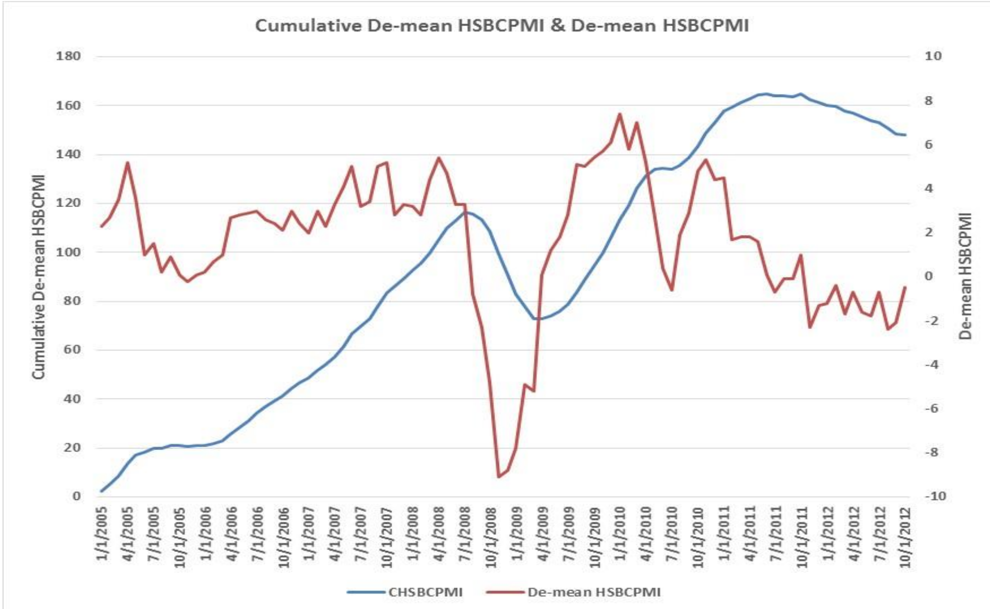


Figure 3.9 Cumulative PMI and De-mean PMI

3.6 Average Disposable Income of City Residents

In the last decade, the nominal income of metropolitan city residents kept increasing. However, the rate of increase of housing prices was much faster than that of income.

Beijing and Shanghai City Bureau of Statistics published the city level residents' average nominal disposable incomes at a quarterly frequency, from 2005Q1 to 2012Q4. The data have seasonal characteristics with obvious higher income in the first quarter of each year compared to other quarters. The seasonality matches annual bonus time, which is in the first quarter right before Chinese New Year.

I transform the quarterly data into monthly data by assuming that monthly income within a given quarter shares the same trend.

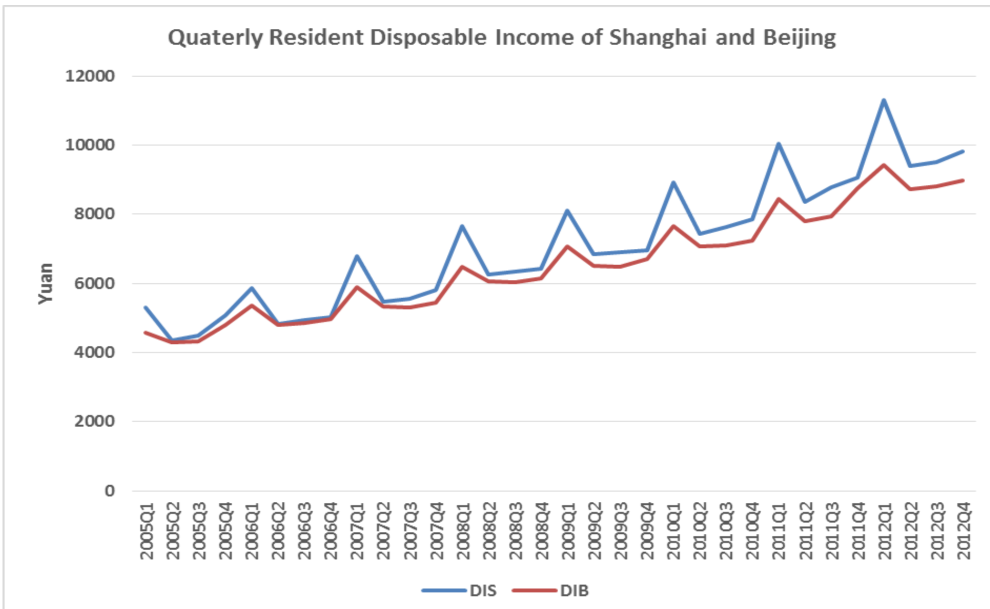
The trend T_q within quarter q is given by:

$$DI_q = 3Ave\_DI_{q-1} + 6T_q \Longrightarrow T_q = \frac{DI_q - 3Ave\_DI_{q-1}}{6} \quad (5)$$

Then, monthly Disposable Income at month i within quarter q is given by:

$$DI_{qi} = Ave\_DI_{q-1} + i \times T_q, where\ i = 1,2,3 \quad (6)$$

The original quarterly data and transformed monthly data are shown in Figure 3.10 and Figure 3.11, respectively.



Note: DIS – Disposable Income of Shanghai; DIB – Disposable Income of Beijing.

Figure 3.10 Quarterly Disposable Income

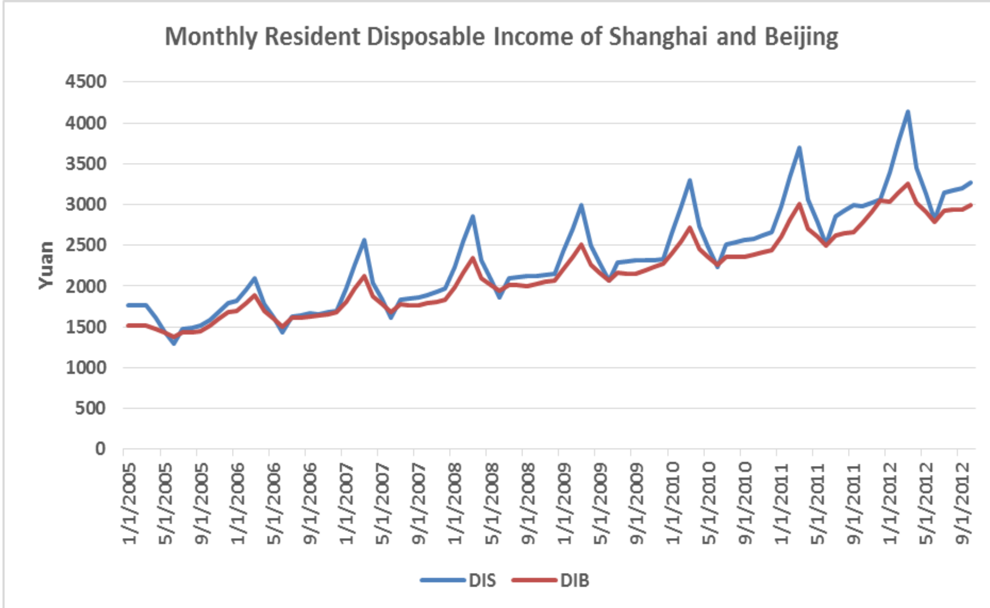


Figure 3.11 Monthly Disposable Income

3.7 City Housing Property Purchase Restriction Policy

In late 2010, in order to curb soaring housing prices in metropolitan cities, municipal governments took various measures to cool down the housing market on the demand side, such as raising the down payment rates and mortgage rates on purchases of non-primary housing.

To implement the central government's housing market adjustment policy, the State Council's No.10 National Notice[13] , imposed the strictest purchasing restriction, which took effect around Jan, 2011. Take the policies in Shanghai as an example, the stipulations are:

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13 The full title of the document is "the State Council's Notice on Firmly Curbing the Surge in Housing Prices in Some Cities".

1. City permanent resident households who already own one residential housing property; and, city non-permanent resident families who have paid city personal income tax for more than one year but still do not have residential housing property in the city, are allowed to purchase only one residential housing property;

2. City non-permanent resident who have not paid city personal income tax for more than one year are not allowed to purchase any residential housing property.

The restriction policy in Beijing was similar to that in Shanghai but even more restrictive. It stipulates that city non-permanent residents who do not have any housing property in Beijing and have paid city personal income tax for at least 5 years are allowed to purchase no more than one residential housing property.

Although these restrictions blocked some self-dwelling demand from new city residents, the major purpose was aimed at blocking investment and speculative capitals from entering the cities' housing market from the demand side.

The Purchase Restriction policy (PRP) is modeled as a dummy variable in Chapter 5. It is set to zero from 01/2005 to 12/2010; and one from 01/2011 to 10/2012.

3.8 Comments on Data

In this study, the housing and land prices are nominal rather than real. Firstly, official CPI data in China excludes housing prices. It makes the CPI an inappropriate deflator for housing prices. In addition, official CPI data in China has always been criticized for underestimating real inflation. Secondly, bank credits variables are nominal loan outstanding balances. Using nominal prices makes analysis of causality with bank credits consistent and easily interpreted.

Chapter 4

METHODOLOGIES

4.1 Vector Error Correction Model

The aim of this dissertation is to quantify the dynamic causal relationships between housing prices and relevant determinates in Beijing and Shanghai. This is achieved by the application of Vector Error Correction Models (VECM) as suggested by Engle and Granger (1987).

A Vector Error Correction Model (VECM) is a dynamic system in which the deviation of the current state from its long-run equilibrium is fed into its short-run dynamics.

The Vector Error Correction Model (VECM) adds short-run error correction features to the Vector Auto-Regression (VAR) model. Its representation states that change of an endogenous variable not only depends on its own and other variables' past changes, but also depends on the extent of deviation from the long-run equilibrium relationship.

The general mathematical form of the Vector Error Correction Model that is specified in the dissertation is:

$$\Delta X_t = \alpha - B(A' X_{t-1} - \delta t - \mu) + \sum_{s=1}^{p-1} \Phi_s \Delta X_{t-s} + \Psi \Delta Z_{t-1} + \varepsilon_t \qquad (7)$$

Where,

X_t is an N×1 vector of endogenous variables;

α is an N×1 vector of intercepts;

A is an N×R matrix of co-integration vector(s) coefficients. By testing the significance of the parameters in the *A* matrix, we know whether the variable enters the co-integrating relationship significantly or not;

B is an N×R matrix of short-run adjustment coefficients (loading matrix). It indicates adjustment speed and direction of the variables towards the long-run equilibrium;

R is the rank of co-integration;

μ is an R×1 vector of intercepts of co-integrating vector(s);

Φ_s are N×N matrices of coefficients of lagged change of endogenous variables. They measures the short-run impacts of lagged endogenous variables;

p is the lag order of the underlying vector autoregression (VAR) model;

Ψ is an N× *k* matrix of coefficients of exogenous variables, *k* is the number of exogenous variables;

ΔZ_{t-1} is a k×1 vector of change of exogenous variables, lagged by 1 period;

ε_t is an N×1 vector of i.i.d. (independent and identically distributed) error terms.

4.2 Variables

As discussed in Chapter 3, there are six endogenous variables and three exogenous variables in the Beijing and the Shanghai Models, respectively.

Endogenous variables in the VECM of Beijing are the Housing Prices of Beijing (HPB), the X-12 (US Census Bureau X-12-Arima Seasonal Adjustment method) Seasonally Adjusted land prices of Beijing (LPB_SA), the Total Bank Credit Loan Outstanding to Resident Sector (BCR), the Total Bank Credit Loan Outstanding to Non-financial Enterprises and Other Sectors (BCB), the Shanghai Stock Exchange Composite Index (SCI) and the Cumulative HSBC Headline Purchase Manager Index (CHSBCPMI). Exogenous variables are the Central bank 5-year Loan Benchmark Rate (MR), the dummy variable Housing Property Purchase Restriction Policy (PRP) and the X-12 Seasonally Adjusted Residents Disposable Income of Beijing (DIB_SA).

Endogenous variables in the VECM of Shanghai are the same as those in the VECM of Beijing except for the Housing Prices of Shanghai (HPS) and the X-12 Seasonally Adjusted Land Prices of Shanghai (LPS_SA). Exogenous variables are the same as those of Beijing except for the X-12 Seasonally Adjusted Residents Disposable Income of Shanghai (DIS_SA).

Land prices can exhibit seasonality. In China, most of the bank credits to developers are issued in the 1st and 3rd quarters of the year. The governments' planning for land supply is usually completed in the 1st quarter of the year. Most land parcels are sold to developers in the first three quarters of the year[14]. Disposable income can also have seasonality because of the distribution of annual bonus or incentive which is in the 1st quarter of the year.[15]. Thus, seasonally adjusted land price and disposable income variables are used in the VECMs.

All series except the CHSBCPMI and the MR are in the natural logarithm of the original series.

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14 The original and the seasonally adjusted natural logarithm of land prices are shown in Figures B.7 and B.8 in the Appendix.

15 The original and the seasonally adjusted natural logarithm of disposable incomes are shown in Figures B.9 and B.10 in the Appendix.

4.3 Techniques

After the VECM models are estimated, Forecast Error Variance Decomposition (FEVD) and Impulse Response functions (IRF) (Sims (1980) & Pesaran and Shin (1998)) are reported to characterize the dynamic causal relationships among endogenous variables.

The forecast error variance decomposition (FEVD) provides a decomposition of forecast error variance of variables in the VAR for various forecast horizons. If the contemporaneous error correlation matrix of the VECM is diagonal, the orthogonalized forecast error variance decomposition (OFEVD) can be used. If the contemporaneous error correlation matrix is non-diagonal, the generalized forecast error variance decomposition (GFEVD) should be used. More discussion on the interpretation of the FEVD is in Chapter 5.4.

Impulse response analysis describes how the economic system reacts to impulses of endogenous (or exogenous) variable over time. An impulse is an unanticipated change of variable, which economists usually call 'shocks'. The impulse response function traces the response of an endogenous variable to one-time shocks to variables over time. If the contemporaneous error correlation matrix is diagonal, the orthogonalized impulse response function (OIRF) can be used. Instead, if the matrix is non-diagonal, the generalized impulse response function (GIRF) should be used. More discussion on the OIRF and the GIRF is in Chapter 5.5.

Chapter 5

EMPIRICAL RESULTS

5.1 Unit Root Tests

The first step in the VECM analysis is to determine the order of integration for each variable. The most popular Augmented Dickey-Fuller (ADF, Said & Dickey, 1984) and the Dickey-Fuller General Least Square (DF-GLS, Elliott, Rothenberg & Stock, 1996) methods are applied. The number of augmented terms in the ADF & DF-GLS tests is determined by both the Akaike information criterion (AIC) and the Schwarz-Bayesian information criterion (SIC).

A linear trend is included in the unit root tests for variables HPB, HPS, LPB_SA, LPS_SA, BCR, BCB, DIB_SA, DIS_SA because they are nominal terms with obvious upward trends.

Whether a linear trend should be included in the unit root tests for SCI is ambiguous. Figure 3.6 suggests that there is no trend in SCI during the sample period. However, in the long-run, stock indices are expected to have a positive trend. Thus, a unit root test without linear trend for the sample period and a unit root test with linear trend for the time period from 1991M1 to 2012M10 are both reported (the Shanghai stock exchange was established in year 1991).

The unit root test results are summarized in Table A.1 to Table A.12 in the Appendix.

Series HPB, HPS, LPB_SA, LPS_SA, BCR, BCB and DIB_SA are integration order 1 with drift (I (1) with drift). Series CHSBCPMI and MR are integration order 1 with no drift (I (1) with no drift). The SCI is found to be an I (1) process with no drift over the sample period; while an I (1) process with drift over the longer period of 21 years. Series DIS_SA is a trend stationary (TS) process.

Therefore VECMs in this analysis use the first difference of all the above time series except for DIS_SA which is a trend stationary process. The error series from the OLS regression of DIS_SA on a constant and a linear time trend is used as the de-trended DIS_SA (DIS_DETR) in the VECM.

5.2 VECM Specifications

5.2.1 Lag Order Selection

I use the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) to select the appropriate lag length. As reported in Table 5.1 and Table 5.2, up to 7 lags are tested. For the VAR of Beijing, the smallest value of the AIC and SBC are both achieved at lag one. For VAR of Shanghai, the smallest value of the AIC and SBC are achieved at lag six and lag one, respectively.

Normally, lags that are too long will sacrifice the degree of freedom for model estimation. Thus, I started with lag order one to specify models of Beijing and Shanghai. The model diagnosis suggests that there are strong auto-correlation of residuals for both Beijing and Shanghai models with lag order one. Then, I progressively increase the lag orders. The model of Beijing passes most of the diagnostic tests at lag two. The model of Shanghai passes most of the tests at lag three. Thus, two and three lags of the first differences are included in the models of Beijing and Shanghai, respectively.

Table 5.1 Beijing AIC and SBC

Beijing		
Lag Length	AIC	SBC
1	-13.44	-11.79
2 *	**-13.29**	-10.64
3	-13.18	-9.51
4	-13.08	-8.39
5	-13.22	-7.47
6	-13.06	-6.26
7	-13.18	-5.3

Table 5.2 Shanghai AIC and SBC

Shanghai		
Lag Length	AIC	SBC
1	-11.35	-9.7
2	-11.32	-8.67
3 *	**-11.65**	-7.98
4	-11.5	-6.8
5	-11.58	-5.84
6	-11.72	-4.91
7	-11.26	-4.39

5.2.2 Identification of Co-integration Relationships

The Johansen (1988) co-integration tests are implemented to determine the rank of co-integration in the Beijing and Shanghai VECMs.

Beijing

The test for the Beijing model includes 2 lags and a restricted trend. The following results are based on a 5% critical value.

Table 5.3 Cointegration Rank Test of Beijing Model

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.400913	155.8047	117.7082	0.0000
At most 1 *	0.319957	109.1810	88.80380	0.0008
At most 2 *	0.301373	74.09148	63.87610	0.0055
At most 3	0.264170	41.45543	42.91525	0.0695
At most 4	0.123956	13.54066	25.87211	0.6952
At most 5	0.016325	1.497821	12.51798	0.9910

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.400913	46.62374	44.49720	0.0289
At most 1	0.319957	35.08948	38.33101	0.1125
At most 2 *	0.301373	32.63605	32.11832	0.0432
At most 3 *	0.264170	27.91477	25.82321	0.0261
At most 4	0.123956	12.04284	19.38704	0.4112
At most 5	0.016325	1.497821	12.51798	0.9910

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The trace test indicates that there are three cointegration relationships. While, the max-eigenvalue test indicates one cointegration relationship. A simulation study suggests that the trace test tends to be more reliable than the max-eigenvalue test. Thus, a cointegration of rank 3 will be used in the Beijing VECM specification.

Shanghai

The test for the Shanghai model includes 3 lags and a restricted trend. The following results are based on a 5% critical value.

Table 5.4 Cointegration Rank Test of Shanghai Model

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.495778	151.1587	117.7082	0.0001
At most 1 *	0.330456	89.53219	88.80380	0.0442
At most 2	0.218843	53.42789	63.87610	0.2751
At most 3	0.178810	31.19978	42.91525	0.4326
At most 4	0.130604	13.46975	25.87211	0.7010
At most 5	0.009661	0.873714	12.51798	0.9996

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.495778	61.62649	44.49720	0.0003
At most 1	0.330456	36.10429	38.33101	0.0881
At most 2	0.218843	22.22811	32.11832	0.4758
At most 3	0.178810	17.73003	25.82321	0.3982
At most 4	0.130604	12.59604	19.38704	0.3617
At most 5	0.009661	0.873714	12.51798	0.9996

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The trace test indicates that there are two cointegration relationships. While, the Max-eigenvalue test indicates there is one cointegration relationship. Cointegration of rank 1 is to be used in the Shanghai VECM specification because it makes the VECM more properly specified.

5.2.3 Estimation and Diagnosis

Estimation of the Beijing and Shanghai models are reported in Table A.15 and Table A.26, respectively. Diagnostic results are reported in Tables A.16-A.25 for the

Beijing model; and in Tables A. 27 - A.36 for the Shanghai Model. (Tables A.15-A.36 are in the Appendix.)

Tables A. 17 and A.28 examine the VECM stability condition (AR root test). There are 3 imposed unit roots in the Beijing model and 5 imposed unit roots in the Shanghai Model. The next largest root has a modulus of 0.86 for Beijing model; and, 0.85 for Shanghai model. The moduli are less than 1, hence, supporting the assumed ranks of cointegration.

To examine the residual serial correlation, Q tests are reported for each endogenous variable. There is no significant residual autocorrelation in the Beijing model or Shanghai model at the 5% level for most of the first 24 lags.

The residual serial correlation is also examined by using the LM tests. There is no significant residual autocorrelation in the Beijing model or Shanghai model at the 5% level for most of the first 24 lags.

The residual Jarque-Bera normality tests indicate that except for residuals of the variable BCR in both the Beijing and Shanghai models, all other residuals are normally distributed at the 5% level.

As shown in Figures B.1- B.2 and Figures B.4- B.5, residuals of BCR in both the Beijing and Shanghai models contain outliers at Jan, 2010[16]. The outliers cause the residuals of BCR to fail both the skewness and kurtosis tests. As shown in Figure B.3 and Figure B.6, after removing the outliers, both residuals pass the normality test at the 5% level.

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16 This is due to a large increase in bank credit to residents. The month over month change in BCR is 7.6% in Jan, 2010, which is about 5.7% higher than the average month over month change of 1.9% observed in the sample period.

Thus, overall both the Beijing and Shanghai models are well specified.

5.3 Cointegration Relationship Analysis

Beijing

In order to facilitate the interpretation of cointegration relationships, the cointegration vectors of the Beijing model are re-normalized. Hence, the coefficient of HPS is 1 in each cointegration vector[17].

The following reports the three re-normalized cointegration vectors and their re-calculated loading matrices[18] for the Beijing model:

$$CV1:\ -0.29^{**}BCR_{t-1} + HPB_{t-1} + 0.004SCI_{t-1} - 0.004 ** CHSBCPMI_{t-1} - 0.002t - 6.56 = 0 \tag{8}$$

$$CV2:\ -0.23 ** BCB_{t-1} + HPB_{t-1} - 0.009SCI_{t-1} - 0.004^{**}CHSBCPMI_{t-1} - 0.006^{**}t - 6.49 = 0 \tag{9}$$

$$CV3:\ -0.23^{**}LPB_{SA_{t-1}} + HPB_{t-1} + 0.16^{**}SCI_{t-1} - 0.001CHSBCPMI_{t-1} - 0.009^{**}t - 8.35 = 0 \tag{10}$$

$$LM1: \begin{bmatrix} 0.29 ** \\ -0.12 \\ 13.77 ** \\ 1.55 \\ -2.71 ** \\ 27.5 \end{bmatrix} \quad LM2: \begin{bmatrix} -0.25 \\ 0.2 \\ -17.25 ** \\ -2.18 ** \\ 2.31 \\ -31.52 \end{bmatrix} \quad LM3: \begin{bmatrix} -0.01 \\ -0.04 \\ 3.72 ** \\ 0.03 \\ -0.47 ** \\ 5 \end{bmatrix}$$

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17 Each of the coefficients in their original cointegration vector are divided by the original coefficient of HPS.

18 Each of the coefficients in their loading matrix is multiplied by the original coefficient of HPS in the corresponding cointegration vector.

** denotes significance at the 5% level

The first cointegration vector indicates that housing prices and bank credit to residents go up and down in the same direction in the long-run. A 1% increase of bank credit to residents is associated with a 0.29% increase of housing prices. Housing prices and PMI also go up and down in the same direction. A 1 unit increase of PMI is associated with a 0.4% increase of housing prices. While, housing prices and the stock index go up and down in the opposite direction. Nevertheless, the coefficient of the stock index is insignificant. The liner trend in this cointegration vector is insignificant.

The first, third and fifth adjustment coefficients in the first loading vector are significantly different from zero. When there is a positive deviation from the long-run equilibrium, where housing prices are above an equilibrium level, bank credit to residents, land prices and the stock index all react to restore the equilibrium. For example, if housing prices are 1% above their equilibrium level, we can expect bank credit to residents and land prices to increase by 0.29% and 13.77% , respectively; while the stock index to decrease by 2.71% , in the next month.

The second cointegration vector indicates that housing prices and bank credit to enterprises are complementary in the long-run. A 1% increase of bank credit to enterprises is associated with a 0.23% increase of housing prices. Similar to that in the first cointegration vector, housing prices and PMI move in the same direction. A 1 unit increase of PMI is associated with a 0.4% increase of housing prices. The linear trend is significant. Holding other variables constant, housing prices increase by 0.6% each month.

The third and fourth adjustment coefficients of the second loading vector are significantly different from zero. When there is a positive deviation from the long-run equilibrium, where housing prices are above an equilibrium level, only housing prices and land prices will respond to restore the equilibrium. For example, if the housing prices is 1% above their equilibrium level, we can expect housing prices to decrease by 2.18% in the next month. Land prices are also expected to decrease by 17.25% in the next month due to the 1% deviation.

The third cointegration vector indicates that housing prices and land prices go up and down in the same direction in the long-run. A 1% increase of land prices is associated with a 0.23% increase of housing prices. Housing prices and the stock index are substitutional in the long-run. A 1% decrease of the stock index is associated with a 0.16% increase of housing prices, which can be evidence of an alternative investment channel effect in the long-run. Housing prices and PMI move in the same direction. Nevertheless, the coefficient of PMI is insignificant. The linear trend in significant. Holding other variables constant, housing prices increase by 0.9% each month.

The third and fifth adjustment coefficients in the third loading vector are significantly different from zero. When there is deviation from the long-run equilibrium, land prices and the stock index react to restore the equilibrium. For example, if the housing prices are 1% above their equilibrium level, we can expect land prices to increase by 3.72% ; while the stock index to decrease by 0.47%, in the next month.

Shanghai

The cointegration vector and its loading matrix for the Shanghai model are reported below:

$$CV1: HPS_{t-1} + 0.51^{**}BCR_{t-1} - 0.004LPS_{SA_{t-1}} - 1.61^{**}BCB_{t-1} + 0.11^{**}SCI_{t-1} - 0.006^{**}CHSBCPMI_{t-1} - 0.006t - 1.8 = 0 \quad (11)$$

$$LM1: \begin{bmatrix} -1.28^{**} \\ 0.02 \\ -4.84^{**} \\ 0.05 \\ -0.29 \\ 5.14 \end{bmatrix}$$

** denotes significance at the 5% level

The cointegration vector indicates that housing prices move in the same direction as bank credit to enterprises and PMI. A 1% increase of bank credit to enterprises is associated with a 1.61% increase of housing prices. A 1 unit increase of PMI is associated with a 0.6% increase of housing prices. While, housing prices are substitutional with the stock index. A 1% decrease of the stock index is associated with a 0.11% increase of housing prices, which can be evidence of an alternative investment channel effect in the long-run. Housing prices and land prices go up and down in the same direction in the long run. Nevertheless, the coefficient of land prices is insignificant.

The first and the third adjustment coefficients of the loading vector are significantly different from zero. It indicates that when the long-run equilibrium is interrupted by external shocks and has a positive deviation from the long-run value, only housing prices will decrease to restore the long-run equilibrium. For example, if the housing prices are 1% above their long-run equilibrium level, we can expect housing prices to decrease by 1.28% in the next month. In the meantime, land prices are expected to decrease by 4.84% in the next month due to the 1% deviation.

5.4 Generalized Forecast Error Variance Decomposition

The contemporaneous error correlation matrix of both the Beijing and Shanghai VECMs are non-diagonal (see Tables A.16 and A.27). The non-diagonal matrix makes orthogonalized forecast error variance decomposition (OFEVD) non-unique and dependent on the ordering of the variables in the VECM. I do not have a preference for the ordering of the variables in the system. Thus, the generalized forecast error variance decomposition (GFEVD) is reported here so that the results are invariant to the ordering of variables in the VECM.

GFEVD is interpreted as the following: as a result of the knowledge of the future realizations of the innovation in an equation, the forecast error variance of a certain variable can drop by a certain percentage. Because of contemporaneous error correlation, the sum of the GFEVD of a given variable over the different innovations is in general greater than 100%.

Housing Prices

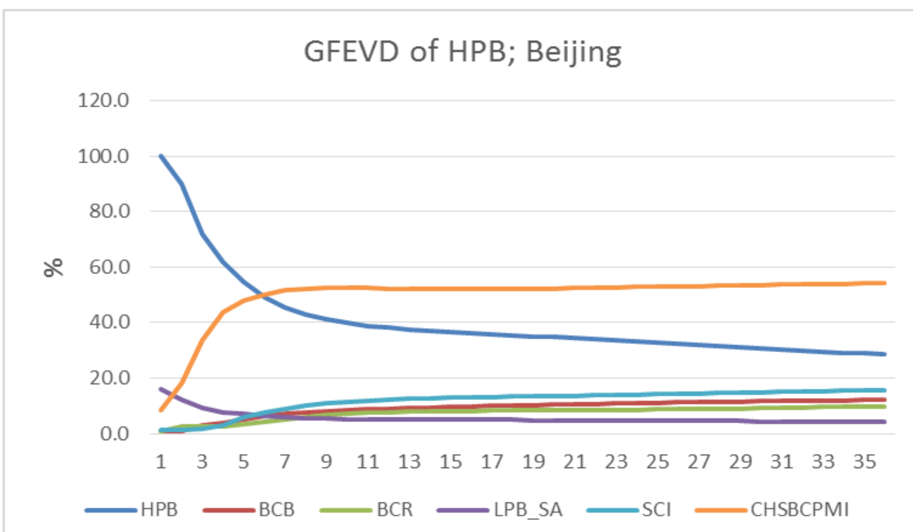


Figure 5.1 GFEVD of HPB

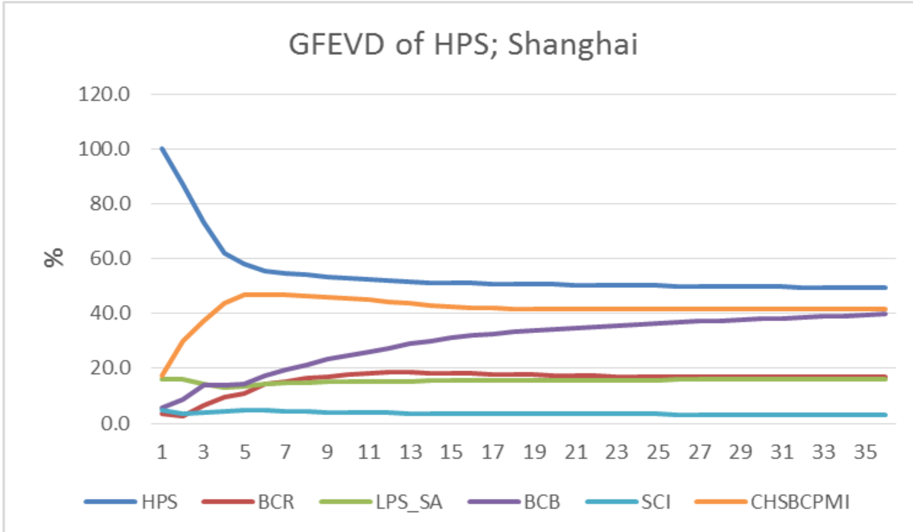


Figure 5.2 GFEVD of HPS

Beijing

The results of the Beijing model indicate that in the short-run (1-6 months), innovations in the housing price equation inflict the most of the uncertainty on future housing prices. If one knows the future innovations in the housing price equation, the FEV (forecast error variance) of housing prices can be reduced by 72% for the 3-month ahead forecasts and 49.1% for the 6-month ahead forecasts. PMI is the second important contributor. Knowing the future innovations in the PMI equation helps reduce the FEV of housing prices by 33.8% for the 3-month ahead forecasts and 50.2% for the 6-month ahead forecasts.

In the intermediate run (7-18 months), innovations in the housing price equation becomes the second largest contributor. Knowing the future innovations in the housing price equation helps reduce the FEV by around 39%. Instead, PMI turns out to be the largest FEV contributor. Knowing the future innovation in the PMI equation helps reduce the FEV by around 52%. The FEV due to innovations in the stock index and bank credit to enterprises equations are around 12% and 9%, which are the third and fourth largest, respectively.

In the long run (19-36 months), PMI, housing prices, the stock index and bank credit to enterprises have the same FEV reduction contribution ranking as those in the intermediate run. Their contributions are around 53%, 32%, 14% and 11%, respectively.

Shanghai

The results of the Shanghai model indicate that in the short run (1-6 months), innovations in the housing price equation also inflict the most of the uncertainty on future housing prices. If one knows the future innovations in the housing price equation, the FEV of housing prices can be reduced by 73.5% for the 3-month ahead forecasts and 55.7% for the 6-month ahead forecasts. The second largest contributor is PMI. Knowing the future innovations in the PMI equation helps reduce the FEV by 37.1% for the 3-month ahead forecasts and 46.7% for the 6-month ahead forecasts.

In the intermediate run (7-18 months), housing prices and PMI remain the first and second largest contributors - their FEV reduction contributions are around 52% and 44% respectively. Bank credit to enterprises and bank credit to residents are the third and the fourth largest FEV reduction contributors at around 28% and 18%, respectively.

In the long run (19-36 months), the FEV reduction contributions of housing prices and PMI still take the lead at around 50% and 42% respectively. Bank credit to enterprises and bank credit to residents keep the same contribution ranking as those in the intermediate run case, whose percentage are at around 37% and17%, respectively.

In both the Beijing and Shanghai models, housing price innovations appear to be the most important contributors to uncertainty of future housing prices in the short run; they are also important in the intermediate - and the long-run. Current changes in housing prices heavily influence people's expectation of future price changes. The phenomenon is more obvious in Shanghai in the intermediate- and the long-run than in Beijing.

Future innovations in PMI are almost as important as those in housing prices in the intermediate- and the long-run. This indicates that innovations in the real economy matter significantly to the future uncertainty of housing prices. Land price innovations matter more in the Shanghai model than those in the Beijing model. Contribution from innovations in bank credit is not negligible. Innovations in bank credit matter more in the Shanghai model than those in the Beijing model. Innovations in the stock index only contribute slightly in the Shanghai model. However, the innovations in the stock index play a larger role in the intermediate- and long-run in the Beijing model. This might be due to the wealth effect of the residents or the implication of profitability of business enterprises, etc. However, China's stock market history has been quite erratic. One should be cautious when interpreting the stock market's relationship with other factors.

Land Prices

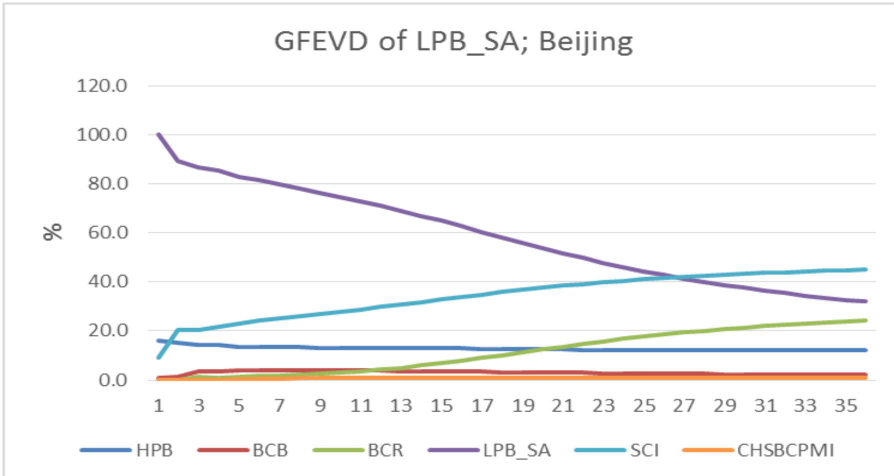


Figure 5.3 GFEVD of LPB_SA

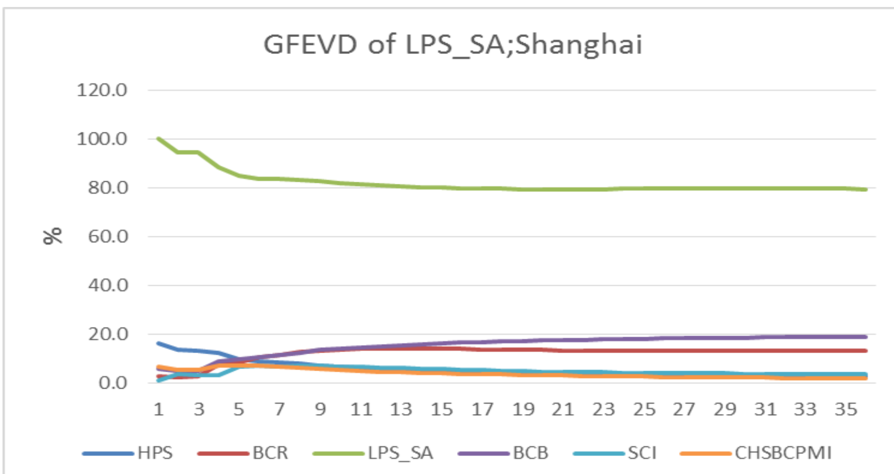


Figure 5.4 GFEVD of LPS_SA

The results of Beijing model indicate that innovations in the land price equation inflict the greatest uncertainty on future land prices through the 36-month forecast horizon. If one knows the future innovations in the land price equation, the FEV of land prices can drop by around 88%, 70% and 42% in the short-run, intermediate-run and long-run, respectively. Although the stock index is the second largest FEV reduction contributor, due to its high volatility and erratic behavior, interpretation of its effects should be made with caution. Housing prices is the third largest contributor in the short- and intermediate-run, which have FEV reductions around 13% and 12%, respectively. In the long-run, bank credit to residents is the third largest contributor. Knowing future innovations in the bank credit to residents equation helps reduce the FEV by 17% for the 24-month ahead forecasts and 24% for the 36-month ahead forecasts.

The results of the Shanghai model also indicate that innovations in the land price equation inflict the greatest uncertainty on future land prices through the 36-month forecast horizon. If one knows the future innovation of land prices, the FEV of land prices can drop by around 91%, 81% and 80% in the short-run, intermediate-run and long-run, respectively. Housing prices is the second largest FEV contributor in the short-run, at about 16.2% for the 1-month ahead forecast and 13.3% for the 3-month ahead forecasts. Bank credit to enterprises and bank credit to residents are the second and the third largest contributors in the intermediate- and the long-run, respectively.

In both the Beijing and Shanghai Models, land price innovations appear to be the most important contributors to the uncertainty of the future land prices. Current changes in land prices influence developers' expectation of future price changes. Innovations in housing prices matter in short-run. Contributions from bank credit innovation is not negligible. Bank credits that enter the real estate market appear to have a serious impact on developers' cash flow.

Stock Market

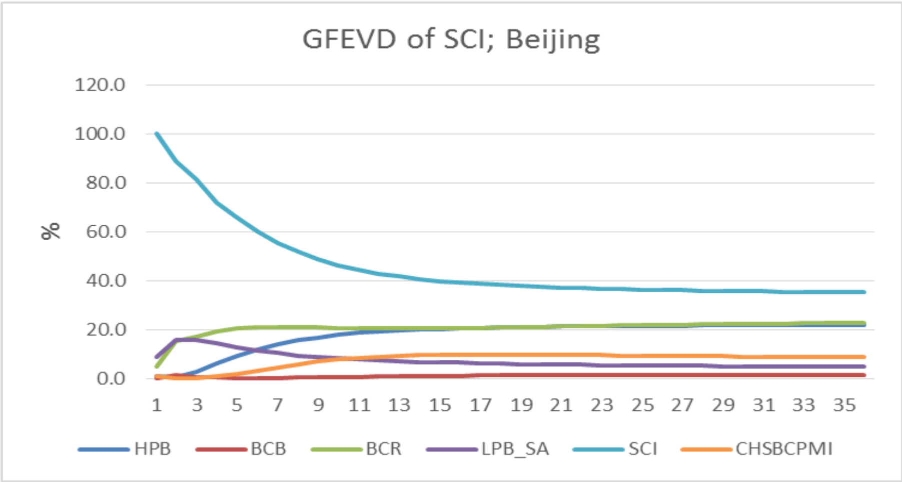


Figure 5.5 GFEVD of SCI, Beijing

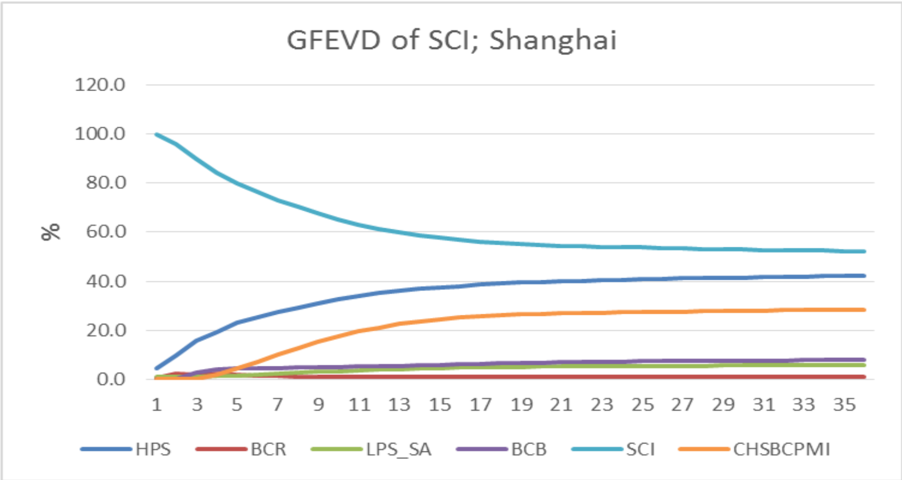


Figure 5.6 GFEVD of SCI, Shanghai

The results of both the Beijing and Shanghai models indicate that innovations in the stock index equation inflict the greatest uncertainty on the future stock index through the 36-month forecast horizon. Knowing the future innovations of stock index can reduce the FEV of the stock index by about 80% for the 3-month ahead forecasts and about 55% for the 12-month ahead forecasts. Current volatility of the stock index heavily influences market expectations of future stock index uncertainty.

Housing prices future innovations are the second largest FEV contributor in both the Beijing and Shanghai models. In the short- and intermediate-run, contributions average around 14% in Beijing and 29% in Shanghai. In the long-run, contributions increase to around 22% in Beijing and 40% in Shanghai. An investment channel substitution effect between housing property and financial assets is more likely than a complementary relationship between the two markets. I will address this using impulse response functions in the next chapter.

The contribution from PMI is also not negligible. The effect of stock market supported by the real economy was present before early 2008. However, the compound return of the stock market has been negative since 2009 despite there was considerable improvement in PMI. Hence, the supporting mechanism of the real economy is quite questionable after 2009.

PMI

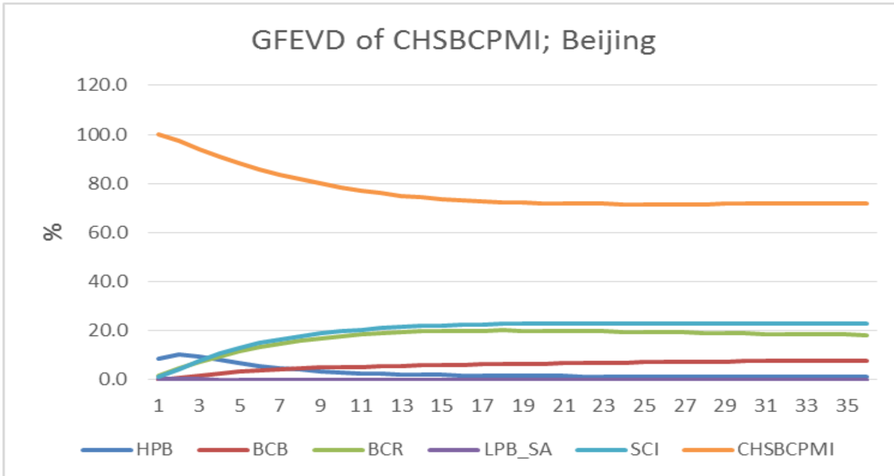


Figure 5.7 GFEVD of CHSBCPMI, Beijing

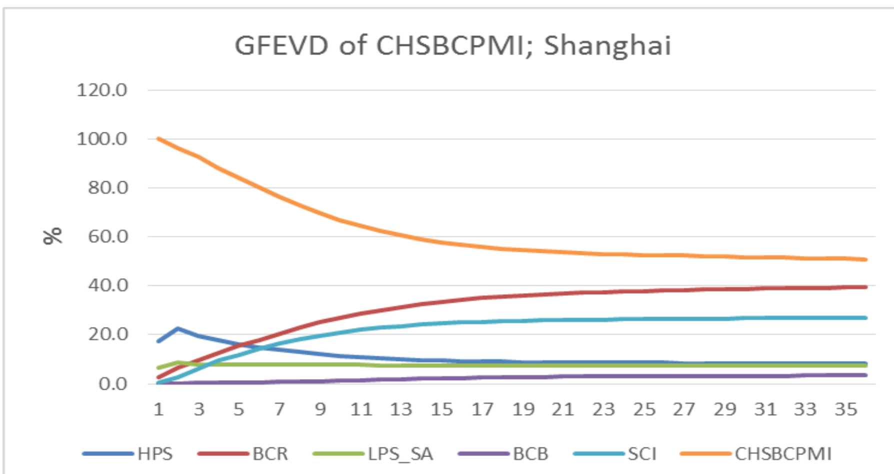


Figure 5.8 GFEVD of CHSBCPMI, Shanghai

The results of both the Beijing and Shanghai models indicate that innovations in the PMI equation inflict the greatest uncertainty on future PMI through the 36-month forecast horizon. The second largest FEV contributor in the short-run is the housing prices in both cities. The percentage of influence in Shanghai is larger than that in Beijing. There are more real-estate related manufacturing companies in areas around Shanghai in southern China than in areas around Beijing in northern China. Housing market conditions would impact those companies more heavily than non-real-estate related manufacturing companies. In the intermediate- and long-run, bank credit to residents becomes the second largest FEV contributor, indicating that residents' borrowing behavior impacts the manufacturing industry.

Bank credits

The estimated VECMs can also be used to produce GFEVD of the bank credit variables. However, bank credits may depend on boarder economic factors than those included in the two models. As an important part of China's monetary policy, bank credits are under the control of the central government's macro-economic directives. As such, causality of bank credit variables is outside the scope of the main research objective of the dissertation.

5.5 Generalized Impulse Response Functions

The generalized forecast error variance decomposition (GFVED) explains the proportion of forecast uncertainty of an endogenous variable that can be reduced by knowing the future innovations in the VECM system. However, the GFVED does not tell us whether the impact is positive or negative, whether it is temporary or has long-run persistence, or the magnitude of the impact. For those purposes, impulse response functions can be used to trace the pattern and magnitude of the response of an endogenous variable to a one-time shock to innovations in the VECM system over time.

The contemporaneous error correlation matrix in both the Beijing and Shanghai VECMs are non-diagonal (see Tables A.16 and A.27). As discussed in Chapter 4.3, when errors are correlated across equations, the orthogonalized impulse response function (OIRF, Sims' 1980) based on Cholesky decomposition is generally not unique. Altering the ordering of the variables in the VECM may change the impulses response results. Thus, the generalized impulse response functions (GIRF, Pesaran & Shin, 1998), which are invariant to the order of variables in the VECM, are reported in this chapter.

All the endogenous variables in the VECMs except PMI are in logarithmic form. For variables in the log form, GIRF measures the percentage change of a variable responding to a one-time one standard deviation shock. Since PMI is in a simple form, GIRF measures the unit change of PMI responding to a one-time one standard deviation shock. Note that different equations in a VECM have different error variance; and for a given equation, the error variances are different in the Beijing and Shanghai models (See Tables A.45 and A.46). Therefore, a one standard deviation shock could mean different percentage or unit changes for different variables, as well as for the same variable in the two cities. To simplify the comparison across different shocks within a VECM, and for the same shock between the two cities, GIRs are rescaled as follows:

● If the response variable is in log form and the impulse variable is also in log form, the original GIR is divided by the standard deviation of the corresponding innovation. Therefore, the rescaled GIR measures the percentage change of the response variable as a result of a one percentage shock to the impulse variable.

● If the response variable is in log form and the impulse variable is PMI. The original GIR is first divided by the standard deviation of the innovation in the PMI equation, then multiplied by 100. The rescaled GIR measures the percentage change of the response variable as a result of a one unit shock to PMI.

● If PMI is the response variable and the impulse variables are in log form, the original GIR is first divided by the standard deviation of the corresponding innovation, and then divided by 100. The rescaled GIR measures the unit change of PMI as a result of a one percentage shock to the impulse variable.

● If PMI is the both response and the impulse variable, the original GIR is divided by the standard deviation of the innovation in the PMI equation. The rescaled GIR measures the unit change of PMI as a result of a one unit shock to itself.

5.5.1 Housing Prices

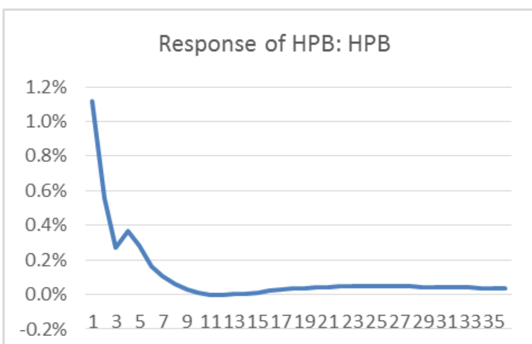


Figure 5.9 Response of HPB to HPB

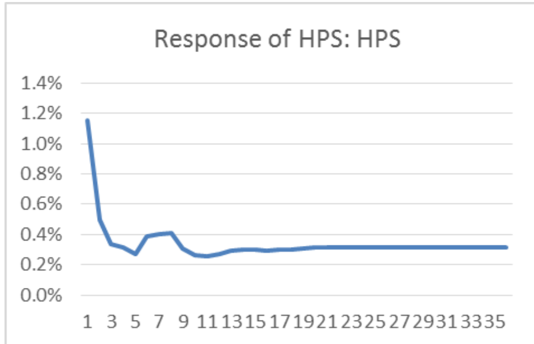


Figure 5.10 Response of HPS to HPS

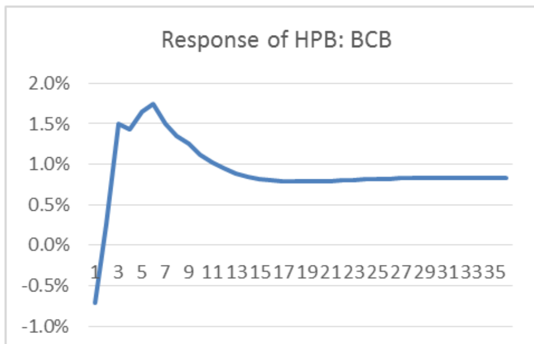


Figure 5.11 Response of HPB to BCB

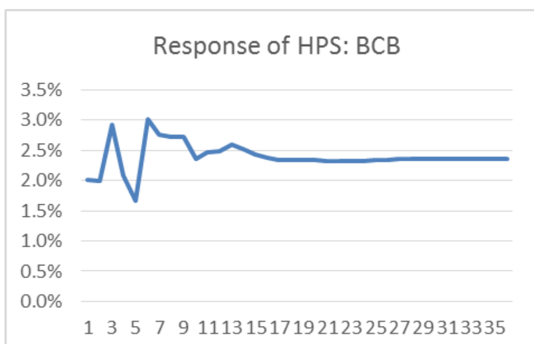


Figure 5.12 Response of HPS to BCB

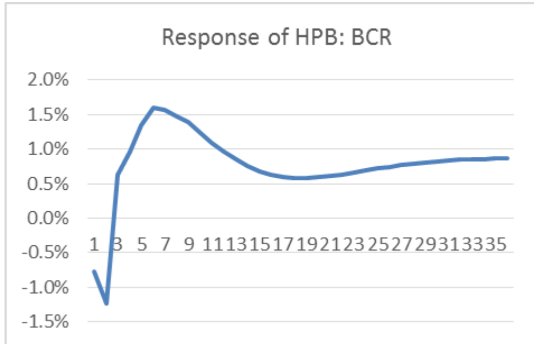


Figure 5.13 Response of HPB to BCR

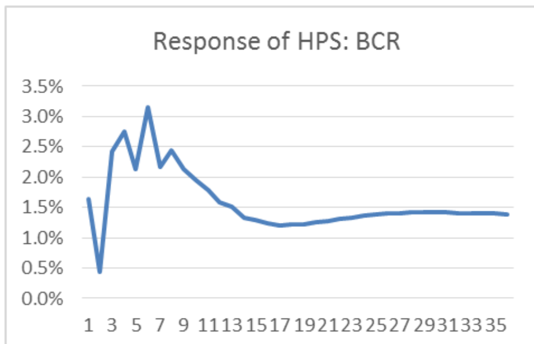


Figure 5.14 Response of HPB to BCR

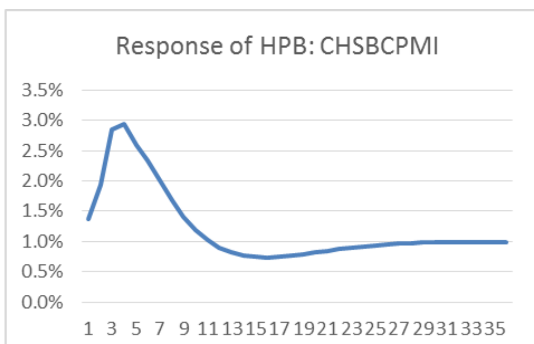


Figure 5.15 Response of HPB to CHSBCPMI

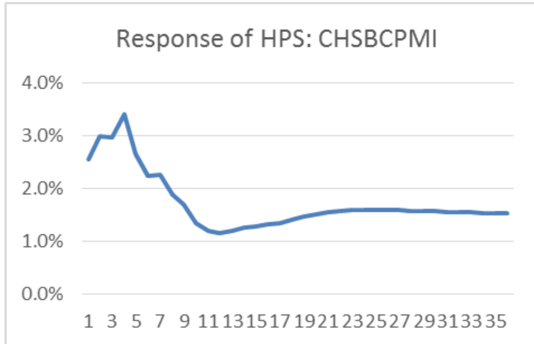


Figure 5.16 Response of HPS TO CHBCPMI

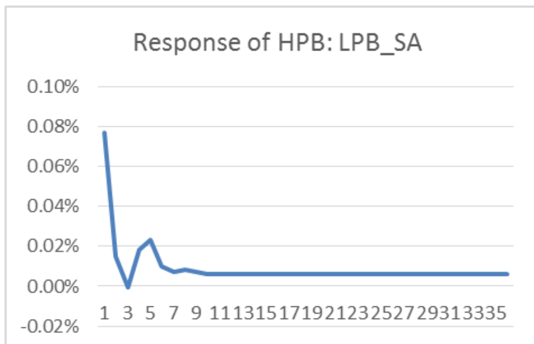


Figure 5.17 Response of HPB to LPB_SA

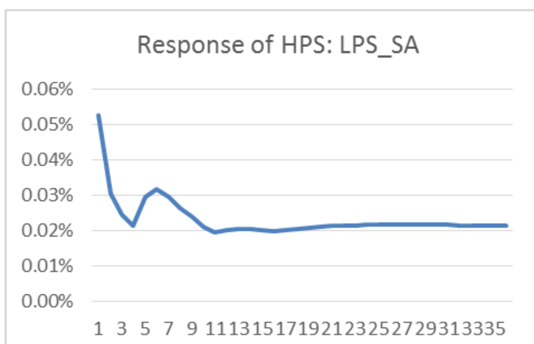


Figure 5.18 Response of HPS to LPB_SA

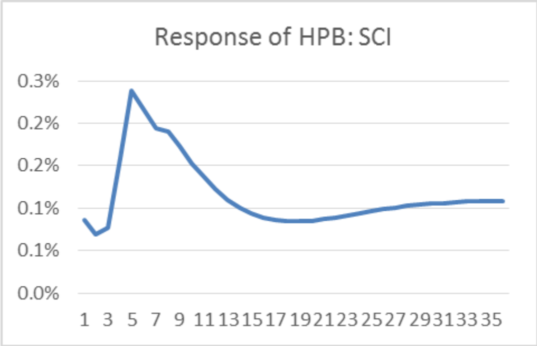


Figure 5.19 Response of HPB to SCI

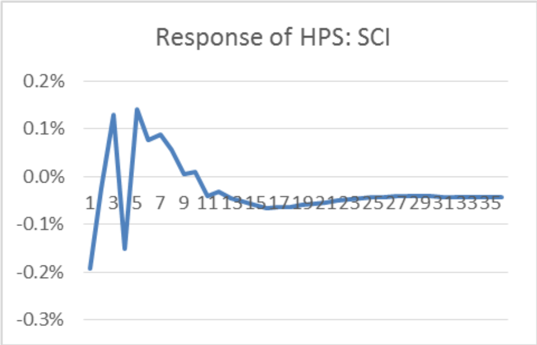


Figure 5.20 Response of HPS to SCI

Figures 5.9, 5.11, 5.13, 5.15, 5.17 and 5.19 illustrate the rescaled GIRF of Beijing housing prices to various shocks for up to 36 months. Figures 5.10, 5.12, 5.14, 5.16, 5.18 and 5.20 illustrate the rescaled GIRF of Shanghai housing prices to various shocks for up to 36 months.

Response to Housing Prices Shocks

Figure 5.9 indicates that following a one percent positive shock to Beijing housing prices, prices increase by 1.1% in the 1st month and 0.6% in the 2nd month. The response dies out after 4 months. Figure 5.10 indicates that following a one percent positive shock to Shanghai housing prices, prices increase by 1.2 % and 0.5% in the 1st and 2nd months, respectively. After 3 months, the response stabilizes at 0.3%.

The two GIRs suggest that a positive feedback effect exists in the housing prices in both Shanghai and Beijing. In Beijing, current housing prices positively influences people's expectation of future prices for up to the next 3 months. In Shanghai, current housing prices positively influence people's expectation of future prices in both the short-run and the long-run. The positive feedback effect could be due to the self-enforcing expectation of housing price appreciation which induces strong investment and speculation demand for housing properties. The conclusions are similar to the findings in Ning & Hoon (2012), Eddie, Hui & Yue (2006), Zhou (2008) and Coleman, LaCour-Little & Vandell (2008).

In addition, housing prices shocks have a permanent impact on prices in Shanghai, but only a transitory impact in Beijing. As the national capital city, the housing market adjustment policies of the central government are always first announced and put into effect in Beijing. This would possibly make buyers in Beijing relatively more conservative than those in Shanghai in making their real estate investment decisions.

Response to Shocks to Bank Credit to Enterprises

Figure 5.11 indicates that following a one percent positive shock to bank credit to enterprises, Beijing housing prices decrease by 0.7% in the first month, and increase thereafter. The peak effect occurs five months after the shock with a 1.7% increase in housing prices. In the long-run, the response stabilizes at 0.8%. Figure 5.12 indicates that following a one percent positive shock to bank credit to enterprises, Shanghai housing prices increase by 1.8% in the first month. The peak effect occurs 6 months after the shock with a 2.6% increase in housing prices. In the long-run, the response stabilized at 2.0%.

The two GIRs suggest, in both the short and long-run, bank credit to enterprises positively impacts housing prices in Beijing and Shanghai. As discussed in chapter 3.3.2, there was evidence that considerable capital flow into the real estate market was actually bank credit to non-real-estate enterprises. This type of capital inflow could dramatically offset the effect of tightened bank credit to real-estate developers after 2010, and give developers sufficient cash flow to raise or at least maintain the housing units' asking prices at a high level. The magnitude of the positive response in Shanghai is larger than that in Beijing. This is probably because that Shanghai and its surrounding areas have more POEs than Beijing and its surrounding areas do. Government oversight is stricter on SOEs than on POEs. Compared to SOEs, POEs would have more freedom to invest larger portions of non-real-estate bank credits into the real-estate market. In addition, even SOEs in the Shanghai area have less strict oversight than those in the Beijing area. Therefore, SOEs in the Shanghai area could invest more bank credit in the real-estate market than those in the Beijing area. Thus, housing prices in Shanghai could be more sensitive to bank credit to enterprises than those in Beijing. We can see more evidence for such arguments in the GIRs of land prices to bank credit to enterprises.

Response to Shocks to Bank Credit to Residents

Figure 5.13 indicates that following a one percent positive shock to bank credit to residents, Beijing housing prices increase by 0.5% in the 3rd month. The peak effect occurs six months after the shock with a 1.6% increase in housing prices. In the long-run, the response stabilizes at 0.9%. Figure 5.14 indicates that following a one percent positive shock to bank credit to residents, Shanghai housing prices increase by 1.4% in the 1st month. The peak effect occurs six months after the shock with a 2.9% increase in housing prices. In the long-run, the response stabilizes at 1.2%.

The two GIRs suggest that overall in the short and long run, bank credit to residents positively impacts housing prices in Beijing and Shanghai. The positive response of Shanghai is faster and larger than that of Beijing. This is probably because,, compared to Beijing, the Shanghai housing market is more market-oriented and less policy driven; therefore, it is more sensitive to capital inflow through bank credit. As discussed in Chapter 3.3.1, bank credit to residents could be used to purchase housing properties directly or to finance real-estate developers through various channels. Overall, bank credit should mainly flow into the demand side. To what extent the bank credit went into the supply side cannot be concluded by the two GIRs. Some results will be shown in the next sub-chapter.

As introduced in Chapter 2, Xu & Chen (2011), Yao, Luo & Loh (2011), Wei & Yuan and Zhou (2008) also found a positive impact of bank credits on housing prices in metropolitan China. Similarly, positive impact of money supply factors on housing prices were found in Hong Kong by Gerlach and Peng (2004); in Taipei by Chen, Tsai & Chang (2007); in the USA by Baffoe-bonnie (1998) and Coleman, LaCour-Little & Vandell (2008); in Helsinki by Oikarinen (2008, 2009); and in European countries by Iacoviello (2000) , Goodhart & Hofmann (2008) and Égert & Mihaljek (2007).

Response to PMI Shocks

Figure 5.15 indicates that following a one unit positive shock to PMI, Beijing housing prices increase by 1.4% in the first month. The peak effect occurs four months after the shock with a 2.9% increase in housing prices. In the long run, the response stabilizes at 1%. Figure 5.16 indicates that following a one unit positive shock to PMI, Shanghai housing prices increase by 2.7% in the first month, with the peak effect of a 3.6% increase occurring at the 4th month. In the long run, the response stabilizes at 1.8%.

The two GIRs suggest that, in the short- and long-run, manufacturing industry conditions positively impact housing prices in Both Beijing and Shanghai. An improved manufacturing industry condition can result in increases in enterprise profit, employee income and employment rate. Increased employee income and employment rate would raise rigid demand for housing properties. Increased enterprise profit could raise investment demand. For example, a considerable number of privately owned enterprises (POEs) invested their extra cash in purchasing housing properties in metropolitan cities. The capital gains of housing properties were expected to be much higher than returns from re-investment in production expending. In addition, the positive impact on housing prices is larger in Shanghai than in Beijing. This is probably because southern China has more manufacturing businesses, especially POEs than northern China does. Hence, investment housing demand from the POEs would be stronger in Shanghai than in Beijing.

Response to Land Prices Shocks

Figures 5.17 and 5.18 indicate housing prices have almost no response to shocks to land prices.

There might be several reasons for why land prices had little impact on housing prices. Firstly, as indicated above, housing prices in metropolitan cities were mainly driven by demand rather than costs of developers. Chen and Patel (1998) also found that housing construction costs had almost no impact on the housing prices in

Taipei. Coleman, LaCour-Little & Vandell (2008) found an insignificant impact of the WRLURI (Wharton land use regulatory index) on metropolitan housing prices in the USA except in the highest tercile of the market. Secondly, sale of housing units lags at least half a year behind land parcel purchase. The lag could be as long as years because of land hoarding. The lag could result in current high housing prices with older cost basis of cheap land before. An example of the irrelevance of land prices could happen in a "second-tier" city such as Eerduosi, Inner Mongolia. Because of the exploration and mining of natural resources around the city such as coal, natural gas and tombarthite, etc., significant housing price appreciation was expected since 2005. The expectation attracted huge capital inflow into the city for real-estate investment, and boosted land prices to a high level. However, after 2011, the demand for housing did not jump up, housing supply severely exceeded demand, and the expectation of housing prices reversed. Even though the land prices were still high at that moment, large amounts of capital retreated out of the city's housing market. The city's 5-year housing price bubble finally burst. The city now has an unpleasant name - "ghost city" - that describes the extremely high housing unites un-sold rate.

As introduced in Chapter 2, Wei & Yuan (2008), Kuang (2005) and Du, Ma & An (2010) found there was a long-run positive impact of land prices to housing prices in China. As discussed in Chapter 5.3, a long-run complementary relationship between housing prices and land prices is found in Beijing.

Response to Stock Index Shocks

Figures 5.19 and 5.20 indicate that the stock index has a slightly positive short-run impact on housing prices in Beijing and Shanghai. It is consistent with the wealth effect. Xu & Chen (2011) also found a positive impact of the stock market on housing prices in China during the period from 1998 to 2010. Nevertheless, as discussed in Chapter 3.4.1, during the subsample period from early 2005 to late 2007, the supportive effect of the stock market on housing prices was expected. However, after early 2008, the supportive effect was questionable. Thus, the interpretation of the slightly positive impact should be made cautiously.

The twelve GIR figures (Figures 5.9 – 5.20) suggest that housing prices in China's metropolitan cities were mainly driven by self-enforcing expectations, bank credits and the real economy.

5.5.2 Land Prices

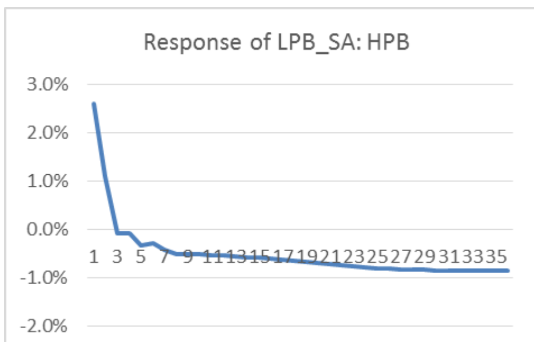


Figure 5.21 Response of LPB_SA to HPB

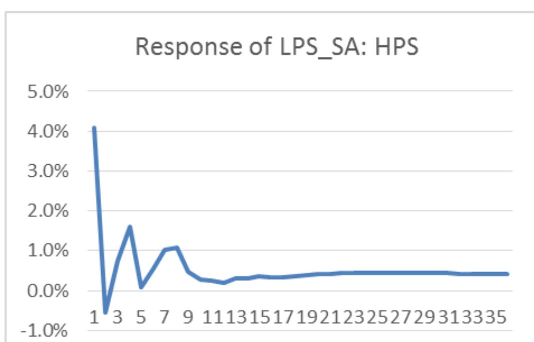


Figure 5.22 Response of LPS_SA to HPS

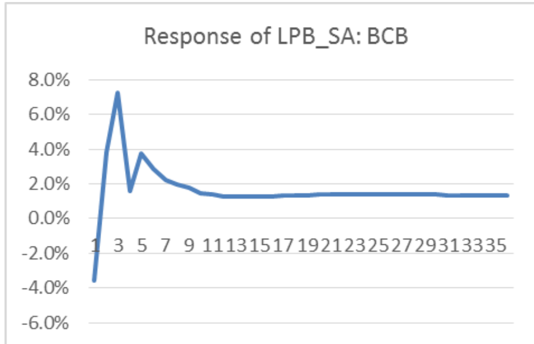


Figure 5.23 Response of LPB_SA to BCB

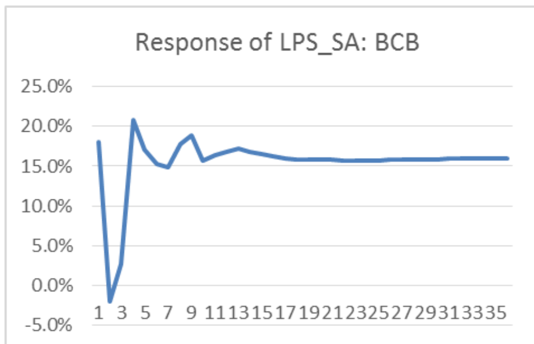


Figure 5.24 Response of LPS_SA to BCB

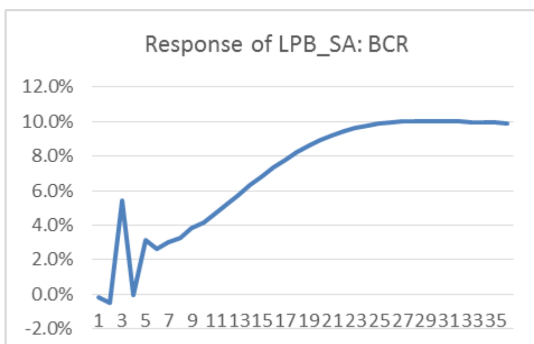


Figure 5.25 Response of LPB_SA to BCR

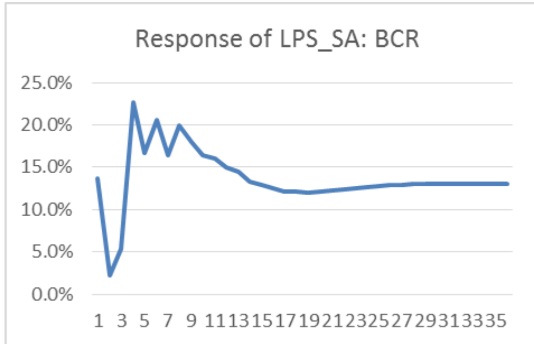


Figure 5.26 Response of LPS_SA to BCR

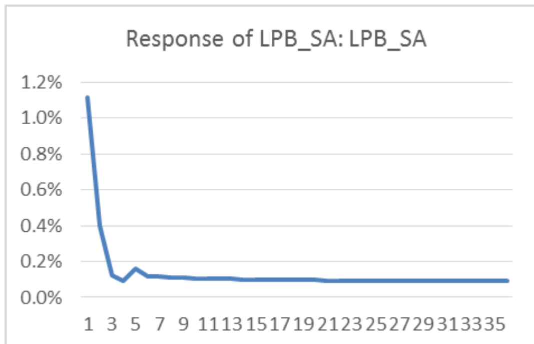


Figure 5.27 Response of LPB_SA to LPB_SA

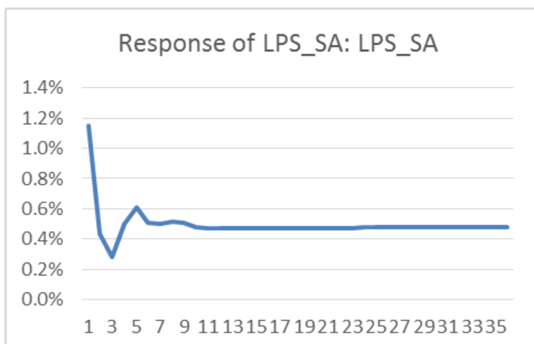


Figure 5.28 Response of LPS_SA to LPS_SA

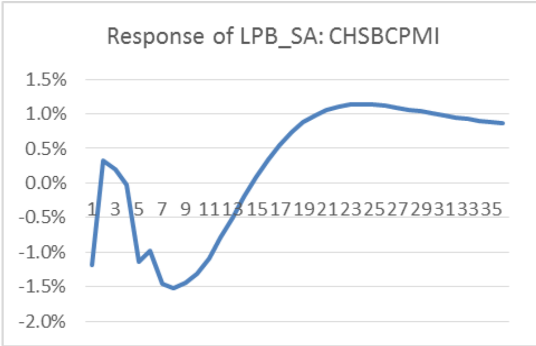


Figure 5.29 Response of LPB_SA to CHSBCPMI

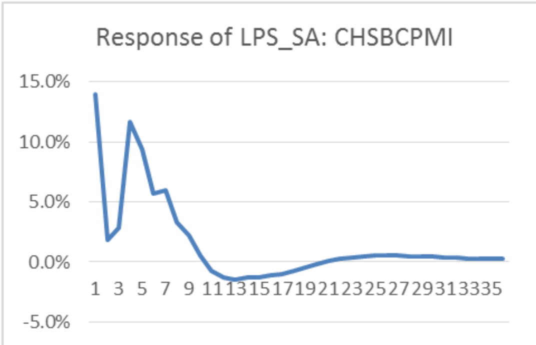


Figure 5.30 Response of LPS_SA to CHSBCPMI

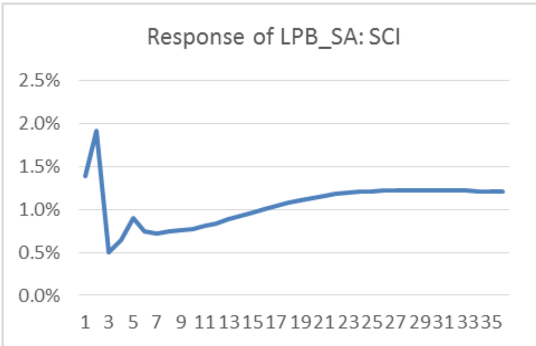


Figure 5.31 Response of LPB_SA to SCI

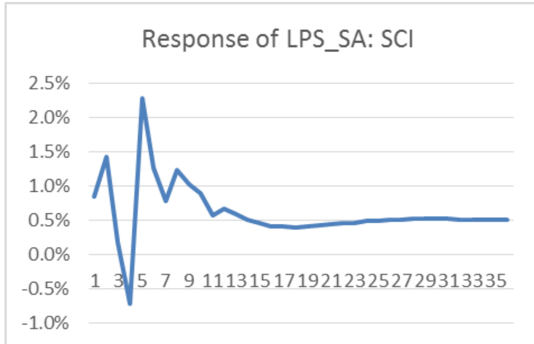


Figure 5.32 Response of LPS_SA to SCI

Figures 5.21, 5.23, 5.25, 5.27, 5.29 and 5.31 illustrate the rescaled GIRFs of Beijing land prices to various shocks for up to 36 months. Figures 5.22, 5.24, 5.26, 5.28, 5.30 and 5.32 illustrate the rescaled GIRFs of Shanghai land prices to various shocks for up to 36 months.

Response to Housing Prices Shocks

Figure 5.21 indicates that following a one percent positive shock to Beijing housing prices, Beijing land prices increase by 2.6% and 1.1% in the 1st and 2nd month, respectively. The response becomes negative after 3 months and stabilizes at -0.8% in the long-run. Figure 5.22 indicates that following a one percent positive shock to Shanghai housing prices, Shanghai land prices increase by 4.0% and 1.4% in the 1st and 4th month, respectively. In the long-run, the response stabilizes at 0.2%.

The two GIRs suggest that, in the short-run, housing prices have a considerably positive impact on land prices in both Beijing and Shanghai. In the long-run, housing prices have a slightly positive impact on land prices in Shanghai. However, Beijing housing prices have some negative impact on Beijing land prices in the long-run. Kuang (2005) also found that housing prices positively interacts with land prices in the short-run in China.

There are several possible explanations for the differences in the long-run responses between the two cities. Firstly, after land prices were boosted upward by housing prices in the short run, municipal governments enacted policies to increase supply of land parcels, aiming to cool down the housing market. Beijing usually implements those policies faster than Shanghai does. This is because relevant national agencies such as the National Development and Reform Commission, Ministry of Construction, etc. are all located in Beijing. Secondly, with Beijing being the national capital, developers in Beijing were more sensitive to the central government's policies to curb housing prices. Such an effect could make developers in Beijing more conservative in the land parcels bidding process than those in Shanghai during the housing price appreciation period.

Besides the above three reasons, the long-run negative response in Beijing may be caused by data limitation. Land prices and housing prices are average prices per square meter. They are not controlled for the location of the housing units or the land parcels. Over time, newly constructed housing units are located further and further away from the center of Beijing and Shanghai. The same situation applies to land parcels. The prices of land parcels and housing units are expected to go down with their distance from city centers. Therefore, our estimates of the GIRFs of housing prices and land prices are likely to be biased downward. This might also explain the negative response of Beijing land prices in the long-run.

Response to Shocks to Bank Credit to Enterprises

Figure 5.23 indicates that following a one percent positive shock to bank credit to enterprises, Beijing land prices increase by 3.8% in the 2nd month. The peak effect occurs three months after the shock with a 7.3% increase in land prices. In the long-run, the response stabilizes at 1.3%. Figure 5.24 indicates that following a one percent positive shock to bank credit to enterprises, Shanghai land prices increase by 17.4% in the first month. The peak effect occurs four months after the shock with a 19.2% increase in land prices. In the long-run, the response stabilizes at 14.6%.

The two GIRs suggest that, in both the short- and long-run, bank credit to enterprises positively impacts land prices in Beijing and Shanghai. In Beijing, the short-run effect is much larger than the long-run effect. In Shanghai, the short-run effect is just slightly larger than the long-run effect. Compared to those of Beijing, the positive responses of Shanghai land prices are larger in both the short- and long-run. As demonstrated in the GIR of housing prices to shocks to bank credit to enterprises, these larger responses could be another piece of evidence that enterprises around Shanghai invested a larger proportion of non-real-estate bank credits into the real-estate market such as land bidding compared to Beijing.

Response to Shocks to Bank Credit to Residents

Figure 5.25 indicates that Beijing land prices almost do not respond to shocks to bank credit to residents in the first two months. In the 3rd month, following a one percent positive shock to bank credit to residents, Beijing land prices increase by 5.4%. In the long-run, the response stabilizes at 9.9%. Figure 5.26 indicates that following a one percent positive shock to bank credit to residents, Shanghai land prices increase by 12.9% in the 1st month. The peak effect occurs four months after the shock with a 22.2% increase in land prices. In the long-run, the response stabilizes at 11.7%.

The two GIRs suggest that, in both the short- and long-run, bank credit to residents positively impacts land prices in Beijing and Shanghai. It indicates that bank credit to residents went into real-estate investments by various channels as discussed in Chapter 3.3.1. The magnitude of the long run impact in Beijing and Shanghai are close. In contrast, the response of Shanghai land prices to bank credit in the short-run is larger than that of Beijing. The difference in the magnitude of short-run responses could be attributed to the residents' investment behaviors: those in Shanghai were more market-sensitive and subjected to less policy restrictions than those in Beijing. It allowed bank credit to residents in Shanghai to enter investment channels more quickly and dramatically. Overall, due to data limitations described earlier in this chapter, these interpretations of land price responses to bank credit in Beijing and Shanghai should be made with caution.

Response to Land Prices Shocks

Figure 5.27 and Figure 5.28 indicate that following a one percent positive shock to land prices, land prices in both Beijing and Shanghai increase by about 1.1% in the 1st month. In the long run, the response in Beijing stabilized at 0.1%, while the long run response in Shanghai stabilized at 0.5%. The land prices positive feedback effect occurred in both Beijing and Shanghai. Current land prices positively influence developers' expectation of future land prices, especially in the short-run. In the long-run, the positive feedback effect is stronger in Shanghai than that in Beijing. Similar to the reasons discussed earlier in this chapter, compared to those in Shanghai, developers in Beijing might be relatively more conservative in the bidding of land parcels.

Response to PMI Shocks

Figure 5.29 and Figure 5.30 indicate that land prices positively respond to a one unit shock to PMI in the long-run in both Beijing and Shanghai. The short-run response of Beijing is inconclusive. The relatively large positive response of Shanghai could be partially related to reasons discussed in the GIR of housing prices to PMI shocks, which is that manufacturing enterprises invested their extra cash in the real estate market.

Response to Stock Index Shocks

Figure 5.31 and Figure 5.32 indicate that land prices were positively impacted by shocks to the stock market. Similar to the discussion in Chapter 5.5.1, it is consistent with the wealth effect with a cautious interpretation.

5.5.3 PMI

Response to Shocks to Housing Prices

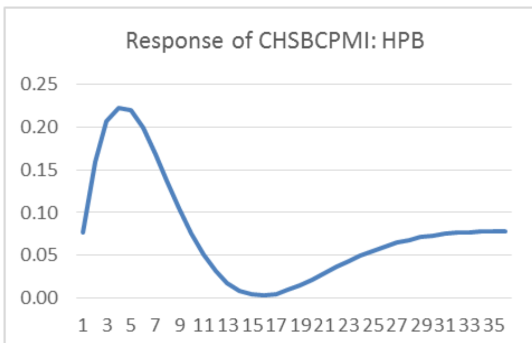


Figure 5.33 Response of CHSBCPMI to HPB

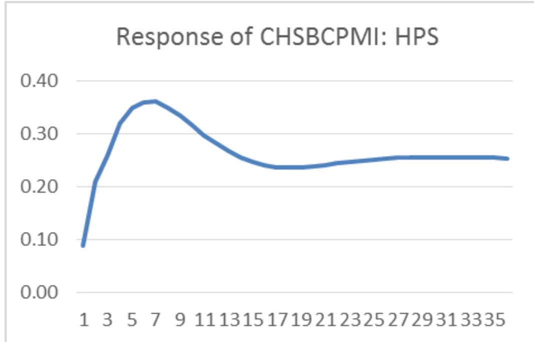


Figure 5.34 Response of CHSBCPMI to HPS

Figure 5.33 indicates that following a one percent positive shock to Beijing housing prices, PMI increases by 0.08 and 0.16 units in the first two months. The peak effect occurs four months after the shock with a 0.22 unit increase in PMI. In the long-run, the response stabilized at 0.08 units. Figure 5.34 indicates that following a one percent positive shock to Shanghai housing prices, the PMI increases by 0.09 and 0.22 units in the first two months. The peak effect occurs six months after the shock with a 0.39 unit increase of the PMI. In the long-run, the response stabilized at 0.26 units.

The two GIRs suggest that housing prices positively impact the manufacturing industry on a modest scale. As discussed in Chapter 3.5.1, the relationship between the housing market and the manufacturing industry was complementary. Zhou (2008) also found that, in China, housing prices positively impact local industrial production.

Response to Shocks to Other Variables

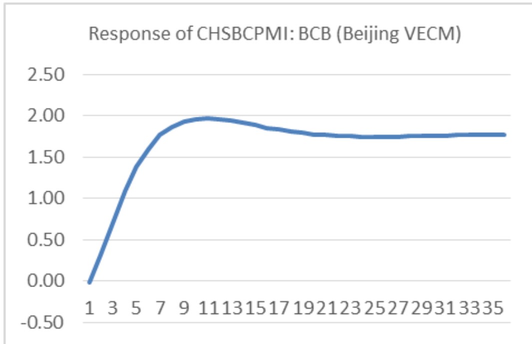


Figure 5.35 Response of CHSBCPMI to BCB (Beijing)

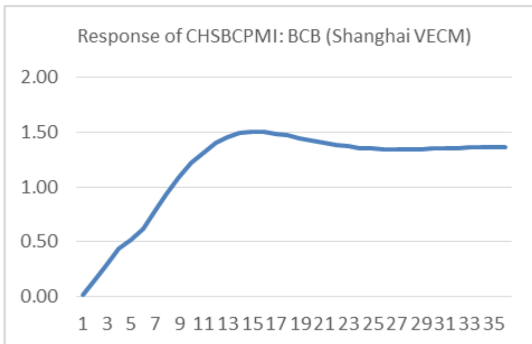


Figure 5.36 Response of CHSBCPMI to BCB (Shanghai)

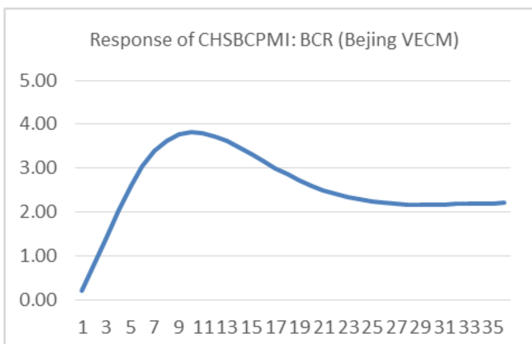


Figure 5.37 Response of CHSBCPMI to BCR (Beijing)

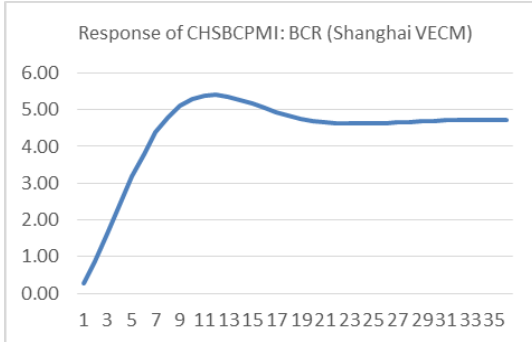


Figure 5.38 Response of CHSBCPMI to BCR (Shanghai)

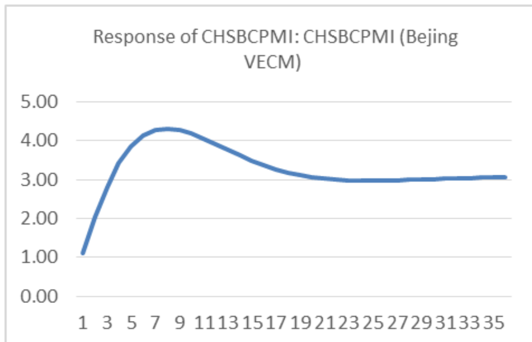


Figure 5.39 Response of CHSBCPMI to CHSBCPMI (Beijing)

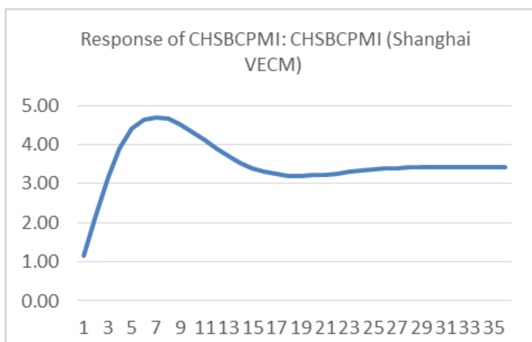


Figure 5.40 Response of CHSBCPMI to CHSBCPMI (Shanghai)

Figures 5.35 to 5.40 illustrate the rescaled GIRF of PMI to shocks to bank credits and to PMI itself according to the VECMs of Beijing and Shanghai. Bank credit to enterprises has a positive impact on the manufacturing industry possibly due to the supportive effect on the enterprises' cash chain. The positive impact from bank credit to residents is possibly due to an increase in household consumption. The positive impact from PMI itself may reflect the industry momentum. Nevertheless, detailed research of these responses is out of the scope of the main research objectives of this dissertation.

5.5.4 Stock Market

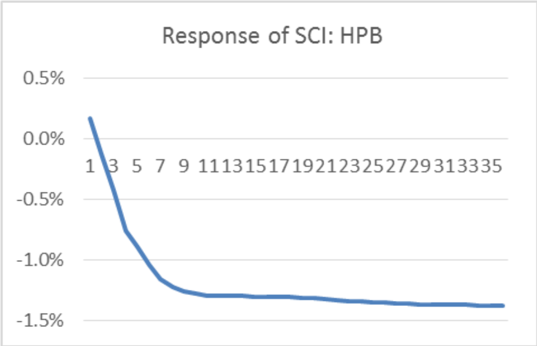


Figure 5.41 Response of SCI to HPB

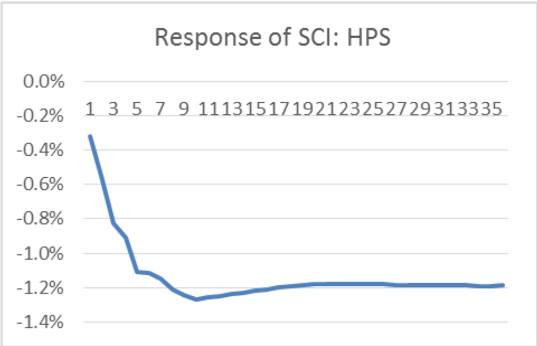


Figure 5.42 Response of SCI to HPS

Figure 5.41 and Figure 5.42 suggest that housing prices negatively impact the stock index in both the short- and long-run. In the long-run, following a one percent positive shock to Beijing housing prices, the stock index decreases by about

1.4%; following a one percent positive shock to Shanghai housing prices, the stock index decreases by about 1.2%. As discussed in chapter 3.4.1, the two GIRs reflect the investment channel substitution effect from the stock market to the housing market.

5.6 Impacts of Exogenous Variable

There are three exogenous variables in the VECMs- housing properties purchase restriction policy, borrowing interest rates and residents' disposable income, all lagged by one month.

The purchase restriction policy variable is very significant in the housing prices equation of both the Beijing and Shanghai models. The coefficient of PRP in the Beijing model indicates that after Jan, 2011, the restriction policies in Beijing decreased the growth rate of Beijing housing prices by about 8.6% in the short-run. The coefficient in the Shanghai model indicates that the restriction policies in Shanghai decreased the growth rate of housing prices by about 6.3% in the short-run. The restrictive policies have a strong effect in curbing the appreciation of housing prices. As discussed in Chapter 3.7, the strong curbing effect suggests that there was a considerable amount of investment/speculative capital inflow on the demand side in the two cities from year 2005 to 2010. These policies were effective in blocking out those capital flows.

The borrowing interest rate variable is insignificant in the housing prices equation in both the Beijing and Shanghai models. It is inconsistent with some of the findings that interest rate negatively impacts housing prices in the U.S. and in other developed countries. As introduced in Chapter 3.3.3, unlike the U.S. where the mortgage rate is fixed for at least 3 years from loan origination, mortgage rates in

China are not fixed during the entire loan period. Changes in interest rates only affect mortgage payments for one year. Hence, the interest rate is not expected to have a significant impact on the demand side. On the supply side, developers finance from both bank credits and non-bank credits. Since non-bank credits are always charged at much higher interest rates than bank credits, even if the benchmark lending rates were raised, developers would still try to finance from the relatively cheaper bank credits as much as possible. Additionally, profits from housing sales are always expected to be much higher than the cost of capital for developers. Thus, neither house buyers nor real estate developers are sensitive to changes in the interest rate. Yao, Luo & Loh (2011), Liang & Cao (2007) and Wei & Yuan (2008) also found a lack of impact of interest rate on housing prices in China.

The disposable income is also insignificant in the housing price equations in the two VECMs. It suggests that income variations of the cities' residents did not matter to housing prices. There are several possible reasons. As discussed before, a considerable share of housing units in Beijing and Shanghai were bought with investment/speculative capital which is less related to local residents' income. In addition, the income data on local residents are from the municipal Bureau of Statistics. In China, the method used by the municipal Bureau does not include "off-the-wage-sheet" income and gray income, etc., which can be a significant portion of the total income of residents. Wei & Yuan (2008) and Zhang, Hua & Zhao (2012) also found that disposable income had an insignificant impact on housing prices in China. While, Chen & Patel (1998) found that household income had a modest positive impact on housing prices in Taipei; and Mahalik & Mallick (2011) found that the real income significantly and positively impacted housing prices in India.

5.7 Policy Implications

In summary, two of the main reasons for the rapid appreciation of housing prices in China's metropolitan cities during the period of 2005-2012 are: 1. self-enforcing expectation; 2. huge bank credits capital inflow. Thus, policy implications on housing prices can be addressed from both demand and supply side mechanisms.

5.7.1 Existing Housing Market Policies

As discussed in Chapters 3.3.1, 3.3.2 and 5.5, tightening bank credit to developers was not an effective way to prevent housing prices from rapidly appreciating since developers were able to raise capital from various other channels. Adjusting interest rate was not effective either due to reasons discussed in Chapters 3.3 and 5.6. As discussed in Chapter 5.6, the policies of housing properties purchase restriction, in contrast, had been very effective by influencing the demand side. However, the purchase restriction policies are fundamentally against the free market approach. They should not be applied over a long period of time due to possible distortions to long run market efficiency.

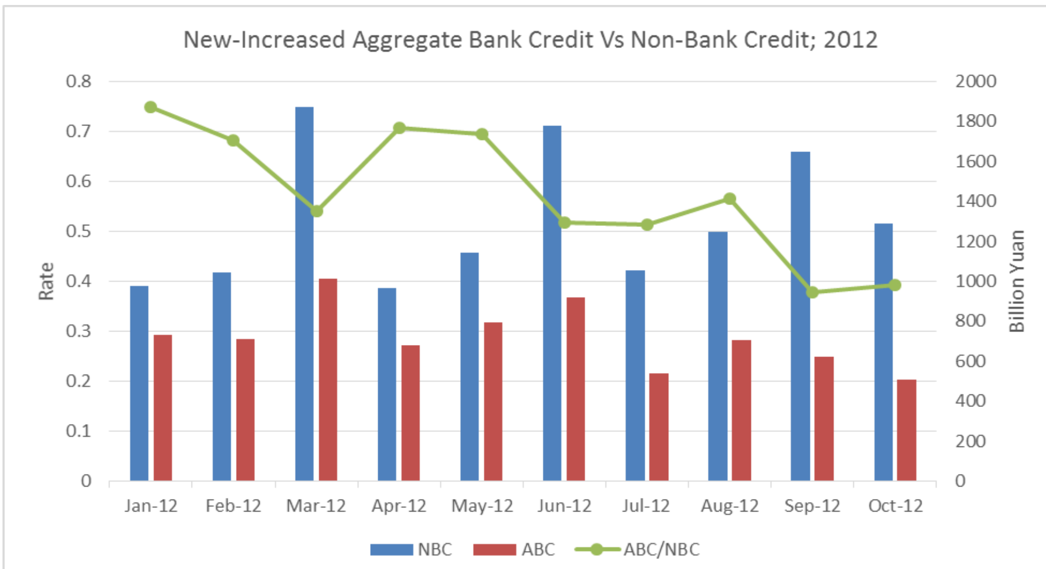
5.7.2 Suggestions

A balanced policy approach to influence housing prices can be "control one side, open the other side."

Control One Side

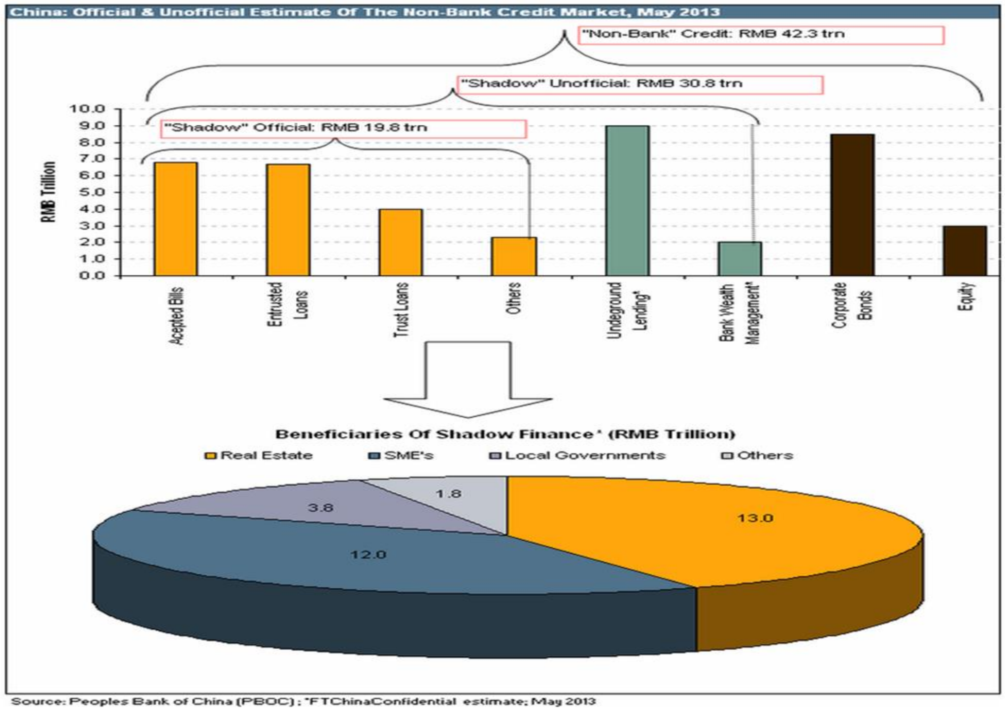
"Control one side" refers to restricting investment or speculative capital from flowing into both the demand side and the supply side of the housing markets.

To implement the policy, one must realize that the capital inflow into China's real-estate market was not only from bank credit, but also from non-bank credit, especially in the last 5 years up to late 2012. At an aggregate level, there is evidence that non-bank credit financing was larger in scale than bank credit. In addition, a significant proportion of the non-bank credit entered the real estate market. Although time series data for the sample period is not available, partial data support these observations, as shown in Figures 5.43 and 5.44.



Note: NBC- New-increased non-bank credit; ABC- New-increased aggregate bank credit; New-increased means month over month difference; Data Source: People's Bank of China.

Figure 5.43 Bank Credit Vs Non-Bank Credit, 2012



Note: Data Source: People's Bank of China

Figure 5.44 China Estimation of the Non-bank Credit Market, May 2013

Figure 5.43 indicates that in 2012, non-bank credit was not only larger than bank credit in total amount, but it also grew faster. Figure 5.44 indicates that by May 2013, shadow banking credit accounted for about 73% of the total non-bank credit. About 42% of the shadow banking credit (RMB 13T out of 30.6T from the pie chart) entered the real estate market.

Thus, besides mortgage loans to consumers and bank credit to developers, other channels of financing allowed more capital to enter China's real estate market. To curb housing prices appreciation in metropolitan cities from both the demand and supply side, government restrictions should cover various financing channels for both housing property buyers and developers. For example, as discussed in Chapters 3.3 and 5.5, regulators should impose stricter supervision on banks' off-balance-sheet activities to prevent large amount of investment capital inflow to real estate markets through products such as trust and wealth management. Despite the challenges, regulators should also seek ways to supervise the shadow banking system. However, restrictive housing financing policies are likely to lead to various economic inefficiencies in the long run.

Open the Other Side

"Open the Other Side" means the government should develop and open up other attractive investment channels to entice speculative and investment capitals to exit the real estate market. For example, the Chinese government has already started to open up the banking industry to private capital. In late 2013, the China Banking Regulatory Commission approved more than 30 new privately owned banks to start business in the next 3 years. Private capital investments of several-hundred-billion RMB were attracted according to unofficial statistics. The Chinese government should open more previously SOEs monopolized markets to other business entities, especially to POEs (privately owned- enterprises). These include the regional and national markets of financial institutions, electricity, energy resources, and communication industries, etc. The government should also improve other investment channels such as stock, bond and trust markets. These improvements should let those investment channels provide more products with higher expected returns and lower risk. Such investment products are expected to dilute the 75% of total residents' wealth allocation in housing properties, as indicated in Chapter 1.3. In addition, the government can gradually open up the "closed" capital accounts[19]. Dropping controls

19 In China, strict rules restrict corporations and individuals to move money in or out of the country freely. The limit for individuals is currently 50,000 USD within a year, while corporate investments need government approval.

on capital accounts and making RMB fully convertible will encourage corporations and individuals to invest in various foreign markets.

Beside these two aspects, other policy approaches can be narrowing the economic development gap between metropolitan cities and other mid/small size cities. The government should expedite industry upgrades and encourage the development of higher quality businesses in mid/small size cities. Rather than enforcing the housing property purchase restriction policies, the creation of high quality jobs in mid/small cities is expected to relieve the high quality labor inflow into metropolitan cities, and hence reduce the demand for housing properties.

Thus, overall, the role of the government is to install policies of further and broader macroeconomic market reforms. The expected outcome should be more market-oriented capital distribution that translates into housing market efficiency in the long-run. However, implementing economic reform policies will be a massive project which ultimately can attract capital investments away from the over-heated housing market into new investment opportunities, and attract high quality labor into mid/small cities. This will require strategic planning, careful specification of objective functions and decent understanding of public policies that affect housing markets in a longer time frame.

Chapter 6

CONCLUSIONS

The overall objective of this dissertation is to investigate determinants of housing prices in Chinese metropolitan cities Beijing and Shanghai, from Jan, 2005 to Oct, 2012. The dynamic causal relationships between housing prices and those relevant determinants have been quantified. The determinants include land prices, bank credit to residents, bank credit to enterprises, the stock market, the manufacturing industry, interest rate, disposable income and purchase-restriction policies. The methodologies employed include the estimation of unit root test, Johansen Cointegration tests, specification of VECMs, generalized forecast error variance decomposition (GFEVD) and generalized impulse response functions (GIRF).

The study found evidence that bank credits, the real economy and self-enforcing expectations are significant drivers of rapid housing price appreciation in Beijing and Shanghai during the examined period. The study found three and one long-run equilibrium relationships in Beijing and Shanghai, respectively. Generally speaking, GFEVD and GIRF found relationships in both Beijing and Shanghai: 1. housing prices positively impacted land prices, while, land prices had little or no impact on housing prices; 2. housing prices negatively impacted the stock market, while, stock market had a tiny positive impact on housing prices; 3. housing prices were positively impacted by both bank credit to residents and bank credit to enterprises; 4. housing prices and the manufacturing industry were positively impacted by each other; 5. purchase- restriction policies had a negative impact on housing prices, while, borrowing interest rate and city residents' income had no impact on housing prices. The effects are of different magnitudes in the two cities mainly because of policy differences.

A number of limitations of this study should also be noted. Firstly, the theoretical model implemented in the study is a partial macroeconomic system which did not permit a full investigation of other direct/indirect influences on housing prices and those determinants. Secondly, data collection in a developing country such as China presents a number of difficulties. The study was not able to obtain data that distinguish bank credits to residents on the demand side from those to the housing supply side; Furthermore, the study was not able to obtain data that distinguish the proportions of cash inflow to the supply side that are from developers' bank credits and from other channels. Housing prices and land prices collected from a private institution may be inaccurate. The inaccuracy may cause quantitatively-based causality results to be inaccurate. These limitations provide a room for future research to address these shortcomings.

Finally, there are a number of policy implications provided. Besides the purchase restriction policies and a possible future housing property tax, the government can curb metropolitan cities' housing price appreciation from two major sides: 1. control investment/speculation capitals inflow to both the demand and supply sides; 2. continue economic reform, create more investment channels for enterprises and residents, to guide investment capital away from the real estate market.

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Appendix A

TABLES

Table A. 1 Unit Root Tests of HPB

HPB	Level(with constant and linear trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	6	-1.977104	0.6053	DS with Drift	5	-4.21851	0.0011	CS nonzero mean
SIC	0	-2.471727	0.3413	DS with Drift	0	-10.39182	0	CS nonzero mean
1% CV		-4.059734				-3.503049		
5% CV		-3.462292				-2.895109		
Conclusion	I(1) with drift							
DF-GLS Test								
	Level(with constant and linear trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	6	-2.137729		DS with Drift	5	-2.424686		CS nonzero mean
SIC	0	-2.371371		DS with Drift	4	-2.153465		CS nonzero mean
1% CV		-3.6066				-2.591505		
5% CV		-3.0524				-1.94453		
Conclusion	I(1) with drift							
Finanial Conclusion: HPB is an I(1) with drift process.								

Table A. 2 Unit Root Tests of HPS

HPS	Level(with constant and linear trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	1	-3.344	0.066	DS with Drift	0	-12.444	0.000	CS nonzero mean
SIC	0	-4.284	0.005	TS	0	-12.444	0.000	CS nonzero mean
1% CV		-4.060				-3.503		
5% CV		-3.459				-2.893		
Conclusion	I(1) with drift							
DF-GLS Test								
	Level(with constant and linear trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	1	-2.129		DS with Drift	4	-1.209		DS no drfit
SIC	1	-2.129		DS with Drift	4	-1.209		DS no drfit
1% CV		-3.610				-2.592		
5% CV		-3.056				-1.945		
Conclusion								
Finanial Conclusion: HPS is an I(1) with drift process.								

Table A. 3 Unit Root Tests of LPB_SA

LPB_SA	Level(with constant and liner trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	6	-1.30962	0.879	DS with Drift	5	-4.661771	0.0002	CS nonzero mean
SIC	0	-3.378826	0.0605	DS with Drift	1	-9.747915	0	CS nonzero mean
1% CV		-4.059734				-3.503879		
5% CV		-3.458856				-2.893589		
Conclusion	I(1) with drift							
DF-GLS Test								
	Level(with constant and liner trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	6	-1.259015		DS with Drift	11	-0.562011		DS no drift
SIC	1	-2.379039		DS with Drift	1	-6.464655		CS nonzero mean
1% CV		-3.6104				-2.591813		
5% CV		-3.0556				-1.944574		
Conclusion	I(1) with drift							
Finanial Conclusion: LPB_SA is an I(1) with drift process.								

Table A. 4 Unit Root Tests of LPS_SA

LPS_SA	Level(with constant and liner trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	2	-2.25272	0.4549	DS with Drift	2	-9.925979	0.0000	CS nonzero mean
SIC	2	-2.25272	0.4549	DS with Drift	1	-11.4775	0	CS nonzero mean
1% CV		-4.06204				-3.503879		
5% CV		-3.45995				-2.893589		
Conclusion	I(1) with drift							
DF-GLS Test								
	Level(with constant and liner trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	2	-2.27254		DS with Drift	2	-9.991375		CS nonzero mean
SIC	2	-2.27254		DS with Drift	1	-11.5349		CS nonzero mean
1% CV		-3.6142				-2.590622		
5% CV		-3.0588				-1.944404		
Conclusion	I(1) with drift							
Finanial Conclusion: LPS_SA is an I(1) without drift process.								

Table A. 5 Unit Root Tests of BCR

BCR	Level(with constant and Liner Trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	3	-3.330284	0.068	DS with Drift	2	-2.45912	0.1289	DS no drift
SIC	3	-3.330284	0.068	DS with Drift	0	-3.142055	0.027	CS nonzero mean
1% CV		-4.063233				-3.504727		
5% CV		-3.460516				-2.893956		
Conclusion	I(1) with drift							
DF-GLS Test								
	Level(with constant and Liner Trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	3	-2.894645		DS with Drift	2	-1.878825		DS no drift
SIC	3	-2.894645		DS with Drift	1	-2.425282		CS nonzero mean
1% CV		-3.618				-2.590622		
5% CV		-3.062				-1.944404		
Conclusion	I(1) with drift							
Finanial Conclusion: BCR is an I(1) with drift process.								

Table A. 6 Unit Root Tests of BCB

BCB	Level(with constant and Liner Trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	4	-2.146358	0.5129	DS with Drift	3	-4.562486	0.0003	CS nonzero mean
SIC	1	-2.258775	0.4517	DS with Drift	0	-6.497879	0	CS nonzero mean
1% CV		-4.060874				-3.503049		
5% CV		-3.459397				-2.89323		
Conclusion	I(1) with drift							
DF-GLS Test								
	Level(with constant and Liner Trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	4	-1.634576			4	-2.919897		CS nonzero mean
SIC	1	-1.699464			0	-5.846639		CS nonzero mean
1% CV		-3.6104				-2.59034		
5% CV		-3.0556				-1.944364		
Conclusion	I(1) with drift							
Finanial Conclusion: BCR is an I(1) with drift process.								

Table A. 7 Unit Root Tests of SCI

SCI	Level(with constant)				1st Difference(without constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	4	-2.964618	0.0422		4	-2.958968	0.0035	CS zero mean
SIC	4	-2.964618	0.0422		1	-5.009797	0.0000	CS zero mean
1% CV		-3.505595				-2.590622		
5% CV		-2.894332				-1.944404		
Conclusion	I(1) without drift							
DF-GLS Test								
	Level(with constant)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	6	-1.29779		DS no drift	3	-2.152058		CS zero mean
SIC	0	-0.744288		DS no drift	3	-2.152058		CS zero mean
1% CV		-2.590065				-2.591204		
5% CV		-1.944324				-1.944487		
Conclusion	I(1) without drift							
Finanial Conclusion: SCI is an I(1) without drift process.								

Table A. 8 Unit Root Tests of SCI (Long Term)

SCI 1991M1-2012M10								
SCI	Level(with constant and Linear Trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	11	-4.67496	0.0010	TS	10	-3.795252	0.0034	CS nonzero mean
SIC	0	-3.436056	0.0489	DS with drift	0	-16.83305	0.0000	CS nonzero mean
1% CV		-3.993608				-3.455387		
5% CV		-3.427137				-2.872455		
Trend	AIC: Significant; SIC: Insignificant							
Conclusion	I (1) with drift							
DF-GLS Test								
	Level(with constant and Linear Trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	11	-1.920188		DS with drift	10	-3.605526		CS nonzero mean
SIC	0	-1.29911		DS with drift	0	-16.77264		CS nonzero mean
1% CV		-3.4661				-2.573886		
5% CV		-2.9178				-1.94205		
Conclusion	I (1) with drift							
Finanial Conclusion: I(1) with drift								

Table A. 9 Unit Root Tests of CHSBCPMI

CHSBCPMI	Level(with constant)				1st Difference(without constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	3	-1.029207	0.7400	DS no drift	2	-3.133433	0.0020	CS zero mean
SIC	1	-1.698599	0.4286	DS no drift	0	-2.083769	0.0363	CS zero mean
1% CV		-3.503049				-2.59034		
5% CV		-2.89323				-1.944364		
Conclusion	I(1) without drift							
DF-GLS Test								
	Level(with constant)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	3	0.21988		DS no drift	2	-3.28673		CS zero mean
SIC	1	-0.629324		DS no drift	2	-3.28673		CS zero mean
1% CV		-2.59034				-2.59091		
5% CV		-1.944364				-1.944445		
Conclusion	I(0)							
Finanial Conclusion: CHSBCPMI is an I(1) without drift process.								

Table A. 10 Unit Root Tests of DIB_SA

DIB_SA	Level(with constant, linear trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	12	-1.6007	0.7843	DS with drift	11	-5.4632	0.0000	CS nonzero mean
SIC	3	-3.3880	0.0594	DS with drift	2	-7.8200	0.0000	CS nonzero mean
1% CV		-4.0753				-3.5133		
5% CV		-3.4662				-2.8977		
Conclusion	I(1) with drift							
DF-GLS Test								
	Level(with constant and linear trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	12	-1.5674		DS with drift	11	-2.1136		CS nonzero mean
SIC	3	-3.4111						
1% CV		-3.6522				-2.5921		
5% CV		-3.0908				-1.9446		
Conclusion	I(1) with drift							
Finanial Conclusion:DIB_SA is an I(1) with drift process.								

Table A. 11 Unit Root Tests of DIS_SA

DIS_SA	Level(with constant, linear trend)				1st Difference(with constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	1	-5.602696	0.0001	TS				
SIC	1	-5.602696	0.0001	TS				
1% CV		-4.060874						
5% CV		-3.459397						
Conclusion	TS process							
DF-GLS Test								
	Level(with constant and linear trend)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	3	-2.400075		DS with drift	8	-0.7390		DS no drift
SIC	1	-3.702408		TS				
1% CV		-3.6104				-2.592782		
5% CV		-3.0556				-1.944713		
Conclusion	TS process							
Finanial Conclusion:DIS_SA is TS process								

Table A. 12 Unit Root Tests of MR

MR	Level(with constant)				1st Difference(without constant)			
ADF Test								
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	2	-1.989765	0.2909	DS no drift	1	-4.639346	0.0000	CS zero mean
SIC	1	-1.698117	0.4289	DS no drift	0	-6.758024	0.0000	CS zero mean
1% CV		-3.503049				-2.59034		
5% CV		-2.89323				-1.944364		
Conclusion	I(1) without drift							
DF-GLS Test								
	Level(with constant)				1st Difference(with constant)			
	Optimal Lag	t-statistics	p-value	Result	Optimal Lag	t-statistics	p-value	Result
AIC	2	-1.665046		DS no drift	1	-4.645088		CS zero mean
SIC	1	-1.390357		DS no drift	0	-6.764741		CS zero mean
1% CV		-2.59034				-2.59034		
5% CV		-1.944364				-1.944364		
Conclusion	I(1) without drift							
Finanial Conclusion: MR is an I(1) without drift process.								

Table A. 13 Johansen Cointegration Test (Beijing)

Sample (adjusted): 2005M04 2012M10
Included observations: 91 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: HPB BCB BCR LPB_SA SCI CHSBCPMI
Exogenous series: D(MR) PRP D(DIB_SA)

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.400913	155.8047	117.7082	0.0000
At most 1 *	0.319957	109.1810	88.80380	0.0008
At most 2 *	0.301373	74.09148	63.87610	0.0055
At most 3	0.264170	41.45543	42.91525	0.0695
At most 4	0.123956	13.54066	25.87211	0.6952
At most 5	0.016325	1.497821	12.51798	0.9910

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.400913	46.62374	44.49720	0.0289
At most 1	0.319957	35.08948	38.33101	0.1125
At most 2 *	0.301373	32.63605	32.11832	0.0432
At most 3 *	0.264170	27.91477	25.82321	0.0261
At most 4	0.123956	12.04284	19.38704	0.4112
At most 5	0.016325	1.497821	12.51798	0.9910

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI	@TREND(05M02)
24.40549	15.11181	-20.21951	-4.606118	4.182983	-0.025815	0.032134
7.201442	-30.06514	32.04262	3.013487	-3.845665	-0.072590	-0.365632
-5.577965	-6.522102	12.39724	-2.058911	1.003921	0.045188	-0.133305

5.989681	17.46681	18.26369	0.474840	1.836971	-0.120080	-0.546520
-0.633966	17.37762	-20.59153	0.003373	-2.311636	0.088786	0.044730
9.420523	-52.73896	9.274045	-0.182603	-2.157355	-0.160660	0.655609

Unrestricted Adjustment Coefficients (alpha):

D(HPB)	-0.016353	-0.025274	0.002888	-0.006332	-0.008806	-0.000296
D(BCB)	0.000351	0.002184	-0.002402	-0.000875	-0.001315	0.000544
D(BCR)	0.000398	-0.000920	-0.003566	0.001190	0.000218	0.000530
D(LPB_SA)	0.065714	-0.116951	0.092442	-0.039130	-0.001834	0.020561
D(SCI)	-0.031567	-0.001822	0.015603	0.013668	0.002079	0.006059
D(CHSBCPMI)	0.104655	-0.192407	0.034838	0.429696	-0.274204	-0.016690

1 Cointegrating Equation(s): Log likelihood 724.1704

Normalized cointegrating coefficients (standard error in parentheses)

HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI	@TREND(05M02)
1.000000	0.619197	-0.828482	-0.188733	0.171395	-0.001058	0.001317
	(0.40608)	(0.30165)	(0.03037)	(0.04268)	(0.00117)	(0.00546)

Adjustment coefficients (standard error in parentheses)

D(HPB)	-0.399106
	(0.16065)
D(BCB)	0.008563
	(0.02360)
D(BCR)	0.009704
	(0.02340)
D(LPB_SA)	1.603790
	(0.93785)
D(SCI)	-0.770398
	(0.20650)
D(CHSBCPMI)	2.554157
	(3.42649)

3 Cointegrating Equation(s): Log likelihood 758.0332

Normalized cointegrating coefficients (standard error in parentheses)

HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI	@TREND(05M02)
1.000000	0.000000	0.000000	-0.227132	0.160768	-0.000719	-0.008502
			(0.03793)	(0.04676)	(0.00110)	(0.00218)
0.000000	1.000000	0.000000	-1.002847	0.750774	0.013162	-0.012320
			(0.19543)	(0.24093)	(0.00569)	(0.01125)
0.000000	0.000000	1.000000	-0.795864	0.548292	0.010246	-0.021060
			(0.17398)	(0.21448)	(0.00506)	(0.01001)

Adjustment coefficients (standard error in parentheses)

D(HPB)	-0.597225	0.493906	-0.443390
	(0.15320)	(0.20157)	(0.23445)
D(BCB)	0.037686	-0.044684	0.033098
	(0.02319)	(0.03052)	(0.03549)
D(BCR)	0.022969	0.056930	-0.081732
	(0.02235)	(0.02941)	(0.03421)
D(LPB_SA)	0.245931	3.906307	-3.930115
	(0.89348)	(1.17561)	(1.36733)
D(SCI)	-0.870555	-0.524004	0.773303
	(0.21522)	(0.28318)	(0.32936)
D(CHSBCPMI)	0.974228	7.139049	-7.849401
	(3.60913)	(4.74875)	(5.52320)

Table A. 14 Johansen Cointegration Test (Shanghai)

Sample (adjusted): 2005M05 2012M10
Included observations: 90 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: HPS BCR LPS_SA BCB SCI CHSBCPMI
Exogenous series: D(MR) PRP DIS_DETR

Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.495778	151.1587	117.7082	0.0001
At most 1 *	0.330456	89.53219	88.80380	0.0442
At most 2	0.218843	53.42789	63.87610	0.2751
At most 3	0.178810	31.19978	42.91525	0.4326
At most 4	0.130604	13.46975	25.87211	0.7010
At most 5	0.009661	0.873714	12.51798	0.9996

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.495778	61.62649	44.49720	0.0003
At most 1	0.330456	36.10429	38.33101	0.0881
At most 2	0.218843	22.22811	32.11832	0.4758

At most 3	0.178810	17.73003	25.82321	0.3982
At most 4	0.130604	12.59604	19.38704	0.3617
At most 5	0.009661	0.873714	12.51798	0.9996

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI	@TREND(05M02)
32.78756	16.57640	-0.127816	-52.76998	3.577847	-0.181261	0.184629
8.445410	-14.56371	-1.675596	29.78787	5.264076	-0.069758	0.013467
3.168947	25.27430	-1.442041	-19.64514	2.918340	-0.069727	-0.150586
8.452109	-23.90459	-0.711394	-10.68220	0.983208	0.063240	0.483159
8.594196	-14.71868	-0.905093	-22.72466	-0.242760	-0.032609	0.562500
-1.747078	13.20337	1.558330	-51.75606	-1.851239	-0.134988	0.602396

Unrestricted Adjustment Coefficients (alpha):

D(HPS)	-0.039340	0.015202	0.003429	0.008565	-0.009245	0.000575
D(BCR)	0.000612	0.002591	-0.001187	0.000747	0.000806	0.000470
D(LPS_SA)	-0.147651	0.099330	0.167803	0.087217	0.074192	0.001862
D(BCB)	0.001520	-0.000156	0.000225	0.002568	-0.000375	0.000492
D(SCI)	-0.008732	-0.012058	0.012726	-0.016218	0.006453	0.005014
D(CHSBCPMI)	0.156889	0.436264	0.245120	-0.098541	-0.183214	0.013851

1 Cointegrating Equation(s): Log likelihood 687.0946

Normalized cointegrating coefficients (standard error in parentheses)

HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI	@TREND(05M02)
1.000000	0.505570	-0.003898	-1.609451	0.109122	-0.005528	0.005631
	(0.18207)	(0.01034)	(0.29817)	(0.02587)	(0.00073)	(0.00360)

Adjustment coefficients (standard error in parentheses)

D(HPS)	-1.289878
	(0.23446)
D(BCR)	0.020072
	(0.03054)
D(LPS_SA)	-4.841121
	(2.06492)
D(BCB)	0.049849
	(0.03247)
D(SCI)	-0.286307
	(0.30107)
D(CHSBCPMI)	5.143997

(4.40022)

2 Cointegrating Equation(s):	Log likelihood	705.1468

Normalized cointegrating coefficients (standard error in parentheses)

HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI	@TREND(05M02)
1.000000	0.000000	-0.047995	-0.444939	0.225693	-0.006148	0.004716
		(0.01459)	(0.35083)	(0.03673)	(0.00076)	(0.00517)
0.000000	1.000000	0.087221	-2.303366	-0.230573	0.001225	0.001810
		(0.02490)	(0.59885)	(0.06269)	(0.00130)	(0.00882)

Adjustment coefficients (standard error in parentheses)

D(HPS)	-1.161493	-0.873518
	(0.23381)	(0.15237)
D(BCR)	0.041955	-0.027590
	(0.02966)	(0.01933)
D(LPS_SA)	-4.002234	-3.894145
	(2.09236)	(1.36360)
D(BCB)	0.048531	0.027476
	(0.03352)	(0.02185)
D(SCI)	-0.388141	0.030861
	(0.30687)	(0.19999)
D(CHSBCPMI)	8.828428	-3.752979
	(4.17014)	(2.71771)

Table A. 15 VECM Estimation (Beijing)

Sample (adjusted): 2005M04 2012M10
Included observations: 91 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2	CointEq3			
BCR(-1)	1.000000	0.000000	0.000000			
BCB(-1)	0.000000	1.000000	0.000000			
LPB_SA(-1)	0.000000	0.000000	1.000000			
HPB(-1)	-3.503969	-4.415258	-4.402723			
	(0.65787)	(0.78573)	(0.96786)			
	[-5.32627]	[-5.61932]	[-4.54892]			
SCI(-1)	-0.015034	0.040942	-0.707817			
	(0.11346)	(0.13551)	(0.16693)			
	[-0.13250]	[0.30213]	[-4.24029]			
CHSBCPMI(-1)	0.012766	0.016337	0.003166			
	(0.00478)	(0.00571)	(0.00703)			
	[2.67224]	[2.86333]	[0.45047]			
@TREND(05M01)	0.008732	0.025220	0.037434			
	(0.00764)	(0.00912)	(0.01124)			
	[1.14343]	[2.76499]	[3.33176]			
C	22.97314	28.64274	36.75301			
Error Correction:	D(BCR)	D(BCB)	D(LPB_SA)	D(HPB)	D(SCI)	D(CHSBCPMI)
CointEq1	-0.081732	0.033098	-3.930115	-0.443390	0.773303	-7.849401
	(0.03468)	(0.03598)	(1.38619)	(0.23768)	(0.33390)	(5.59938)
	[-2.35675]	[0.91988]	[-2.83519]	[-1.86549]	[2.31594]	[-1.40183]
CointEq2	0.056930	-0.044684	3.906307	0.493906	-0.524004	7.139049
	(0.02982)	(0.03094)	(1.19182)	(0.20435)	(0.28709)	(4.81426)
	[1.90930]	[-1.44440]	[3.27759]	[2.41691]	[-1.82525]	[1.48290]
CointEq3	0.002738	0.009910	-0.845450	-0.006784	0.107783	-1.133597
	(0.00511)	(0.00530)	(0.20435)	(0.03504)	(0.04922)	(0.82544)
	[0.53562]	[1.86827]	[-4.13734]	[-0.19363]	[2.18969]	[-1.37333]
D(BCR(-1))	0.031759	-0.074823	-3.164202	-1.403022	2.310752	30.66700
	(0.12121)	(0.12576)	(4.84501)	(0.83074)	(1.16706)	(19.5709)
	[0.26201]	[-0.59496]	[-0.65308]	[-1.68888]	[1.97997]	[1.56697]
D(BCR(-2))	0.221987	-0.064596	2.173171	-0.269537	0.970729	-0.062479
	(0.12129)	(0.12584)	(4.84816)	(0.83128)	(1.16782)	(19.5837)

	[1.83018]	[-0.51331]	[0.44825]	[-0.32424]	[0.83123]	[-0.00319]
D(BCB(-1))	-0.139264	0.076423	3.158739	0.816086	0.393542	12.47239
	(0.12467)	(0.12934)	(4.98303)	(0.85441)	(1.20031)	(20.1285)
	[-1.11709]	[0.59085]	[0.63390]	[0.95515]	[0.32787]	[0.61964]
D(BCB(-2))	-0.093521	0.040606	-0.312531	0.440957	-1.713178	6.008668
	(0.11657)	(0.12095)	(4.65950)	(0.79893)	(1.12238)	(18.8216)
	[-0.80226]	[0.33574]	[-0.06707]	[0.55193]	[-1.52638]	[0.31924]
D(LPB_SA(-1))	-0.002861	-0.006013	0.101017	-0.008899	-0.020472	0.594195
	(0.00439)	(0.00455)	(0.17532)	(0.03006)	(0.04223)	(0.70820)
	[-0.65215]	[-1.32129]	[0.57617]	[-0.29602]	[-0.48476]	[0.83902]
D(LPB_SA(-2))	0.002243	0.001907	0.010263	-0.002262	-0.018242	0.980101
	(0.00338)	(0.00351)	(0.13519)	(0.02318)	(0.03256)	(0.54609)
	[0.66323]	[0.54354]	[0.07591]	[-0.09760]	[-0.56018]	[1.79476]
D(HPB(-1))	-0.009575	-0.001538	-0.086844	0.024232	0.497218	2.686976
	(0.02130)	(0.02210)	(0.85136)	(0.14598)	(0.20508)	(3.43900)
	[-0.44954]	[-0.06959]	[-0.10201]	[0.16600]	[2.42455]	[0.78132]
D(HPB(-2))	-0.016753	-0.012369	-0.135186	-0.124117	0.186909	-1.969847
	(0.01836)	(0.01905)	(0.73379)	(0.12582)	(0.17675)	(2.96406)
	[-0.91259]	[-0.64941]	[-0.18423]	[-0.98648]	[1.05745]	[-0.66458]
D(SCI(-1))	0.036039	0.017947	0.696095	0.031880	-0.189380	2.600874
	(0.01160)	(0.01204)	(0.46377)	(0.07952)	(0.11171)	(1.87335)
	[3.10606]	[1.49087]	[1.50095]	[0.40091]	[-1.69525]	[1.38835]
D(SCI(-2))	0.032177	0.008781	-0.311399	0.025098	-0.136513	1.951677
	(0.01200)	(0.01245)	(0.47955)	(0.08223)	(0.11551)	(1.93711)
	[2.68198]	[0.70544]	[-0.64935]	[0.30524]	[-1.18178]	[1.00752]
D(CHSBCPMI(-1))	0.000625	7.04E-05	-0.010517	0.010585	-0.001405	0.717885
	(0.00082)	(0.00085)	(0.03282)	(0.00563)	(0.00790)	(0.13256)
	[0.76170]	[0.08267]	[-0.32047]	[1.88119]	[-0.17780]	[5.41557]
D(CHSBCPMI(-2))	-0.000202	-0.001831	-0.002970	0.008961	9.65E-05	0.060818
	(0.00083)	(0.00086)	(0.03300)	(0.00566)	(0.00795)	(0.13328)
	[-0.24504]	[-2.13735]	[-0.09000]	[1.58384]	[0.01214]	[0.45630]
C	0.016609	0.015426	0.134448	0.016586	-0.021228	-0.406581
	(0.00337)	(0.00349)	(0.13457)	(0.02307)	(0.03241)	(0.54357)
	[4.93335]	[4.41645]	[0.99911]	[0.71885]	[-0.65489]	[-0.74798]
D(MR)	0.005000	0.006386	-0.483276	-0.010438	0.112565	1.735359
	(0.00814)	(0.00844)	(0.32529)	(0.05577)	(0.07836)	(1.31397)
	[0.61439]	[0.75637]	[-1.48569]	[-0.18714]	[1.43660]	[1.32070]
PRP	0.000142	0.005457	-0.449753	-0.085973	-0.079292	-0.878228
	(0.00362)	(0.00375)	(0.14453)	(0.02478)	(0.03482)	(0.58383)
	[0.03921]	[1.45454]	[-3.11175]	[-3.46915]	[-2.27750]	[-1.50426]

D(DIB_SA)	-0.018965	-0.078144	1.430856	0.307867	-0.587502	1.739479
	(0.05444)	(0.05648)	(2.17604)	(0.37311)	(0.52416)	(8.78991)
	[-0.34836]	[-1.38349]	[0.65755]	[0.82513]	[-1.12084]	[0.19789]
R-squared	0.581259	0.492285	0.454120	0.437100	0.421923	0.864043
Adj. R-squared	0.476574	0.365356	0.317649	0.296375	0.277404	0.830054
Sum sq. resids	0.004958	0.005337	7.921876	0.232900	0.459650	129.2594
S.E. equation	0.008299	0.008610	0.331702	0.056875	0.079900	1.339877
F-statistic	5.552448	3.878431	3.327612	3.106062	2.919491	25.42117
Log likelihood	317.5744	314.2226	-18.04738	142.4209	111.4874	-145.0922
Akaike AIC	-6.562074	-6.488409	0.814228	-2.712547	-2.032690	3.606421
Schwarz SC	-6.037829	-5.964164	1.338473	-2.188302	-1.508445	4.130667
Mean dependent	0.019393	0.011738	0.030266	0.011014	0.006159	1.532967
S.D. dependent	0.011470	0.010808	0.401554	0.067803	0.093994	3.250198

Determinant resid covariance (dof adj.)	9.55E-15
Determinant resid covariance	2.34E-15
Log likelihood	758.0332
Akaike information criterion	-13.69304
Schwarz criterion	-9.968135

Table A. 16 Residual Correlation Matrix (Beijing)

Sample (adjusted): 2005M04 2012M10
Included observations: 91 after adjustments

Correlation t-Statistic Probability	BCR	BCB	LPB_SA	HPB	SCI	CHSBCPMI
BCR	1.000000					

BCB	0.481076	1.000000				
	5.176885	-----				
	0.0000	-----				
LPB_SA	-0.003723	-0.083694	1.000000			
	-0.035118	-0.792348	-----			
	0.9721	0.4303	-----			
HPB	-0.101257	-0.096547	0.401387	1.000000		
	-0.960192	-0.915096	4.134341	-----		
	0.3396	0.3626	0.0001	-----		
SCI	0.224669	0.041482	0.299125	0.108104	1.000000	
	2.175129	0.391674	2.957347	1.025864	-----	
	0.0323	0.6962	0.0040	0.3077	-----	

CHSBCPMI	0.120611	-0.011262	-0.042782	0.290136	0.100449	1.000000
	1.146208	-0.106255	-0.403976	2.860168	0.952447	-----
	0.2548	0.9156	0.6872	0.0053	0.3435	-----

Table A. 17 AR Root Test (Beijing)

Roots of Characteristic Polynomial
Endogenous variables: HPB BCB BCR LPB_SA SCI CHSBCPMI
Exogenous variables: D(MR) PRP D(DIB_SA)
Lag specification: 1 2

Root	Modulus
1.000000 - 7.34e-16i	1.000000
1.000000 + 7.34e-16i	1.000000
1.000000	1.000000
0.843992 - 0.146369i	0.856590
0.843992 + 0.146369i	0.856590
0.702378	0.702378
0.679603	0.679603
-0.277738 + 0.514018i	0.584254
-0.277738 - 0.514018i	0.584254
-0.502563	0.502563
-0.016970 - 0.501642i	0.501929
-0.016970 + 0.501642i	0.501929
-0.419621 - 0.113639i	0.434736
-0.419621 + 0.113639i	0.434736
0.187367 + 0.351535i	0.398351
0.187367 - 0.351535i	0.398351
0.291417 - 0.150008i	0.327760
0.291417 + 0.150008i	0.327760

VEC specification imposes 3 unit root(s).

Table A. 18 LM Test for Residual Serial Correlation (Beijing)

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h

Sample: 2005M01 2012M10
Included observations: 91

Lags	LM-Stat	Prob

1	51.72304	0.0434
2	33.33331	0.5961
3	49.66056	0.0644
4	36.52136	0.4444
5	33.28224	0.5985
6	53.55825	0.0300
7	30.84131	0.7123
8	56.81842	0.0150
9	56.51195	0.0160
10	52.62260	0.0363
11	29.62475	0.7646
12	58.25965	0.0109
13	36.09170	0.4644
14	49.64437	0.0646
15	37.50005	0.4002
16	55.45162	0.0202
17	40.44114	0.2806
18	30.71089	0.7181
19	52.64250	0.0362
20	33.19051	0.6029
21	41.78840	0.2338
22	35.94385	0.4713
23	30.80293	0.7140
24	50.32181	0.0569

Probs from chi-square with 36 df.

Table A. 19 Residual Serial Autocorrelation Q-Test of BCR (Beijing)

Sample: 2005M01 2012M10
Included observations: 91

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	-0.053	-0.053	0.2618	0.609
.*|. |	.*|. |	2	-0.071	-0.074	0.7477	0.688
. |* |	. |* |	3	0.163	0.156	3.2905	0.349
. |. |	. |. |	4	-0.061	-0.052	3.6551	0.455
.*|. |	.*|. |	5	-0.155	-0.143	6.0156	0.305
.*|. |	.*|. |	6	-0.095	-0.148	6.9122	0.329
. |. |	. |. |	7	-0.033	-0.050	7.0241	0.426
. |. |	. |. |	8	-0.064	-0.043	7.4388	0.490
. |. |	. |* |	9	0.066	0.081	7.8915	0.545
. |. |	. |. |	10	0.059	0.041	8.2504	0.604
.*|. |	.*|. |	11	-0.106	-0.127	9.4366	0.582
. |** |	. |** |	12	0.273	0.229	17.439	0.134
.*|. |	.*|. |	13	-0.120	-0.162	19.008	0.123
. |. |	. |* |	14	0.013	0.102	19.026	0.164
. |. |	.*|. |	15	0.001	-0.102	19.026	0.213
. |. |	. |. |	16	-0.048	0.021	19.288	0.254
. |. |	. |* |	17	0.054	0.082	19.623	0.294

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	18	-0.027	0.001	19.710	0.349
.*|. |	.*|. |	19	-0.107	-0.129	21.063	0.333
.*|. |	.*|. |	20	-0.112	-0.152	22.554	0.311
. |. |	. |. |	21	0.000	-0.053	22.554	0.368
.*|. |	.*|. |	22	-0.098	-0.124	23.739	0.361
.*|. |	.*|. |	23	-0.173	-0.087	27.442	0.238
. |** |	. |* |	24	0.262	0.131	36.138	0.053

Table A. 20 Residual Serial Autocorrelation Q-Test of BCB (Beijing)

Sample: 2005M01 2012M10
Included observations: 91

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	-0.010	-0.010	0.0092	0.924
. |. |	. |. |	2	-0.018	-0.018	0.0412	0.980
. |. |	. |. |	3	0.061	0.061	0.3998	0.940
**|. |	**|. |	4	-0.212	-0.212	4.7685	0.312
. |. |	. |. |	5	-0.007	-0.006	4.7736	0.444
.*|. |	.*|. |	6	-0.091	-0.108	5.5949	0.470
.*|. |	.*|. |	7	-0.158	-0.140	8.0958	0.324
. |. |	. |. |	8	0.006	-0.049	8.1001	0.424
. |. |	. |. |	9	-0.050	-0.060	8.3585	0.498
.*|. |	.*|. |	10	-0.118	-0.164	9.8137	0.457
. |. |	.*|. |	11	-0.025	-0.114	9.8811	0.541
. |** |	. |** |	12	0.244	0.229	16.277	0.179
. |* |	. |. |	13	0.095	0.063	17.258	0.188
. |* |	. |. |	14	0.099	0.046	18.332	0.192
.*|. |	**|. |	15	-0.157	-0.248	21.087	0.134
. |. |	. |. |	16	-0.041	0.009	21.275	0.168
. |. |	. |. |	17	0.069	0.050	21.825	0.192
.*|. |	. |. |	18	-0.113	-0.040	23.318	0.179
. |. |	. |. |	19	-0.033	-0.063	23.450	0.218
.*|. |	.*|. |	20	-0.116	-0.168	25.057	0.199
. |* |	. |* |	21	0.090	0.147	26.044	0.205
. |* |	. |* |	22	0.082	0.089	26.868	0.216
. |. |	. |* |	23	-0.019	0.076	26.914	0.260
. |* |	. |. |	24	0.120	-0.021	28.739	0.230

Table A. 21 Residual Serial Autocorrelation Q-Test of LPB_SA (Beijing)

Sample: 2005M01 2012M10
Included observations: 91

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob

<table>
<tr><td>. |. |</td><td>. |. |</td><td>1</td><td>-0.064</td><td>-0.064</td><td>0.3897</td><td>0.532</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>2</td><td>-0.007</td><td>-0.011</td><td>0.3941</td><td>0.821</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>3</td><td>-0.057</td><td>-0.058</td><td>0.7013</td><td>0.873</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>4</td><td>-0.019</td><td>-0.027</td><td>0.7356</td><td>0.947</td></tr>
<tr><td>.*|. |</td><td>.*|. |</td><td>5</td><td>-0.141</td><td>-0.147</td><td>2.7033</td><td>0.746</td></tr>
<tr><td>. |* |</td><td>. |* |</td><td>6</td><td>0.151</td><td>0.132</td><td>4.9867</td><td>0.546</td></tr>
<tr><td>.*|. |</td><td>.*|. |</td><td>7</td><td>-0.167</td><td>-0.165</td><td>7.8010</td><td>0.350</td></tr>
<tr><td>. |. |</td><td>.*|. |</td><td>8</td><td>-0.049</td><td>-0.080</td><td>8.0458</td><td>0.429</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>9</td><td>-0.054</td><td>-0.065</td><td>8.3512</td><td>0.499</td></tr>
<tr><td>.*|. |</td><td>.*|. |</td><td>10</td><td>-0.137</td><td>-0.193</td><td>10.308</td><td>0.414</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>11</td><td>0.005</td><td>0.004</td><td>10.311</td><td>0.503</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>12</td><td>0.054</td><td>-0.044</td><td>10.621</td><td>0.562</td></tr>
<tr><td>**|. |</td><td>**|. |</td><td>13</td><td>-0.223</td><td>-0.255</td><td>15.998</td><td>0.249</td></tr>
<tr><td>. |. |</td><td>.*|. |</td><td>14</td><td>-0.005</td><td>-0.088</td><td>16.001</td><td>0.313</td></tr>
<tr><td>. |* |</td><td>. |. |</td><td>15</td><td>0.124</td><td>0.037</td><td>17.714</td><td>0.278</td></tr>
<tr><td>. |* |</td><td>. |* |</td><td>16</td><td>0.135</td><td>0.132</td><td>19.786</td><td>0.230</td></tr>
<tr><td>. |. |</td><td>.*|. |</td><td>17</td><td>-0.021</td><td>-0.103</td><td>19.836</td><td>0.283</td></tr>
<tr><td>. |* |</td><td>. |. |</td><td>18</td><td>0.107</td><td>0.018</td><td>21.153</td><td>0.272</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>19</td><td>-0.042</td><td>0.020</td><td>21.362</td><td>0.317</td></tr>
<tr><td>. |* |</td><td>. |. |</td><td>20</td><td>0.099</td><td>0.056</td><td>22.522</td><td>0.313</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>21</td><td>-0.041</td><td>-0.053</td><td>22.729</td><td>0.359</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>22</td><td>0.046</td><td>-0.003</td><td>22.992</td><td>0.402</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>23</td><td>0.020</td><td>0.058</td><td>23.040</td><td>0.458</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>24</td><td>-0.023</td><td>-0.026</td><td>23.109</td><td>0.513</td></tr>
</table>

Table A. 22 Residual Serial Autocorrelation Q-Test of HPB (Beijing)

Sample: 2005M01 2012M10
Included observations: 91

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>. |. |</td><td>. |. |</td><td>1</td><td>-0.033</td><td>-0.033</td><td>0.1047</td><td>0.746</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>2</td><td>-0.045</td><td>-0.046</td><td>0.2943</td><td>0.863</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>3</td><td>0.017</td><td>0.014</td><td>0.3219</td><td>0.956</td></tr>
<tr><td>.*|. |</td><td>**|. |</td><td>4</td><td>-0.203</td><td>-0.205</td><td>4.3479</td><td>0.361</td></tr>
<tr><td>. |* |</td><td>. |* |</td><td>5</td><td>0.152</td><td>0.147</td><td>6.6327</td><td>0.249</td></tr>
<tr><td>**|. |</td><td>**|. |</td><td>6</td><td>-0.253</td><td>-0.287</td><td>13.007</td><td>0.043</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>7</td><td>-0.035</td><td>-0.003</td><td>13.128</td><td>0.069</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>8</td><td>0.038</td><td>-0.060</td><td>13.274</td><td>0.103</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>9</td><td>-0.062</td><td>0.008</td><td>13.667</td><td>0.135</td></tr>
<tr><td>. |** |</td><td>. |* |</td><td>10</td><td>0.254</td><td>0.140</td><td>20.414</td><td>0.026</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>11</td><td>-0.025</td><td>0.032</td><td>20.481</td><td>0.039</td></tr>
<tr><td>. |. |</td><td>.*|. |</td><td>12</td><td>-0.038</td><td>-0.074</td><td>20.639</td><td>0.056</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>13</td><td>0.005</td><td>-0.024</td><td>20.642</td><td>0.080</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>14</td><td>-0.023</td><td>0.059</td><td>20.701</td><td>0.110</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>15</td><td>0.035</td><td>-0.042</td><td>20.839</td><td>0.142</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>16</td><td>-0.028</td><td>0.071</td><td>20.929</td><td>0.181</td></tr>
<tr><td>.*|. |</td><td>.*|. |</td><td>17</td><td>-0.091</td><td>-0.097</td><td>21.873</td><td>0.190</td></tr>
<tr><td>. |. |</td><td>. |. |</td><td>18</td><td>0.061</td><td>0.073</td><td>22.301</td><td>0.219</td></tr>
</table>

. |. |	.*|. |	19	-0.051	-0.101	22.609	0.255
. |. |	. |. |	20	-0.016	-0.012	22.639	0.307
. |* |	. |. |	21	0.076	0.022	23.333	0.326
**|. |	.*|. |	22	-0.210	-0.182	28.736	0.153
. |. |	. |. |	23	0.000	-0.046	28.736	0.189
. |. |	. |. |	24	0.020	-0.010	28.787	0.228

Table A. 23 Residual Serial Autocorrelation Q-Test of SCI (Beijing)

Sample: 2005M01 2012M10
Included observations: 91

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	-0.039	-0.039	0.1406	0.708
. |. |	. |. |	2	-0.022	-0.023	0.1851	0.912
.*|. |	.*|. |	3	-0.121	-0.123	1.5913	0.661
. |** |	. |* |	4	0.219	0.212	6.2663	0.180
. |. |	. |. |	5	-0.033	-0.028	6.3748	0.271
.*|. |	.*|. |	6	-0.079	-0.090	7.0013	0.321
. |. |	. |. |	7	-0.026	0.023	7.0702	0.422
.*|. |	.*|. |	8	-0.076	-0.143	7.6653	0.467
. |. |	. |. |	9	-0.002	-0.012	7.6657	0.568
. |. |	. |. |	10	0.028	0.065	7.7448	0.654
. |. |	.*|. |	11	-0.031	-0.069	7.8439	0.727
. |. |	. |. |	12	0.025	0.073	7.9109	0.792
.*|. |	.*|. |	13	-0.143	-0.153	10.132	0.683
.*|. |	.*|. |	14	-0.112	-0.185	11.500	0.646
. |. |	. |. |	15	-0.006	0.031	11.505	0.716
. |. |	. |. |	16	0.065	-0.012	11.984	0.745
.*|. |	.*|. |	17	-0.105	-0.090	13.246	0.720
.*|. |	.*|. |	18	-0.169	-0.110	16.540	0.555
. |. |	. |. |	19	0.061	0.001	16.979	0.591
. |. |	. |. |	20	0.057	-0.006	17.370	0.629
. |. |	. |. |	21	-0.012	-0.040	17.388	0.687
.*|. |	.*|. |	22	-0.086	-0.066	18.285	0.689
. |. |	. |. |	23	0.063	0.039	18.786	0.714
. |. |	. |. |	24	0.009	-0.037	18.797	0.763

Table A. 24 Residual Serial Autocorrelation Q-Test of CHSBCPMI (Beijing)

Sample: 2005M01 2012M10
Included observations: 91

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob

. |. |	. |. |	1	-0.030	-0.030	0.0857	0.770
. |* |	. |* |	2	0.090	0.089	0.8606	0.650
. |. |	. |. |	3	-0.001	0.005	0.8606	0.835
. |. |	. |. |	4	-0.048	-0.056	1.0821	0.897
.*|. |	.*|. |	5	-0.131	-0.136	2.7758	0.735
.*|. |	.*|. |	6	-0.193	-0.198	6.4775	0.372
. |. |	. |. |	7	-0.027	-0.022	6.5502	0.477
**|. |	**|. |	8	-0.224	-0.207	11.656	0.167
. |* |	. |. |	9	0.094	0.068	12.564	0.183
. |. |	. |. |	10	0.025	0.029	12.629	0.245
. |. |	.*|. |	11	-0.063	-0.138	13.054	0.290
. |. |	. |. |	12	0.068	-0.008	13.549	0.330
. |* |	. |. |	13	0.100	0.061	14.641	0.330
.*|. |	.*|. |	14	-0.076	-0.150	15.269	0.360
.*|. |	.*|. |	15	-0.104	-0.125	16.466	0.352
. |. |	. |. |	16	-0.001	-0.060	16.466	0.421
.*|. |	.*|. |	17	-0.109	-0.113	17.819	0.400
. |. |	. |. |	18	0.028	0.036	17.907	0.462
. |. |	. |. |	19	0.007	-0.040	17.913	0.528
. |* |	. |* |	20	0.119	0.077	19.591	0.484
. |. |	. |. |	21	0.024	0.006	19.658	0.543
. |. |	.*|. |	22	-0.014	-0.173	19.683	0.603
. |. |	. |. |	23	0.071	0.003	20.310	0.623
. |. |	. |. |	24	-0.047	-0.002	20.584	0.663

Table A. 25 Residual Normality Test (Beijing)

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 2005M01 2012M10
Included observations: 91

Component	Skewness	Chi-sq	df	Prob.
1	1.060365	17.05300	1	0.0000
2	-0.022263	0.007517	1	0.9309
3	0.197861	0.593757	1	0.4410
4	-0.131451	0.262071	1	0.6087
5	-0.308202	1.440661	1	0.2300
6	-0.458035	3.181908	1	0.0745
Joint		22.53891	6	0.0010

Component	Kurtosis	Chi-sq	df	Prob.
1	7.234967	68.00332	1	0.0000
2	3.068803	0.017949	1	0.8934

3	3.652544	1.614541	1	0.2039
4	4.128634	4.829877	1	0.0280
5	2.860559	0.073724	1	0.7860
6	2.751411	0.234311	1	0.6283
Joint		74.77373	6	0.0000

Component	Jarque-Bera	df	Prob.
1	85.05632	2	0.0000
2	0.025467	2	0.9873
3	2.208299	2	0.3315
4	5.091948	2	0.0784
5	1.514385	2	0.4690
6	3.416219	2	0.1812
Joint	97.31264	12	0.0000

Table A. 26 VECM Estimation (Shanghai)

Sample (adjusted): 2005M05 2012M10
Included observations: 90 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
HPS(-1)	1.000000
BCR(-1)	0.505570 (0.18207) [2.77682]
LPS_SA(-1)	-0.003898 (0.01034) [-0.37684]
BCB(-1)	-1.609451 (0.29817) [-5.39777]
SCI(-1)	0.109122 (0.02587) [4.21832]
CHSBCPMI(-1)	-0.005528 (0.00073) [-7.55280]
@TREND(05M01)	0.005631 (0.00360) [1.56233]
C	1.803476

Error Correction:	D(HPS)	D(BCR)	D(LPS_SA)	D(BCB)	D(SCI)	D(CHSBCPMI)
CointEq1	-1.289878 (0.23446) [-5.50145]	0.020072 (0.03054) [0.65720]	-4.841121 (2.06492) [-2.34446]	0.049849 (0.03247) [1.53534]	-0.286307 (0.30107) [-0.95097]	5.143997 (4.40022) [1.16903]
D(HPS(-1))	0.521989 (0.18114) [2.88167]	0.003782 (0.02360) [0.16027]	3.085574 (1.59532) [1.93414]	-0.014820 (0.02508) [-0.59081]	0.046032 (0.23260) [0.19790]	0.420618 (3.39954) [0.12373]
D(HPS(-2))	0.387690 (0.14611) [2.65348]	0.010732 (0.01903) [0.56390]	4.450261 (1.28677) [3.45848]	0.009497 (0.02023) [0.46938]	-0.136346 (0.18761) [-0.72674]	-4.354086 (2.74202) [-1.58791]
D(HPS(-3))	0.166482 (0.11819)	0.006448 (0.01540)	2.656642 (1.04091)	0.004064 (0.01637)	0.051196 (0.15177)	-0.541322 (2.21811)

	[1.40860]	[0.41884]	[2.55224]	[0.24831]	[0.33734]	[-0.24405]
D(BCR(-1))	-0.898769	0.029832	4.846154	-0.071522	2.130763	31.18034
	(1.06993)	(0.13937)	(9.42294)	(0.14816)	(1.37388)	(20.0797)
	[-0.84003]	[0.21405]	[0.51429]	[-0.48272]	[1.55091]	[1.55283]
D(BCR(-2))	0.563262	0.324937	0.866966	-0.094616	0.547059	19.24481
	(1.02354)	(0.13333)	(9.01440)	(0.14174)	(1.31432)	(19.2092)
	[0.55031]	[2.43714]	[0.09618]	[-0.66754]	[0.41623]	[1.00186]
D(BCR(-3))	1.281191	0.094659	12.35366	0.140426	0.842968	-14.43128
	(1.03926)	(0.13537)	(9.15284)	(0.14392)	(1.33450)	(19.5042)
	[1.23279]	[0.69924]	[1.34971]	[0.97575]	[0.63167]	[-0.73991]
D(LPS_SA(-1))	-0.005359	-0.000859	-0.540876	-0.001357	-0.016248	-0.009351
	(0.01184)	(0.00154)	(0.10427)	(0.00164)	(0.01520)	(0.22220)
	[-0.45264]	[-0.55706]	[-5.18703]	[-0.82778]	[-1.06874]	[-0.04208]
D(LPS_SA(-2))	-0.009471	0.000791	-0.507182	-0.000104	-0.007717	-0.118176
	(0.01217)	(0.00159)	(0.10719)	(0.00169)	(0.01563)	(0.22842)
	[-0.77815]	[0.49917]	[-4.73158]	[-0.06153]	[-0.49378]	[-0.51737]
D(LPS_SA(-3))	0.003769	0.001538	-0.235197	0.000840	-0.007947	0.157510
	(0.01141)	(0.00149)	(0.10049)	(0.00158)	(0.01465)	(0.21413)
	[0.33037]	[1.03507]	[-2.34055]	[0.53165]	[-0.54238]	[0.73557]
D(BCB(-1))	-0.045090	0.018431	-15.18861	0.146056	-1.029232	-6.712658
	(1.04414)	(0.13601)	(9.19579)	(0.14459)	(1.34076)	(19.5957)
	[-0.04318]	[0.13551]	[-1.65169]	[1.01013]	[-0.76765]	[-0.34256]
D(BCB(-2))	0.012858	-0.070896	-2.897860	0.022231	-2.792055	1.841601
	(0.95465)	(0.12435)	(8.40767)	(0.13220)	(1.22585)	(17.9163)
	[0.01347]	[-0.57012]	[-0.34467]	[0.16816]	[-2.27764]	[0.10279]
D(BCB(-3))	-0.993999	0.285770	6.135893	0.027722	-0.606919	8.853733
	(0.95658)	(0.12460)	(8.42463)	(0.13247)	(1.22833)	(17.9524)
	[-1.03912]	[2.29343]	[0.72833]	[0.20928]	[-0.49410]	[0.49318]
D(SCI(-1))	0.152404	0.040462	1.114771	0.021698	-0.112144	4.056506
	(0.09169)	(0.01194)	(0.80749)	(0.01270)	(0.11773)	(1.72072)
	[1.66223]	[3.38786]	[1.38053]	[1.70894]	[-0.95252]	[2.35745]
D(SCI(-2))	0.155025	0.017509	0.386009	0.003089	-0.001650	1.612257
	(0.09597)	(0.01250)	(0.84518)	(0.01329)	(0.12323)	(1.80103)
	[1.61542]	[1.40062]	[0.45672]	[0.23242]	[-0.01339]	[0.89519]
D(SCI(-3))	-0.245140	-0.008669	-0.937029	-0.014112	0.109065	-0.284456
	(0.09805)	(0.01277)	(0.86350)	(0.01358)	(0.12590)	(1.84007)
	[-2.50025]	[-0.67877]	[-1.08515]	[-1.03936]	[0.86628]	[-0.15459]
D(CHSBCPMI(-1))	0.015214	0.000622	-0.033687	-0.000141	0.001245	0.781005
	(0.00709)	(0.00092)	(0.06248)	(0.00098)	(0.00911)	(0.13314)
	[2.14452]	[0.67269]	[-0.53918]	[-0.14396]	[0.13667]	[5.86605]

D(CHSBCPMI(-2))	-0.003346	-0.001201	0.010191	-0.002196	-0.001846	0.081748
	(0.00834)	(0.00109)	(0.07342)	(0.00115)	(0.01071)	(0.15646)
	[-0.40141]	[-1.10584]	[0.13880]	[-1.90183]	[-0.17245]	[0.52249]
D(CHSBCPMI(-3))	0.005261	0.000416	0.034660	-8.79E-05	-0.015568	-0.156541
	(0.00698)	(0.00091)	(0.06150)	(0.00097)	(0.00897)	(0.13105)
	[0.75343]	[0.45711]	[0.56357]	[-0.09094]	[-1.73617]	[-1.19447]
C	-0.017861	0.007564	-0.213793	0.014314	0.033476	-0.320668
	(0.02655)	(0.00346)	(0.23380)	(0.00368)	(0.03409)	(0.49821)
	[-0.67284]	[2.18748]	[-0.91444]	[3.89373]	[0.98206]	[-0.64364]
D(MR)	0.001346	-0.004617	0.305693	0.000714	0.149628	1.537961
	(0.06725)	(0.00876)	(0.59224)	(0.00931)	(0.08635)	(1.26203)
	[0.02001]	[-0.52705]	[0.51616]	[0.07665]	[1.73281]	[1.21864]
PRP	-0.063034	0.000589	-0.253300	-0.001917	-0.062591	-0.134324
	(0.02200)	(0.00287)	(0.19378)	(0.00305)	(0.02825)	(0.41294)
	[-2.86482]	[0.20563]	[-1.30715]	[-0.62923]	[-2.21532]	[-0.32529]
DIS_DETR	-0.326775	-0.047946	3.286023	0.030137	-0.356060	10.07697
	(0.38716)	(0.05043)	(3.40978)	(0.05361)	(0.49715)	(7.26604)
	[-0.84402]	[-0.95070]	[0.96371]	[0.56211]	[-0.71620]	[1.38686]
R-squared	0.558179	0.557773	0.548305	0.435881	0.360067	0.884111
Adj. R-squared	0.413104	0.412565	0.399987	0.250648	0.149940	0.846058
Sum sq. resids	0.308349	0.005232	23.91686	0.005913	0.508428	108.6044
S.E. equation	0.067840	0.008837	0.597468	0.009394	0.087112	1.273170
F-statistic	3.847508	3.841184	3.696826	2.353151	1.713565	23.23370
Log likelihood	127.7305	311.1704	-68.06930	305.6642	105.2264	-136.1601
Akaike AIC	-2.327345	-6.403786	2.023762	-6.281426	-1.827253	3.536890
Schwarz SC	-1.688505	-5.764946	2.662602	-5.642585	-1.188412	4.175731
Mean dependent	0.008686	0.019428	0.007390	0.011800	0.006437	1.492222
S.D. dependent	0.088553	0.011530	0.771320	0.010852	0.094483	3.244952

Determinant resid covariance (dof adj.)	5.53E-14
Determinant resid covariance	9.42E-15
Log likelihood	687.0946
Akaike information criterion	-12.04655
Schwarz criterion	-8.019076

Table A. 27 Residual Correlation Matrix (Shanghai)

Sample (adjusted): 2005M05 2012M10
Included observations: 90 after adjustments
Balanced sample (listwise missing value deletion)

Correlation

t-Statistic Probability	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
HPS	1.000000					

BCR	0.185621	1.000000				
	1.772079	-----				
	0.0798	-----				
LPS_SA	0.402426	0.175374	1.000000			
	4.123745	1.671055	-----			
	0.0001	0.0983	-----			
BCB	0.241103	0.499720	0.246808	1.000000		
	2.330499	5.411979	2.389170	-----		
	0.0221	0.0000	0.0190	-----		
SCI	-0.213906	0.082343	0.107538	0.015252	1.000000	
	-2.054160	0.775073	1.014676	0.143089	-----	
	0.0429	0.4404	0.3130	0.8865	-----	
CHSBCPMI	0.415348	0.157763	0.257916	0.011783	0.048638	1.000000
	4.283241	1.498719	2.504191	0.110541	0.456802	-----
	0.0000	0.1375	0.0141	0.9122	0.6489	-----

Table A. 28 AR Root Test (Shanghai)

Roots of Characteristic Polynomial
Endogenous variables: HPS BCR LPS_SA BCB SCI CHSBCPMI
Exogenous variables: D(MR) PRP DIS_DETR
Lag specification: 1 3

Root	Modulus
1.000000	1.000000
1.000000 - 1.98e-15i	1.000000
1.000000 + 1.98e-15i	1.000000
1.000000	1.000000
1.000000	1.000000
0.823893 - 0.222951i	0.853526
0.823893 + 0.222951i	0.853526
-0.647542 + 0.331086i	0.727275
-0.647542 - 0.331086i	0.727275
0.426329 - 0.581081i	0.720702
0.426329 + 0.581081i	0.720702
-0.656727	0.656727
-0.012084 - 0.640965i	0.641079
-0.012084 + 0.640965i	0.641079

0.349759 - 0.524403i	0.630341
0.349759 + 0.524403i	0.630341
-0.318342 - 0.506935i	0.598602
-0.318342 + 0.506935i	0.598602
-0.179387 - 0.565061i	0.592852
-0.179387 + 0.565061i	0.592852
0.567326	0.567326
-0.500345	0.500345
0.404046	0.404046
-0.274460	0.274460

VEC specification imposes 5 unit root(s).

Table A. 29 LM Test for Residual Serial Correlation (Shanghai)

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Sample: 2005M01 2012M10
Included observations: 90

Lags	LM-Stat	Prob
1	45.83347	0.1262
2	32.96152	0.6139
3	36.40589	0.4498
4	49.80735	0.0627
5	50.71523	0.0528
6	34.35150	0.5471
7	36.61515	0.4401
8	37.81464	0.3864
9	27.57413	0.8420
10	29.39738	0.7739
11	31.02952	0.7039
12	64.63688	0.0024
13	46.25159	0.1177
14	43.81803	0.1738
15	43.06321	0.1946
16	41.06819	0.2581
17	27.56283	0.8424
18	35.51197	0.4916
19	54.09731	0.0268
20	29.80591	0.7570
21	40.20214	0.2894
22	36.87438	0.4283
23	47.99569	0.0872
24	50.48885	0.0551

Probs from chi-square with 36 df.

Table A. 30 Residual Serial Autocorrelation Q-test of HPS (Shanghai)

Sample: 2005M01 2012M10
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.*|. |	.*|. |	1	-0.141	-0.141	1.8471	0.174
. |. |	. |. |	2	0.017	-0.003	1.8729	0.392
. |* |	. |* |	3	0.121	0.126	3.2702	0.352
.*|. |	.*|. |	4	-0.106	-0.074	4.3519	0.360
. |* |	. |* |	5	0.113	0.089	5.6015	0.347
.*|. |	.*|. |	6	-0.181	-0.175	8.8187	0.184
.*|. |	.*|. |	7	-0.071	-0.102	9.3189	0.231
. |* |	. |* |	8	0.118	0.077	10.725	0.218
. |. |	. |. |	9	-0.032	0.056	10.832	0.287
. |. |	. |. |	10	0.064	0.054	11.256	0.338
. |. |	. |. |	11	-0.013	-0.006	11.275	0.421
. |. |	. |. |	12	0.048	0.038	11.515	0.485
. |. |	. |. |	13	0.041	-0.006	11.697	0.553
. |. |	. |. |	14	0.007	0.050	11.702	0.630
. |. |	. |. |	15	-0.043	-0.040	11.910	0.686
. |* |	. |* |	16	0.078	0.090	12.591	0.702
.*|. |	.*|. |	17	-0.170	-0.178	15.872	0.533
. |. |	.*|. |	18	-0.056	-0.092	16.236	0.576
. |. |	. |. |	19	0.041	0.015	16.431	0.628
. |. |	. |. |	20	-0.062	0.012	16.879	0.661
. |** |	. |** |	21	0.236	0.237	23.581	0.314
.*|. |	. |. |	22	-0.083	-0.016	24.412	0.326
. |* |	. |* |	23	0.130	0.111	26.495	0.278
. |* |	. |. |	24	0.143	0.032	29.066	0.218

Table A. 31 Residual Serial Autocorrelation Q-test of BCR (Shanghai)

Sample: 2005M01 2012M10
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	0.022	0.022	0.0463	0.830
.*|. |	.*|. |	2	-0.086	-0.086	0.7360	0.692
. |. |	. |. |	3	-0.007	-0.003	0.7407	0.864
. |. |	. |. |	4	-0.031	-0.038	0.8324	0.934
. |. |	. |. |	5	-0.064	-0.064	1.2338	0.942
. |. |	. |. |	6	0.071	0.069	1.7323	0.943
. |. |	.*|. |	7	-0.058	-0.074	2.0662	0.956
. |. |	. |. |	8	-0.040	-0.027	2.2276	0.973
. |. |	. |. |	9	-0.047	-0.061	2.4541	0.982
. |. |	. |. |	10	0.012	0.008	2.4700	0.991

.*|. |	.*|. |	11	-0.068	-0.076	2.9596	0.991
. |** |	. |** |	12	0.292	0.290	11.985	0.447
.*|. |	**|. |	13	-0.182	-0.244	15.533	0.275
. |. |	. |* |	14	0.003	0.105	15.534	0.343
. |. |	. |. |	15	0.019	-0.051	15.574	0.411
. |. |	. |. |	16	-0.021	0.001	15.625	0.479
. |. |	. |. |	17	0.006	0.035	15.628	0.550
. |. |	. |. |	18	0.042	-0.037	15.827	0.605
.*|. |	. |. |	19	-0.091	-0.033	16.787	0.604
.*|. |	.*|. |	20	-0.128	-0.163	18.735	0.539
.*|. |	. |. |	21	-0.088	-0.045	19.656	0.543
. |. |	. |. |	22	0.013	-0.061	19.676	0.603
. |. |	. |. |	23	0.001	0.066	19.676	0.661
. |** |	. |* |	24	0.254	0.123	27.782	0.269

Table A. 32 Residual Serial Autocorrelation Q-test of LPS_SA (Shanghai)

Sample: 2005M01 2012M10
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	-0.034	-0.034	0.1058	0.745
. |. |	. |. |	2	-0.041	-0.042	0.2640	0.876
. |. |	. |. |	3	0.014	0.011	0.2830	0.963
. |. |	. |. |	4	0.020	0.019	0.3203	0.988
.*|. |	.*|. |	5	-0.097	-0.095	1.2355	0.941
. |* |	. |* |	6	0.129	0.126	2.8869	0.823
.*|. |	.*|. |	7	-0.073	-0.077	3.4226	0.843
.*|. |	.*|. |	8	-0.139	-0.134	5.3797	0.716
. |. |	. |. |	9	-0.039	-0.052	5.5343	0.785
. |* |	. |* |	10	0.158	0.139	8.1099	0.618
. |. |	. |. |	11	-0.007	0.027	8.1157	0.703
.*|. |	.*|. |	12	-0.072	-0.094	8.6678	0.731
. |. |	. |. |	13	0.024	0.013	8.7276	0.793
.*|. |	.*|. |	14	-0.084	-0.075	9.5018	0.798
. |. |	. |. |	15	-0.015	0.001	9.5251	0.849
. |. |	. |. |	16	0.059	-0.003	9.9110	0.871
. |. |	. |. |	17	0.039	0.040	10.080	0.900
.*|. |	. |. |	18	-0.111	-0.050	11.495	0.872
. |. |	. |. |	19	0.043	0.026	11.715	0.897
. |. |	. |. |	20	0.017	-0.006	11.750	0.924
. |. |	. |. |	21	0.034	0.027	11.892	0.942
.*|. |	.*|. |	22	-0.105	-0.109	13.226	0.927
. |. |	. |. |	23	-0.013	-0.051	13.247	0.946
. |. |	. |* |	24	0.019	0.076	13.290	0.961

Table A. 33 Residual Serial Autocorrelation Q-test of BCB (Shanghai)

Sample: 2005M01 2012M10
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	0.005	0.005	0.0025	0.960
. |. |	. |. |	2	-0.018	-0.018	0.0325	0.984
. |. |	. |. |	3	-0.014	-0.014	0.0508	0.997
.*|. |	.*|. |	4	-0.128	-0.128	1.6186	0.805
. |* |	. |* |	5	0.104	0.106	2.6747	0.750
.*|. |	.*|. |	6	-0.112	-0.122	3.9024	0.690
.*|. |	.*|. |	7	-0.190	-0.192	7.4985	0.379
. |. |	.*|. |	8	-0.055	-0.073	7.7996	0.453
. |. |	. |. |	9	0.001	0.017	7.7997	0.554
. |. |	.*|. |	10	-0.026	-0.086	7.8722	0.641
. |* |	. |* |	11	0.142	0.122	10.000	0.530
. |** |	. |*** |	12	0.351	0.399	23.086	0.027
. |* |	. |* |	13	0.133	0.159	24.975	0.023
. |* |	. |* |	14	0.153	0.162	27.522	0.016
.*|. |	.*|. |	15	-0.168	-0.121	30.623	0.010
.*|. |	.*|. |	16	-0.099	-0.094	31.718	0.011
. |. |	. |. |	17	0.058	-0.052	32.096	0.015
.*|. |	. |. |	18	-0.120	-0.050	33.741	0.014
. |. |	. |. |	19	-0.056	0.052	34.105	0.018
**|. |	.*|. |	20	-0.221	-0.110	39.861	0.005
. |. |	. |* |	21	-0.000	0.080	39.861	0.008
. |* |	. |. |	22	0.088	0.033	40.812	0.009
. |* |	. |. |	23	0.119	0.035	42.555	0.008
. |** |	. |. |	24	0.219	0.064	48.599	0.002

Table A. 34 Residual Serial Autocorrelation Q-test of SCI (Shanghai)

Sample: 2005M01 2012M10
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	-0.049	-0.049	0.2270	0.634
. |. |	. |. |	2	-0.017	-0.020	0.2554	0.880
.*|. |	.*|. |	3	-0.098	-0.100	1.1721	0.760
. |** |	. |** |	4	0.257	0.249	7.5138	0.111
. |. |	. |. |	5	-0.040	-0.026	7.6666	0.176
.*|. |	.*|. |	6	-0.133	-0.145	9.4194	0.151
. |* |	. |* |	7	0.087	0.140	10.176	0.179
. |. |	. |. |	8	0.039	-0.033	10.326	0.243
. |. |	.*|. |	9	-0.062	-0.085	10.723	0.295
. |. |	. |* |	10	0.010	0.119	10.732	0.379

. |. |	. |. |	11	0.021	-0.050	10.780	0.462
. |* |	. |* |	12	0.151	0.133	13.200	0.355
.*|. |	.*|. |	13	-0.199	-0.134	17.456	0.179
.*|. |	**|. |	14	-0.126	-0.211	19.188	0.158
. |* |	. |** |	15	0.138	0.224	21.292	0.128
. |* |	. |. |	16	0.081	-0.019	22.032	0.142
. |. |	. |. |	17	-0.042	-0.024	22.237	0.176
**|. |	.*|. |	18	-0.264	-0.127	30.228	0.035
. |* |	. |. |	19	0.167	0.009	33.494	0.021
. |. |	. |. |	20	-0.042	-0.038	33.707	0.028
. |. |	. |. |	21	-0.006	0.037	33.711	0.039
.*|. |	. |. |	22	-0.083	-0.030	34.545	0.043
. |. |	. |. |	23	0.050	-0.022	34.849	0.054
.*|. |	.*|. |	24	-0.118	-0.153	36.610	0.048

Table A. 35 Residual Serial Autocorrelation Q-test of CHSBCPMI (Shanghai)

Sample: 2005M01 2012M10
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	0.019	0.019	0.0332	0.855
. |. |	. |. |	2	0.010	0.009	0.0422	0.979
. |* |	. |* |	3	0.074	0.074	0.5668	0.904
.*|. |	.*|. |	4	-0.075	-0.078	1.1098	0.893
.*|. |	.*|. |	5	-0.144	-0.144	3.1339	0.679
.*|. |	.*|. |	6	-0.125	-0.128	4.6685	0.587
. |. |	. |. |	7	-0.023	-0.007	4.7221	0.694
.*|. |	.*|. |	8	-0.148	-0.135	6.9430	0.543
. |. |	. |. |	9	0.017	0.016	6.9729	0.640
. |. |	. |. |	10	0.017	-0.021	7.0014	0.725
.*|. |	.*|. |	11	-0.096	-0.121	7.9652	0.716
. |. |	. |. |	12	0.005	-0.045	7.9674	0.788
. |. |	.*|. |	13	-0.029	-0.078	8.0607	0.840
. |. |	.*|. |	14	-0.055	-0.084	8.3868	0.868
.*|. |	.*|. |	15	-0.135	-0.172	10.393	0.794
. |. |	. |. |	16	0.034	-0.030	10.523	0.838
. |. |	. |. |	17	-0.013	-0.065	10.543	0.879
. |* |	. |* |	18	0.110	0.088	11.936	0.851
. |* |	. |. |	19	0.099	0.005	13.076	0.835
. |* |	. |* |	20	0.130	0.080	15.068	0.773
. |* |	. |* |	21	0.151	0.094	17.812	0.661
.*|. |	.*|. |	22	-0.077	-0.113	18.539	0.674
. |. |	. |. |	23	0.008	-0.019	18.547	0.727
. |. |	. |. |	24	0.006	0.047	18.552	0.775

Table A. 36 Residual Normality Test (Shanghai)

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 2005M01 2012M10
Included observations: 90

Component	Skewness	Chi-sq	df	Prob.
1	0.192294	0.554655	1	0.4564
2	2.520862	95.32118	1	0.0000
3	-0.244911	0.899718	1	0.3429
4	-0.116770	0.204528	1	0.6511
5	-0.287246	1.237652	1	0.2659
6	-0.314152	1.480370	1	0.2237
Joint		99.69810	6	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	2.623185	0.532460	1	0.4656
2	17.60684	800.0996	1	0.0000
3	3.278180	0.290191	1	0.5901
4	2.759434	0.217020	1	0.6413
5	3.048049	0.008658	1	0.9259
6	3.052104	0.010181	1	0.9196
Joint		801.1581	6	0.0000

Component	Jarque-Bera	df	Prob.
1	1.087116	2	0.5807
2	895.4208	2	0.0000
3	1.189909	2	0.5516
4	0.421548	2	0.8100
5	1.246310	2	0.5362
6	1.490551	2	0.4746
Joint	900.8562	12	0.0000

Table A. 37 GFEVD of HPB

FGVD of HPB:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	100.0	0.9	1.0	16.1	1.2	8.4
2	89.9	0.8	2.6	12.1	1.4	18.0
3	72.0	2.9	2.3	9.2	1.6	33.8
4	61.8	3.9	2.5	7.7	3.0	43.5
5	54.6	5.2	3.3	7.0	5.8	47.7
6	49.1	6.4	4.3	6.3	7.6	50.2
7	45.5	7.1	5.3	5.9	8.8	51.7
8	43.0	7.7	6.0	5.6	9.9	52.2
9	41.1	8.1	6.6	5.4	10.8	52.4
10	39.8	8.5	7.1	5.2	11.4	52.4
11	38.9	8.8	7.5	5.1	11.9	52.4
12	38.1	9.0	7.7	5.1	12.2	52.3
13	37.6	9.2	7.9	5.0	12.5	52.2
14	37.1	9.4	8.0	5.0	12.8	52.2
15	36.6	9.6	8.1	4.9	12.9	52.2
16	36.2	9.8	8.2	4.9	13.1	52.2
17	35.8	10.0	8.3	4.9	13.2	52.2
18	35.5	10.1	8.3	4.8	13.3	52.2
19	35.1	10.3	8.3	4.8	13.4	52.3
20	34.7	10.4	8.4	4.8	13.5	52.3
21	34.3	10.6	8.4	4.8	13.7	52.4
22	34.0	10.7	8.5	4.7	13.8	52.5
23	33.6	10.8	8.5	4.7	13.9	52.7
24	33.2	10.9	8.6	4.6	14.0	52.8
25	32.8	11.1	8.7	4.6	14.1	52.9
26	32.4	11.2	8.7	4.6	14.3	53.1
27	32.0	11.3	8.8	4.5	14.4	53.2
28	31.5	11.4	8.9	4.5	14.5	53.3
29	31.1	11.5	9.0	4.4	14.7	53.4
30	30.7	11.6	9.1	4.4	14.8	53.6
31	30.3	11.7	9.2	4.4	15.0	53.7
32	29.9	11.8	9.4	4.3	15.1	53.8
33	29.6	11.8	9.5	4.3	15.3	53.9
34	29.2	11.9	9.6	4.2	15.4	54.0
35	28.8	12.0	9.7	4.2	15.6	54.1
36	28.5	12.1	9.8	4.2	15.7	54.2

Table A. 38 GFEVD of LPB_SA

GFEVD of LPB_SA:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	16.1	0.7	0.0	100.0	8.9	0.2
2	15.0	1.2	0.0	89.3	20.5	0.2
3	14.4	3.3	1.1	86.8	20.5	0.2
4	14.2	3.3	1.1	85.5	21.5	0.2
5	13.7	3.7	1.4	83.0	23.1	0.3
6	13.4	3.9	1.6	81.4	24.2	0.3
7	13.3	4.0	1.9	79.8	25.1	0.5
8	13.3	4.0	2.1	78.0	26.1	0.7
9	13.2	4.0	2.6	76.3	27.0	0.8
10	13.2	3.9	3.0	74.6	27.8	1.0
11	13.2	3.9	3.6	72.8	28.8	1.0
12	13.2	3.8	4.2	70.9	29.7	1.0
13	13.1	3.7	5.0	69.0	30.7	1.0
14	13.0	3.6	5.9	67.0	31.8	1.0
15	12.9	3.5	6.9	64.9	32.8	0.9
16	12.8	3.4	7.9	62.7	33.8	0.9
17	12.7	3.3	9.1	60.5	34.8	0.9
18	12.6	3.2	10.2	58.3	35.8	0.9
19	12.5	3.1	11.4	56.1	36.7	0.9
20	12.5	3.0	12.5	53.9	37.6	0.9
21	12.4	2.9	13.7	51.8	38.4	0.9
22	12.3	2.9	14.8	49.8	39.2	0.9
23	12.3	2.8	15.8	47.9	39.8	1.0
24	12.2	2.7	16.8	46.1	40.5	1.0
25	12.2	2.6	17.7	44.4	41.1	1.0
26	12.2	2.5	18.6	42.9	41.6	1.0
27	12.2	2.5	19.4	41.4	42.1	1.0
28	12.2	2.4	20.1	40.0	42.5	1.0
29	12.2	2.3	20.8	38.7	42.9	1.0
30	12.2	2.3	21.4	37.5	43.3	1.0
31	12.3	2.2	22.0	36.4	43.6	1.0
32	12.3	2.2	22.6	35.4	43.9	1.0
33	12.3	2.1	23.1	34.4	44.2	1.0
34	12.3	2.1	23.6	33.5	44.5	1.0
35	12.3	2.1	24.0	32.7	44.7	1.0
36	12.4	2.0	24.4	31.9	45.0	1.0

Table A. 39 GFEVD of SCI (Beijing)

GFEVD of SCI:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	1.2	0.2	5.0	8.9	100.0	1.0
2	0.9	1.5	15.3	15.7	88.9	0.5
3	2.9	0.9	17.1	15.7	81.2	0.4
4	6.5	0.6	19.4	14.7	72.0	1.1
5	9.3	0.5	20.7	13.1	65.7	2.1
6	11.8	0.4	21.2	11.7	60.2	3.5
7	14.0	0.5	21.3	10.5	55.5	4.8
8	15.7	0.6	21.2	9.6	51.8	6.0
9	17.0	0.7	21.0	8.9	48.8	7.1
10	18.0	0.9	20.8	8.4	46.5	7.9
11	18.8	1.0	20.7	8.0	44.6	8.6
12	19.4	1.1	20.6	7.6	43.0	9.1
13	19.9	1.2	20.6	7.3	41.8	9.5
14	20.2	1.3	20.6	7.1	40.8	9.8
15	20.5	1.3	20.7	6.8	40.0	9.9
16	20.7	1.4	20.8	6.6	39.3	10.0
17	20.9	1.4	20.9	6.5	38.8	10.0
18	21.1	1.5	21.0	6.3	38.3	10.0
19	21.2	1.5	21.1	6.2	37.9	10.0
20	21.3	1.5	21.3	6.1	37.6	9.9
21	21.4	1.5	21.4	6.0	37.3	9.9
22	21.5	1.6	21.6	5.8	37.1	9.8
23	21.5	1.6	21.7	5.8	36.9	9.7
24	21.6	1.6	21.8	5.7	36.7	9.6
25	21.7	1.6	22.0	5.6	36.5	9.5
26	21.7	1.6	22.1	5.5	36.4	9.5
27	21.8	1.6	22.2	5.4	36.2	9.4
28	21.8	1.6	22.3	5.4	36.1	9.3
29	21.9	1.6	22.4	5.3	36.0	9.3
30	22.0	1.6	22.5	5.2	35.8	9.2
31	22.0	1.6	22.5	5.2	35.7	9.2
32	22.0	1.6	22.6	5.1	35.6	9.1
33	22.1	1.6	22.7	5.1	35.5	9.1
34	22.1	1.7	22.7	5.0	35.4	9.1
35	22.2	1.7	22.8	5.0	35.4	9.0
36	22.2	1.7	22.9	5.0	35.3	9.0

Table A. 40 GFEVD of CHSBCPMI (Beijing)

GFEVD of CHSBCPMI:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	8.4	0.0	1.5	0.2	1.0	100.0
2	10.1	0.7	4.8	0.2	4.1	97.2
3	9.4	1.7	7.3	0.1	7.8	94.0
4	8.0	2.7	9.6	0.0	10.8	90.8
5	6.8	3.4	11.6	0.0	13.0	88.2
6	5.7	3.9	13.2	0.0	14.9	85.8
7	4.8	4.3	14.6	0.0	16.4	83.6
8	4.0	4.6	15.9	0.0	17.7	81.7
9	3.4	4.9	16.9	0.0	18.8	79.9
10	3.0	5.1	17.7	0.0	19.6	78.4
11	2.6	5.3	18.4	0.0	20.4	77.1
12	2.4	5.5	18.9	0.0	21.0	76.0
13	2.1	5.6	19.3	0.0	21.5	75.1
14	2.0	5.8	19.6	0.0	21.8	74.3
15	1.8	5.9	19.8	0.0	22.2	73.7
16	1.7	6.0	19.9	0.0	22.4	73.1
17	1.6	6.2	20.0	0.0	22.6	72.7
18	1.6	6.3	20.0	0.0	22.8	72.4
19	1.5	6.4	20.0	0.0	22.9	72.2
20	1.4	6.5	20.0	0.0	22.9	72.0
21	1.4	6.6	19.9	0.0	23.0	71.8
22	1.3	6.8	19.8	0.0	23.0	71.7
23	1.3	6.9	19.7	0.0	23.0	71.7
24	1.3	7.0	19.6	0.0	23.0	71.6
25	1.3	7.1	19.4	0.0	23.0	71.6
26	1.2	7.1	19.3	0.0	23.0	71.6
27	1.2	7.2	19.2	0.0	23.0	71.6
28	1.2	7.3	19.1	0.0	23.0	71.6
29	1.2	7.4	18.9	0.0	22.9	71.6
30	1.2	7.5	18.8	0.0	22.9	71.6
31	1.2	7.5	18.7	0.0	22.9	71.7
32	1.2	7.6	18.6	0.0	22.8	71.7
33	1.2	7.7	18.5	0.0	22.8	71.7
34	1.1	7.7	18.4	0.0	22.8	71.7
35	1.1	7.8	18.3	0.0	22.8	71.8
36	1.1	7.8	18.2	0.0	22.7	71.8

Table A. 41 GFEVD of HPS

GFEVD of HPS:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	100.0	3.4	16.2	5.8	4.6	17.3
2	87.2	2.7	15.9	8.5	3.4	30.1
3	73.5	6.4	14.5	13.8	3.9	37.1
4	62.2	9.6	12.9	14.0	4.4	44.0
5	58.0	11.0	13.7	14.2	5.0	47.1
6	55.7	14.5	14.3	17.4	4.7	46.7
7	54.6	15.1	14.7	19.5	4.6	47.0
8	54.4	16.4	14.9	21.3	4.3	46.4
9	53.5	17.1	15.0	23.3	4.1	46.0
10	52.9	17.8	15.2	24.6	4.0	45.6
11	52.3	18.3	15.3	26.1	3.9	45.0
12	51.9	18.5	15.4	27.5	3.8	44.4
13	51.6	18.5	15.4	28.9	3.7	43.7
14	51.4	18.4	15.4	30.1	3.6	43.1
15	51.2	18.3	15.5	31.1	3.6	42.6
16	51.1	18.1	15.5	31.9	3.6	42.3
17	50.9	17.9	15.5	32.6	3.6	42.0
18	50.8	17.8	15.6	33.3	3.6	41.8
19	50.7	17.6	15.6	33.9	3.6	41.7
20	50.6	17.5	15.6	34.4	3.6	41.6
21	50.5	17.3	15.7	34.8	3.5	41.6
22	50.4	17.2	15.7	35.3	3.5	41.6
23	50.3	17.1	15.8	35.7	3.4	41.6
24	50.2	17.1	15.8	36.0	3.4	41.6
25	50.1	17.0	15.8	36.4	3.3	41.6
26	50.1	17.0	15.9	36.8	3.3	41.6
27	50.0	16.9	15.9	37.1	3.2	41.6
28	49.9	16.9	15.9	37.4	3.2	41.6
29	49.8	16.9	16.0	37.8	3.1	41.6
30	49.8	16.9	16.0	38.1	3.1	41.6
31	49.7	16.9	16.0	38.4	3.0	41.6
32	49.6	16.8	16.1	38.7	3.0	41.6
33	49.6	16.8	16.1	38.9	3.0	41.5
34	49.5	16.8	16.1	39.2	2.9	41.5
35	49.5	16.8	16.2	39.5	2.9	41.5
36	49.4	16.8	16.2	39.7	2.9	41.4

Table A. 42

Table A. 42 GFEVD of LPS_SA

GFEVD of LPS_SA:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	16.2	3.1	100.0	6.1	1.2	6.7
2	13.6	2.6	94.5	5.1	3.6	5.6
3	13.3	2.8	94.5	5.0	3.5	5.5
4	12.4	7.7	88.5	9.1	3.4	7.5
5	9.9	8.5	84.9	10.0	6.9	7.5
6	8.9	10.6	83.6	10.8	7.2	7.1
7	8.5	11.5	83.8	11.5	7.0	7.0
8	8.1	12.8	83.3	12.6	7.2	6.4
9	7.5	13.5	82.6	13.7	7.1	5.9
10	7.0	13.9	82.0	14.1	7.0	5.5
11	6.5	14.2	81.4	14.7	6.7	5.2
12	6.1	14.3	80.9	15.2	6.5	4.8
13	5.8	14.3	80.5	15.7	6.2	4.6
14	5.5	14.3	80.2	16.1	6.0	4.3
15	5.2	14.2	79.9	16.5	5.8	4.1
16	5.0	14.1	79.8	16.8	5.6	3.9
17	4.8	13.9	79.6	17.0	5.4	3.8
18	4.6	13.8	79.5	17.2	5.2	3.6
19	4.5	13.7	79.5	17.4	5.0	3.5
20	4.3	13.6	79.5	17.6	4.9	3.3
21	4.2	13.5	79.5	17.8	4.7	3.2
22	4.1	13.5	79.5	17.9	4.6	3.1
23	3.9	13.4	79.5	18.0	4.5	3.0
24	3.8	13.4	79.5	18.1	4.4	2.9
25	3.7	13.4	79.5	18.3	4.3	2.8
26	3.7	13.3	79.5	18.4	4.3	2.7
27	3.6	13.3	79.5	18.5	4.2	2.6
28	3.5	13.3	79.5	18.6	4.1	2.5
29	3.4	13.3	79.5	18.7	4.0	2.5
30	3.3	13.3	79.5	18.7	4.0	2.4
31	3.3	13.3	79.5	18.8	3.9	2.3
32	3.2	13.3	79.5	18.9	3.9	2.3
33	3.1	13.3	79.5	19.0	3.8	2.2
34	3.1	13.3	79.5	19.1	3.8	2.1
35	3.0	13.3	79.5	19.1	3.7	2.1
36	3.0	13.2	79.5	19.2	3.7	2.0

Table A. 43 GFEVD of SCI (Shanghai)

GFEVD of SCI:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	4.6	0.7	1.2	0.0	100.0	0.2
2	9.8	2.4	0.8	0.0	96.1	0.1
3	15.9	1.7	1.2	2.9	89.9	0.2
4	19.0	2.1	1.3	4.0	84.3	1.9
5	23.1	1.8	1.5	4.3	80.0	4.3
6	25.2	1.6	1.9	4.6	76.4	7.3
7	27.4	1.4	2.3	4.7	73.1	10.1
8	29.3	1.2	2.6	4.7	70.3	12.7
9	31.0	1.0	3.0	4.8	67.6	15.2
10	32.7	0.9	3.4	5.0	65.2	17.5
11	33.9	0.9	3.7	5.2	63.1	19.5
12	35.0	0.9	4.0	5.3	61.3	21.1
13	36.0	0.9	4.2	5.5	59.9	22.5
14	36.8	0.9	4.4	5.7	58.7	23.6
15	37.5	1.0	4.6	5.9	57.7	24.5
16	38.1	1.0	4.8	6.1	56.8	25.2
17	38.6	1.0	4.9	6.3	56.2	25.7
18	39.0	1.1	5.0	6.5	55.6	26.1
19	39.4	1.1	5.1	6.6	55.2	26.4
20	39.7	1.1	5.2	6.8	54.8	26.7
21	40.0	1.1	5.2	6.9	54.5	26.9
22	40.2	1.1	5.3	7.0	54.3	27.0
23	40.4	1.1	5.3	7.1	54.1	27.2
24	40.6	1.1	5.4	7.2	53.9	27.3
25	40.8	1.1	5.4	7.3	53.7	27.4
26	41.0	1.1	5.5	7.4	53.5	27.5
27	41.1	1.0	5.5	7.4	53.4	27.6
28	41.3	1.0	5.5	7.5	53.2	27.7
29	41.4	1.0	5.6	7.5	53.1	27.8
30	41.5	1.0	5.6	7.6	52.9	27.9
31	41.7	1.0	5.6	7.6	52.8	28.0
32	41.8	1.0	5.6	7.7	52.7	28.1
33	41.9	1.0	5.7	7.7	52.6	28.2
34	42.0	1.0	5.7	7.8	52.4	28.3
35	42.1	1.0	5.7	7.8	52.3	28.4
36	42.2	1.0	5.7	7.8	52.2	28.5

Table A. 44 GFEVD of CHSBCPMI (Shanghai)

GFEVD of CHSBCPMI:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	17.3	2.5	6.7	0.0	0.2	100.0
2	22.8	6.4	8.9	0.2	2.6	96.4
3	19.3	9.6	7.9	0.3	6.1	92.6
4	17.7	12.5	8.0	0.5	9.4	88.1
5	16.2	15.4	8.0	0.5	11.8	84.2
6	14.9	17.9	8.0	0.6	14.4	80.0
7	13.8	20.5	7.9	0.7	16.4	76.2
8	12.9	22.8	7.8	0.8	18.2	72.8
9	12.1	25.0	7.8	1.0	19.7	69.7
10	11.5	26.9	7.7	1.2	20.9	66.9
11	10.9	28.6	7.6	1.4	22.0	64.5
12	10.5	30.1	7.6	1.6	22.9	62.4
13	10.1	31.4	7.6	1.8	23.6	60.7
14	9.8	32.5	7.5	2.0	24.2	59.2
15	9.5	33.5	7.5	2.2	24.6	57.9
16	9.3	34.3	7.5	2.3	25.0	56.9
17	9.1	35.0	7.5	2.4	25.3	56.0
18	9.0	35.6	7.5	2.6	25.5	55.3
19	8.9	36.1	7.5	2.7	25.7	54.7
20	8.8	36.6	7.5	2.8	25.9	54.2
21	8.7	36.9	7.5	2.9	26.0	53.8
22	8.7	37.2	7.5	2.9	26.1	53.4
23	8.6	37.5	7.5	3.0	26.2	53.1
24	8.6	37.7	7.5	3.0	26.3	52.9
25	8.5	37.9	7.5	3.1	26.4	52.7
26	8.5	38.1	7.5	3.1	26.5	52.5
27	8.5	38.3	7.5	3.1	26.5	52.3
28	8.4	38.4	7.5	3.2	26.6	52.1
29	8.4	38.6	7.5	3.2	26.6	52.0
30	8.4	38.7	7.6	3.2	26.7	51.8
31	8.3	38.8	7.6	3.2	26.8	51.6
32	8.3	39.0	7.6	3.3	26.8	51.5
33	8.3	39.1	7.6	3.3	26.9	51.4
34	8.3	39.2	7.6	3.3	26.9	51.2
35	8.2	39.3	7.6	3.3	27.0	51.1
36	8.2	39.4	7.6	3.3	27.0	51.0

Table A. 45 Standard Deviation of Error in Beijing VECM

Variable	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
STD	0.05087	0.007701	0.007422	0.296683	0.071	1.198422

Table A. 46 Standard Deviation of Error in Shanghai VECM

Variable	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
STD	0.05886	0.007667	0.518391	0.008151	0.075582	1.10466

Table A. 47 GIR of HPB

Response of HPB:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	0.056875	-0.00549	-0.00576	0.022829	0.006148	0.016501
2	0.028252	0.002013	-0.0091	0.004435	0.00492	0.023185
3	0.013667	0.011568	0.004608	-0.00024	0.005481	0.0342
4	0.018798	0.010995	0.007171	0.005416	0.011367	0.035229
5	0.014444	0.012738	0.010013	0.006862	0.016991	0.031016
6	0.008392	0.013417	0.011823	0.002922	0.015484	0.027974
7	0.005341	0.011591	0.011658	0.002065	0.013834	0.024074
8	0.003023	0.010362	0.010899	0.002447	0.013604	0.020048
9	0.001409	0.009665	0.010327	0.002101	0.012418	0.016924
10	0.000535	0.008629	0.009181	0.001767	0.010861	0.014341
11	-4.38E-06	0.007845	0.008082	0.00176	0.009761	0.012274
12	-0.00011	0.007315	0.007138	0.001742	0.008746	0.010827
13	6.07E-05	0.006856	0.006269	0.001738	0.007846	0.009838
14	0.000318	0.00653	0.005555	0.001762	0.007171	0.00922
15	0.000652	0.006324	0.00503	0.001785	0.006667	0.008926
16	0.001022	0.006183	0.004654	0.00181	0.006314	0.008863
17	0.001366	0.006107	0.004424	0.001835	0.00611	0.008965
18	0.001671	0.006079	0.004323	0.001851	0.006019	0.009183
19	0.001929	0.006079	0.004323	0.001861	0.006019	0.009471
20	0.002131	0.006101	0.004401	0.001867	0.00609	0.009793
21	0.002278	0.006136	0.004539	0.001866	0.00621	0.010123
22	0.002376	0.006177	0.004714	0.001862	0.006362	0.010441
23	0.002429	0.00622	0.004912	0.001854	0.00653	0.010734
24	0.002446	0.006261	0.005118	0.001844	0.006705	0.010995
25	0.002434	0.006298	0.005321	0.001833	0.006875	0.011219
26	0.002401	0.006331	0.005514	0.001821	0.007036	0.011404
27	0.002352	0.006358	0.005691	0.001809	0.007181	0.011553
28	0.002293	0.006379	0.005848	0.001798	0.00731	0.011667
29	0.00223	0.006396	0.005984	0.001787	0.00742	0.011751
30	0.002166	0.006408	0.006099	0.001777	0.007511	0.011808
31	0.002104	0.006415	0.006192	0.001769	0.007585	0.011842
32	0.002046	0.00642	0.006266	0.001762	0.007643	0.011859
33	0.001994	0.006421	0.006323	0.001756	0.007686	0.011862
34	0.001948	0.006421	0.006363	0.001751	0.007716	0.011854
35	0.001909	0.006418	0.006391	0.001747	0.007735	0.011838
36	0.001877	0.006415	0.006407	0.001744	0.007746	0.011818

Table A. 48 GIR of LPB_SA

Response of LPB_SA:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	0.133141	-0.02776	-0.00124	0.331702	0.09922	-0.01419
2	0.056412	0.029548	-0.0036	0.11968	0.136625	0.003968
3	-0.00343	0.056046	0.040206	0.03712	0.03532	0.0024
4	-0.00412	0.01224	-0.00021	0.027252	0.045543	-0.00038
5	-0.01605	0.028648	0.023481	0.048322	0.063933	-0.01365
6	-0.01426	0.021867	0.01929	0.035197	0.052946	-0.01173
7	-0.02124	0.017033	0.022462	0.034507	0.051432	-0.01752
8	-0.0252	0.015034	0.024069	0.033253	0.053488	-0.01822
9	-0.02529	0.013618	0.028713	0.032539	0.05406	-0.01724
10	-0.02582	0.011223	0.030768	0.031706	0.05522	-0.01573
11	-0.02708	0.010524	0.03485	0.031175	0.057785	-0.01301
12	-0.02737	0.009939	0.038733	0.030568	0.060068	-0.00951
13	-0.0278	0.009528	0.042714	0.030306	0.063005	-0.00597
14	-0.02857	0.009543	0.046775	0.029944	0.066072	-0.00241
15	-0.02938	0.009654	0.050773	0.029582	0.069034	0.000992
16	-0.03034	0.009802	0.054502	0.029299	0.071935	0.004006
17	-0.03146	0.010026	0.057998	0.029033	0.074676	0.006612
18	-0.03264	0.010242	0.061156	0.028772	0.077134	0.008779
19	-0.03386	0.010424	0.063942	0.028545	0.079318	0.010491
20	-0.03509	0.010581	0.066355	0.028342	0.081207	0.011782
21	-0.03627	0.010696	0.068392	0.02816	0.082789	0.012696
22	-0.03739	0.010769	0.070067	0.028005	0.084083	0.013278
23	-0.03841	0.010806	0.071408	0.027873	0.085109	0.013586
24	-0.03933	0.01081	0.072448	0.027764	0.085891	0.013673
25	-0.04014	0.010788	0.073222	0.027675	0.086462	0.01359
26	-0.04082	0.010746	0.073768	0.027606	0.086852	0.013384
27	-0.0414	0.010689	0.074124	0.027553	0.087092	0.013093
28	-0.04186	0.010624	0.074325	0.027514	0.087212	0.012753
29	-0.04223	0.010554	0.074404	0.027488	0.087239	0.012392
30	-0.04251	0.010484	0.074391	0.027472	0.087196	0.012029
31	-0.04271	0.010417	0.074311	0.027463	0.087104	0.011683
32	-0.04285	0.010354	0.074186	0.027461	0.086981	0.011363
33	-0.04293	0.010297	0.074035	0.027464	0.08684	0.011078
34	-0.04297	0.010247	0.07387	0.027469	0.086693	0.01083
35	-0.04298	0.010204	0.073704	0.027477	0.086548	0.010621
36	-0.04296	0.010169	0.073545	0.027486	0.086412	0.010451

Table A. 49 GIR of SCI (Beijing)

Response of SCI:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	0.008638	0.003314	0.017951	0.0239	0.0799	0.008026
2	-0.00594	0.013136	0.039723	0.037183	0.068134	0.001659
3	-0.02157	-0.00204	0.039085	0.034618	0.072378	-0.00369
4	-0.03838	0.000804	0.051567	0.038314	0.079667	-0.01641
5	-0.04519	-0.00317	0.054953	0.03395	0.079316	-0.02386
6	-0.05284	-0.00742	0.056953	0.032194	0.077945	-0.03298
7	-0.05888	-0.01081	0.05752	0.030906	0.077168	-0.03921
8	-0.06199	-0.01327	0.058533	0.030367	0.076047	-0.04351
9	-0.06377	-0.01556	0.058575	0.030045	0.075211	-0.04648
10	-0.06512	-0.01695	0.059043	0.029758	0.074877	-0.04817
11	-0.06571	-0.01798	0.05954	0.029476	0.074616	-0.04879
12	-0.06593	-0.01873	0.060147	0.029367	0.074748	-0.04878
13	-0.06604	-0.01916	0.060921	0.029271	0.075145	-0.04828
14	-0.06606	-0.01941	0.061832	0.029168	0.075688	-0.04747
15	-0.06609	-0.01953	0.062807	0.029088	0.076367	-0.04651
16	-0.06616	-0.01956	0.063839	0.029015	0.077138	-0.0455
17	-0.06629	-0.01953	0.064878	0.02894	0.07793	-0.04452
18	-0.06648	-0.01947	0.065886	0.028869	0.078717	-0.04362
19	-0.06672	-0.0194	0.066839	0.028801	0.07947	-0.04283
20	-0.067	-0.01932	0.067718	0.028735	0.080165	-0.04217
21	-0.0673	-0.01926	0.068504	0.028675	0.080788	-0.04163
22	-0.06762	-0.0192	0.069193	0.02862	0.081333	-0.04122
23	-0.06793	-0.01916	0.069782	0.02857	0.081795	-0.04092
24	-0.06824	-0.01913	0.070272	0.028526	0.082178	-0.04072
25	-0.06852	-0.01911	0.070669	0.028489	0.082485	-0.0406
26	-0.06878	-0.0191	0.070981	0.028457	0.082723	-0.04055
27	-0.06901	-0.0191	0.071216	0.028432	0.082899	-0.04056
28	-0.0692	-0.01911	0.071386	0.028411	0.083023	-0.0406
29	-0.06937	-0.01912	0.0715	0.028395	0.083102	-0.04067
30	-0.06951	-0.01914	0.071568	0.028383	0.083146	-0.04076
31	-0.06962	-0.01916	0.0716	0.028375	0.083161	-0.04086
32	-0.0697	-0.01918	0.071603	0.02837	0.083154	-0.04096
33	-0.06976	-0.0192	0.071586	0.028367	0.083133	-0.04106
34	-0.06981	-0.01921	0.071555	0.028366	0.083101	-0.04115
35	-0.06984	-0.01923	0.071515	0.028366	0.083063	-0.04123
36	-0.06985	-0.01925	0.071469	0.028368	0.083022	-0.0413

Table A. 50 GIR of CHSBCPMI (Beijing)

Response of CHSBCPMI:						
Period	HPB	BCB	BCR	LPB_SA	SCI	CHSBCPMI
1	0.388747	-0.01509	0.161604	-0.05732	0.134589	1.339877
2	0.80669	0.24134	0.598315	-0.11824	0.556176	2.43857
3	1.04985	0.540495	1.045271	-0.00388	1.118678	3.365074
4	1.131595	0.838713	1.523507	0.000582	1.646017	4.116395
5	1.114855	1.064149	1.933812	0.016042	2.047312	4.636183
6	1.010051	1.226154	2.258528	0.024839	2.400763	4.962311
7	0.857949	1.358286	2.521597	0.024166	2.659562	5.130199
8	0.696819	1.437957	2.695244	0.015164	2.829471	5.17588
9	0.533112	1.486071	2.796985	0.009921	2.931876	5.125754
10	0.385074	1.510235	2.835833	0.004506	2.972971	5.013917
11	0.261357	1.515086	2.822118	0.001503	2.964508	4.862242
12	0.163346	1.507229	2.767065	0.001195	2.920042	4.689753
13	0.091947	1.492007	2.683067	0.002904	2.849531	4.511896
14	0.046109	1.472256	2.579384	0.006481	2.762062	4.339317
15	0.022494	1.450911	2.464963	0.011673	2.666019	4.179388
16	0.017624	1.429983	2.347108	0.017834	2.567493	4.036956
17	0.027797	1.410598	2.231416	0.024596	2.471333	3.914465
18	0.049207	1.39356	2.122133	0.031612	2.381174	3.812651
19	0.078428	1.379276	2.022246	0.038535	2.299375	3.731046
20	0.112459	1.367816	1.933556	0.045124	2.227332	3.668269
21	0.148741	1.359086	1.856962	0.051211	2.165687	3.622373
22	0.18523	1.352858	1.792624	0.056669	2.114435	3.591119
23	0.220361	1.348818	1.740125	0.061436	2.073112	3.572149
24	0.252999	1.346621	1.698648	0.065491	2.040943	3.56314
25	0.282396	1.345917	1.667109	0.068847	2.016942	3.561914
26	0.308131	1.346367	1.64427	0.071542	2.000018	3.566498
27	0.330045	1.347663	1.628833	0.073635	1.989053	3.575167
28	0.348182	1.349537	1.619517	0.075194	1.982955	3.586462
29	0.362742	1.351759	1.615105	0.076291	1.980701	3.599182
30	0.374027	1.354143	1.614484	0.077001	1.981369	3.612378
31	0.382403	1.356543	1.616666	0.077396	1.984147	3.62533
32	0.388271	1.358848	1.620801	0.077542	1.988345	3.637515
33	0.392035	1.360981	1.626176	0.0775	1.993391	3.648584
34	0.394089	1.362892	1.632212	0.077322	1.998827	3.658333
35	0.394795	1.364555	1.638456	0.077053	2.004301	3.666668
36	0.394484	1.365961	1.644565	0.076729	2.009551	3.673586

Table A. 51 GIR of HPS

Response of HPS:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	0.06784	0.012592	0.0273	0.016356	-0.01451	0.028177
2	0.029322	0.003289	0.015891	0.016329	-0.00183	0.03305
3	0.019946	0.018539	0.012684	0.023816	0.009764	0.032824
4	0.018332	0.021042	0.011103	0.01703	-0.01147	0.037645
5	0.016112	0.016311	0.015414	0.013586	0.010566	0.029277
6	0.022668	0.024208	0.016521	0.024504	0.005711	0.024688
7	0.023514	0.016607	0.015303	0.022442	0.006666	0.024904
8	0.023926	0.018707	0.013699	0.022134	0.0042	0.020898
9	0.018151	0.016356	0.012503	0.022262	0.000446	0.018707
10	0.01552	0.014881	0.010924	0.019238	0.000658	0.014942
11	0.015246	0.013685	0.010207	0.020092	-0.00317	0.013288
12	0.015958	0.012098	0.010567	0.020337	-0.00234	0.012877
13	0.017409	0.011602	0.010719	0.021142	-0.00343	0.013144
14	0.017544	0.010233	0.010651	0.020525	-0.00394	0.013897
15	0.017723	0.009912	0.010512	0.019889	-0.00444	0.014165
16	0.017429	0.009439	0.010394	0.0194	-0.00502	0.0146
17	0.017526	0.009264	0.01046	0.019026	-0.00481	0.014975
18	0.017868	0.009331	0.010609	0.019079	-0.0049	0.015575
19	0.018204	0.009355	0.010812	0.01903	-0.00451	0.016211
20	0.018527	0.009605	0.010969	0.019059	-0.0043	0.016745
21	0.018623	0.009764	0.011082	0.018997	-0.00405	0.017172
22	0.018676	0.010012	0.011153	0.018945	-0.00381	0.017408
23	0.018666	0.010219	0.011204	0.018959	-0.00365	0.01756
24	0.018668	0.010409	0.011252	0.01899	-0.00344	0.017626
25	0.018675	0.010578	0.011286	0.019066	-0.00332	0.017648
26	0.018659	0.010691	0.011306	0.01912	-0.00321	0.017627
27	0.018634	0.010783	0.011307	0.01917	-0.00315	0.017565
28	0.018586	0.010829	0.011295	0.019203	-0.00313	0.017481
29	0.01854	0.010853	0.011276	0.019228	-0.00313	0.017381
30	0.018497	0.010852	0.011255	0.019251	-0.00315	0.017286
31	0.018464	0.010835	0.011235	0.019266	-0.00318	0.0172
32	0.018441	0.010809	0.011217	0.019278	-0.00321	0.017131
33	0.018423	0.010775	0.011201	0.019281	-0.00325	0.017077
34	0.018412	0.010741	0.011187	0.01928	-0.00328	0.017038
35	0.018405	0.010708	0.011176	0.019274	-0.00332	0.017014
36	0.018403	0.010679	0.011169	0.019267	-0.00334	0.017001

Table A. 52 GIR of LPS_SA

Response of LPS_SA:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	0.240437	0.104781	0.597468	0.14746	0.06425	0.154097
2	-0.03158	0.017265	0.227448	-0.01645	0.107534	0.020386
3	0.044004	0.041053	0.146453	0.022693	0.014239	0.031376
4	0.094332	0.173818	0.258985	0.169124	-0.0547	0.129273
5	0.00513	0.128232	0.31483	0.138637	0.171431	0.103593
6	0.03226	0.157408	0.262302	0.124144	0.095699	0.063077
7	0.059714	0.125469	0.257936	0.121109	0.059269	0.065752
8	0.063168	0.152345	0.268626	0.144233	0.093083	0.036373
9	0.028042	0.138053	0.263615	0.153779	0.076999	0.024057
10	0.015721	0.125683	0.248461	0.127644	0.067292	0.005553
11	0.01431	0.123153	0.242911	0.133142	0.042449	-0.00779
12	0.01137	0.114441	0.24552	0.136745	0.050657	-0.01462
13	0.017637	0.110635	0.245892	0.140693	0.044099	-0.01674
14	0.018894	0.101483	0.244143	0.13706	0.037501	-0.01445
15	0.020693	0.098782	0.243275	0.134566	0.034935	-0.01446
16	0.019198	0.095547	0.242722	0.132859	0.030673	-0.01263
17	0.019121	0.092991	0.242736	0.129881	0.031022	-0.01094
18	0.020771	0.092626	0.242998	0.129443	0.029211	-0.00819
19	0.022427	0.091964	0.243938	0.128896	0.030667	-0.00479
20	0.02444	0.092911	0.244878	0.12894	0.031651	-0.00168
21	0.025299	0.093428	0.245594	0.12855	0.032757	0.001187
22	0.025929	0.094591	0.24607	0.128069	0.034114	0.003038
23	0.026127	0.09572	0.246446	0.12803	0.034992	0.004404
24	0.026252	0.096792	0.246811	0.128048	0.036288	0.005225
25	0.026402	0.09786	0.247084	0.128382	0.037104	0.005704
26	0.026403	0.098629	0.247275	0.128642	0.037913	0.005899
27	0.026362	0.099321	0.247366	0.128932	0.038431	0.005791
28	0.026156	0.09975	0.247371	0.129152	0.038735	0.005501
29	0.025927	0.100038	0.247314	0.129317	0.03891	0.005048
30	0.025688	0.100172	0.247222	0.129477	0.038893	0.004556
31	0.025481	0.100178	0.247123	0.129592	0.038837	0.00407
32	0.025323	0.100113	0.247023	0.129692	0.038685	0.003635
33	0.025191	0.099973	0.246928	0.129744	0.038514	0.003275
34	0.025099	0.099813	0.246842	0.129764	0.038324	0.002986
35	0.025031	0.099636	0.24677	0.129758	0.038136	0.002778
36	0.024993	0.099469	0.246714	0.129733	0.037973	0.002639

Table A. 53 GIR of SCI (Shanghai)

Response of SCI:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	-0.01863	0.007173	0.009368	0.001329	0.087112	0.004237
2	-0.03244	0.016983	-0.00489	-0.00155	0.078674	0.000833
3	-0.04848	0.008421	-0.01267	-0.02612	0.085786	-0.00495
4	-0.05341	0.017659	-0.01318	-0.02617	0.089921	-0.02467
5	-0.06539	0.012009	-0.01674	-0.02585	0.091449	-0.03721
6	-0.06551	0.009497	-0.02022	-0.02704	0.0914	-0.04823
7	-0.06769	0.006851	-0.02296	-0.02445	0.082436	-0.05376
8	-0.07134	0.002412	-0.0242	-0.02568	0.083611	-0.05933
9	-0.07312	6.52E-05	-0.02616	-0.02598	0.07773	-0.06352
10	-0.07473	-0.00476	-0.02738	-0.02793	0.075124	-0.0658
11	-0.07397	-0.00666	-0.02802	-0.02827	0.072674	-0.06738
12	-0.07374	-0.00941	-0.02821	-0.02854	0.070677	-0.06699
13	-0.07292	-0.01103	-0.02825	-0.0295	0.070012	-0.06623
14	-0.07235	-0.01213	-0.02827	-0.03007	0.068664	-0.06488
15	-0.07191	-0.0129	-0.0281	-0.03097	0.068753	-0.0635
16	-0.07127	-0.01295	-0.02785	-0.03134	0.068635	-0.06209
17	-0.07078	-0.01296	-0.02752	-0.0317	0.069083	-0.06063
18	-0.07018	-0.01254	-0.02718	-0.03185	0.069637	-0.0594
19	-0.0698	-0.01209	-0.02688	-0.03191	0.070181	-0.05831
20	-0.06953	-0.01155	-0.02662	-0.03195	0.070851	-0.05753
21	-0.06939	-0.011	-0.02643	-0.0319	0.071337	-0.05699
22	-0.06935	-0.01052	-0.0263	-0.03185	0.071843	-0.05669
23	-0.06934	-0.01007	-0.02621	-0.03173	0.072203	-0.05657
24	-0.0694	-0.00974	-0.02615	-0.03161	0.072491	-0.05659
25	-0.06947	-0.00948	-0.02614	-0.03149	0.072685	-0.05671
26	-0.06956	-0.00932	-0.02615	-0.03139	0.072779	-0.0569
27	-0.06967	-0.00924	-0.02619	-0.03131	0.072818	-0.05713
28	-0.06977	-0.00921	-0.02623	-0.03124	0.07279	-0.05736
29	-0.06986	-0.00923	-0.02628	-0.03119	0.072735	-0.05757
30	-0.06993	-0.00929	-0.02633	-0.03116	0.072652	-0.05776
31	-0.06998	-0.00936	-0.02637	-0.03115	0.072562	-0.05792
32	-0.07002	-0.00944	-0.02641	-0.03115	0.072473	-0.05803
33	-0.07004	-0.00953	-0.02644	-0.03116	0.072389	-0.05811
34	-0.07005	-0.0096	-0.02646	-0.03117	0.072319	-0.05815
35	-0.07005	-0.00966	-0.02647	-0.03119	0.072262	-0.05817
36	-0.07004	-0.00972	-0.02648	-0.0312	0.072221	-0.05816

Table A. 54 GIR of CHSBCPMI

Response of CHSBCPMI:						
Period	HPS	BCR	LPS_SA	BCB	SCI	CHSBCPMI
1	0.528808	0.200859	0.328371	0.015002	0.061924	1.27317
2	1.23261	0.680272	0.770692	0.127445	0.450587	2.44858
3	1.531728	1.24778	1.000741	0.236087	1.048893	3.499871
4	1.889505	1.84942	1.336942	0.354341	1.677091	4.317249
5	2.061189	2.433417	1.551078	0.422644	2.143613	4.868258
6	2.11561	2.90138	1.702093	0.504742	2.68074	5.122765
7	2.127347	3.35953	1.773339	0.643673	2.986118	5.20177
8	2.060692	3.660417	1.820847	0.76662	3.257834	5.156104
9	1.971531	3.91708	1.825012	0.888572	3.425006	4.995627
10	1.856051	4.054876	1.803196	0.995372	3.498624	4.788909
11	1.754019	4.130298	1.763578	1.072114	3.522009	4.548108
12	1.658896	4.142483	1.717712	1.144363	3.479502	4.312735
13	1.574377	4.106769	1.668105	1.18615	3.419339	4.095685
14	1.508297	4.044276	1.618511	1.213794	3.326889	3.909797
15	1.454897	3.961185	1.574007	1.221965	3.232006	3.762472
16	1.420677	3.875787	1.537405	1.220481	3.139578	3.652939
17	1.400454	3.791335	1.509126	1.210517	3.055305	3.58248
18	1.394576	3.716254	1.489674	1.194992	2.986944	3.544807
19	1.39852	3.654049	1.477825	1.177729	2.931928	3.535002
20	1.408826	3.605283	1.472636	1.159036	2.894278	3.545769
21	1.423318	3.571461	1.47244	1.141698	2.869932	3.570488
22	1.439126	3.550148	1.47604	1.126264	2.858443	3.603576
23	1.455263	3.540514	1.482121	1.113801	2.857024	3.63984
24	1.470074	3.539671	1.489566	1.104594	2.862857	3.675823
25	1.4829	3.545497	1.497406	1.098293	2.873933	3.708543
26	1.493166	3.555701	1.504862	1.094787	2.887461	3.736322
27	1.500657	3.568178	1.511442	1.0934	2.902026	3.75821
28	1.505588	3.581428	1.516841	1.093797	2.915953	3.774009
29	1.508191	3.594062	1.520952	1.095406	2.928391	3.784133
30	1.508961	3.605304	1.523799	1.097802	2.938736	3.789277
31	1.508306	3.614586	1.525494	1.100585	2.946685	3.790414
32	1.506677	3.6217	1.526217	1.103403	2.952301	3.788522
33	1.504465	3.626668	1.526166	1.106035	2.95571	3.784583
34	1.501997	3.629655	1.525558	1.1083	2.957272	3.779467
35	1.499549	3.630976	1.524592	1.110128	2.957342	3.773901
36	1.497308	3.630962	1.523444	1.111485	2.956328	3.768463

Appendix B

FIGURES

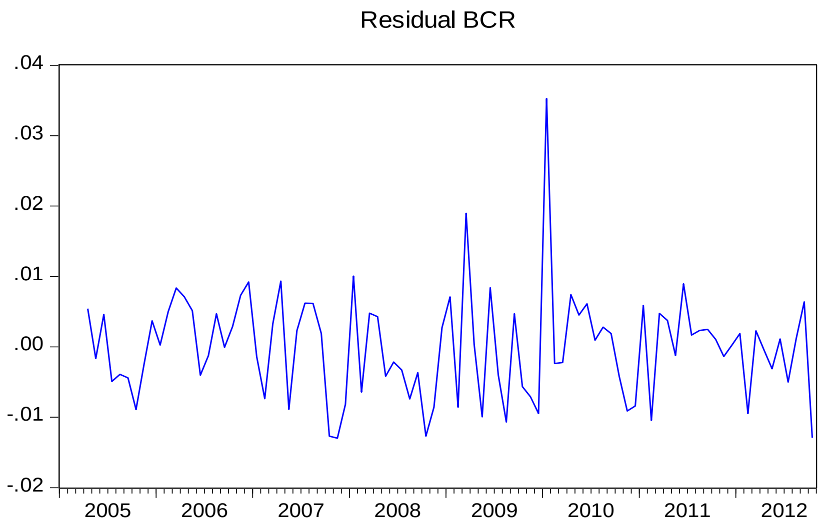

Figure B. 1 Residual of BCR (Beijing)

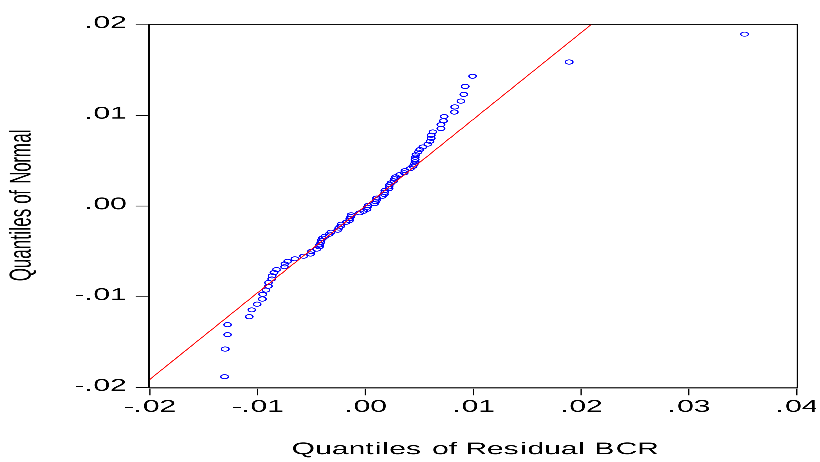

Figure B. 2 QQ Plot of Residual BCR (Beijing)

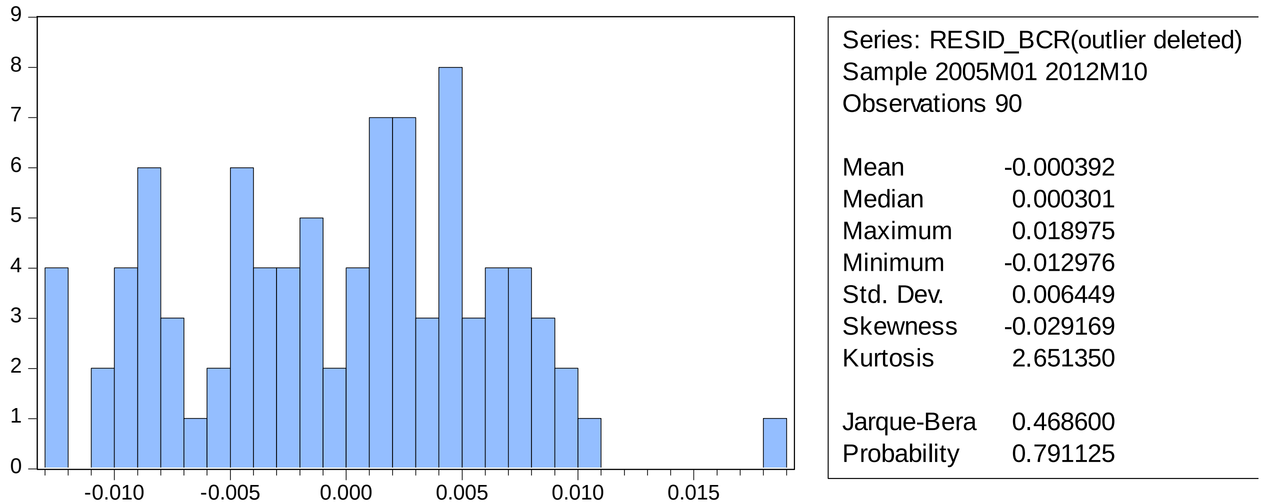

Figure B. 3 Exclude the Outlier Normality Test of Residual BCR (Beijing)

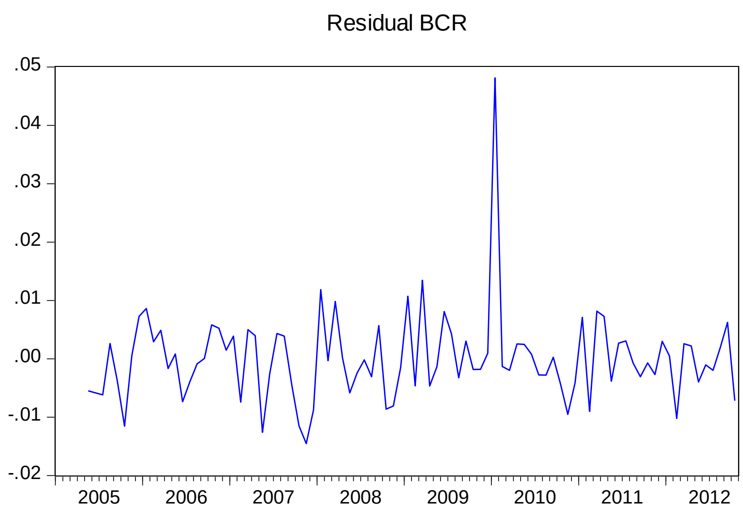

Figure B. 4 Residual of BCR (Shanghai)

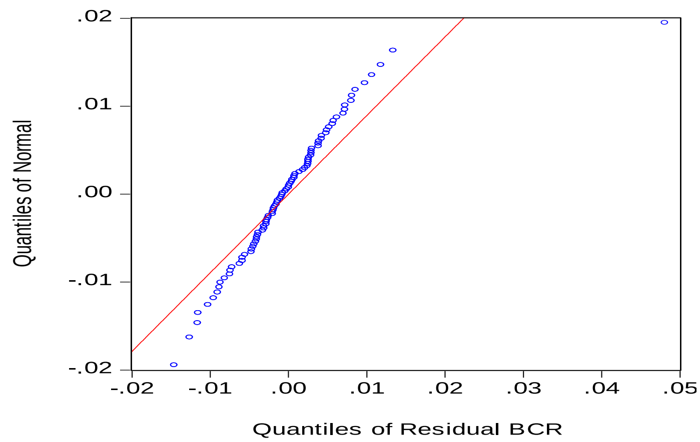

Figure B. 5 QQ Plot of Residual BCR (Shanghai Model)

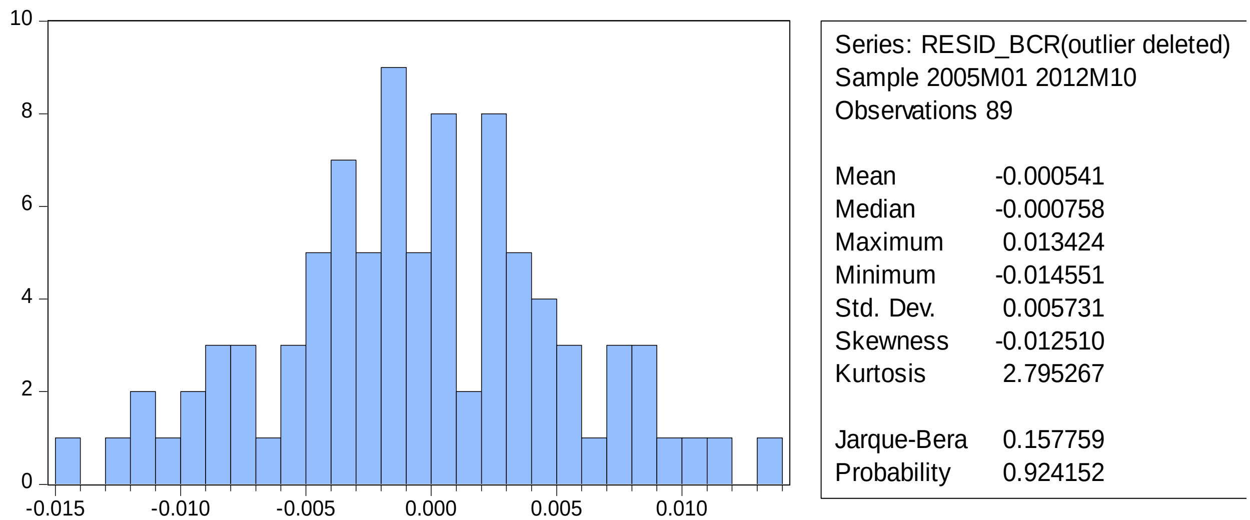

Figure B. 6 Exclude the Outlier Normality Test of Residual BCR (Shanghai)

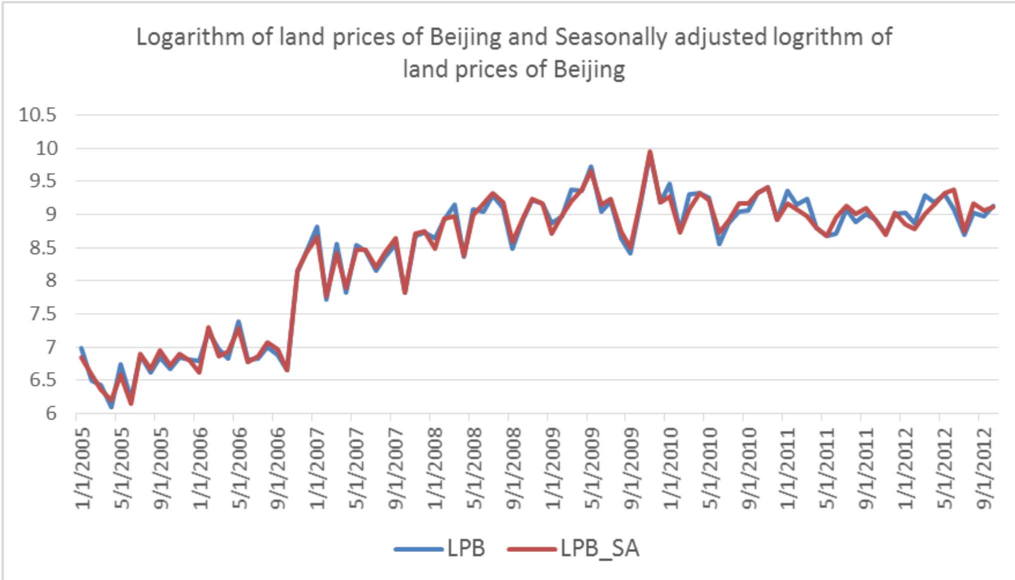

Figure B. 7 LPB and LPB_SA

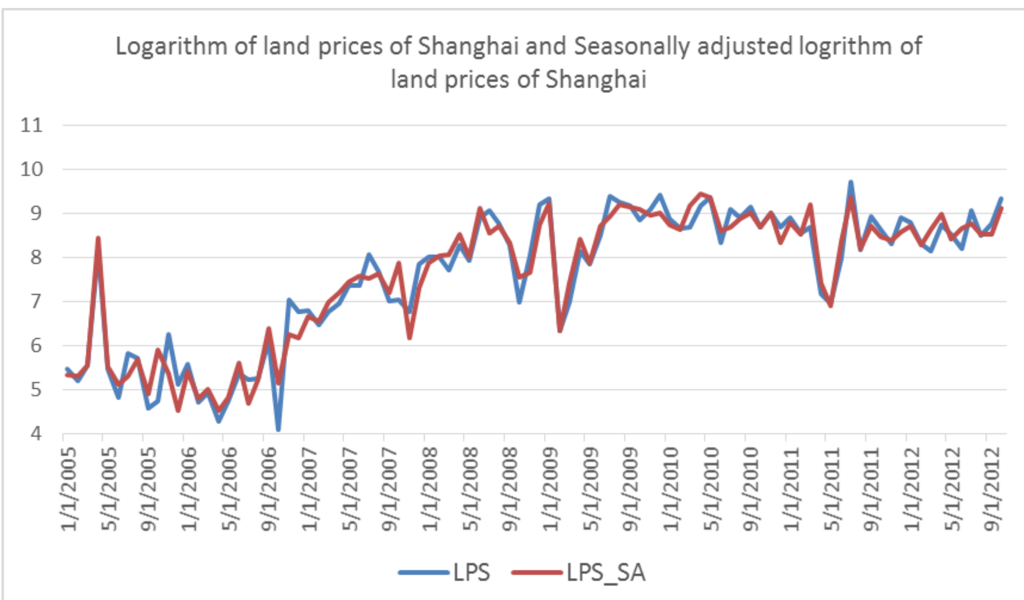

Figure B. 8 LPS and LPS_SA

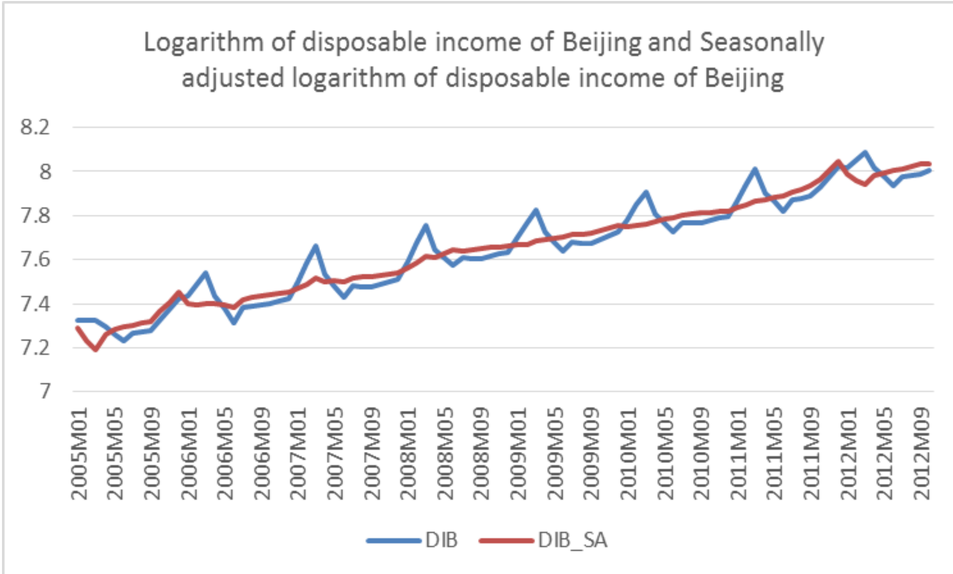

Figure B. 9 DIB and DIB_SA

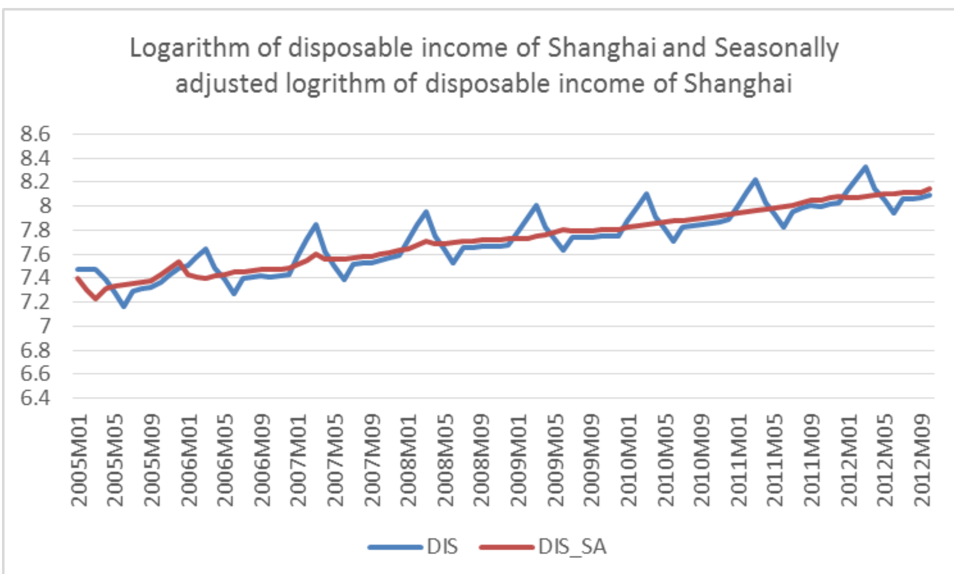

Figure B. 10 DIS and DIS_SA

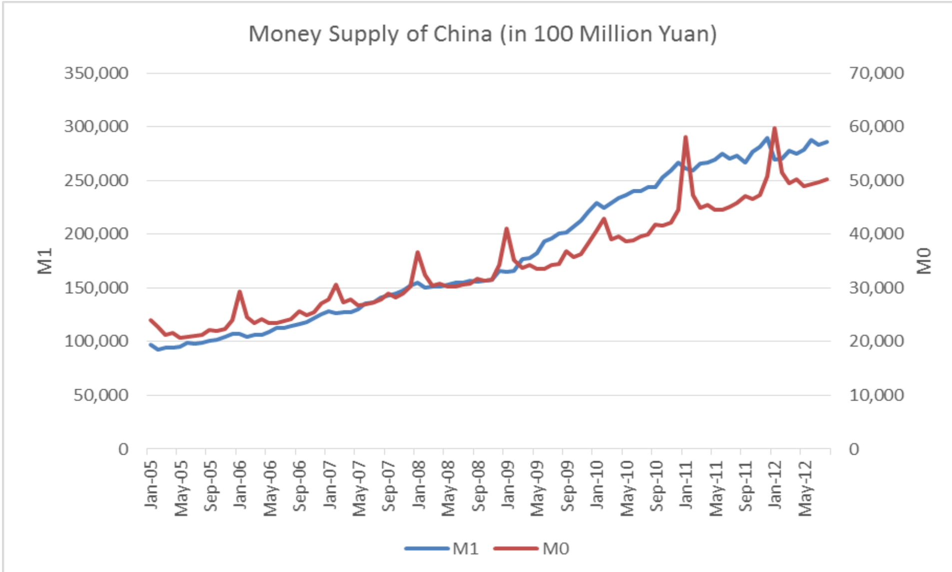

Figure B. 11 Money Supply of China