

Research on Dynamic Relationship between Asset Prices Volatility and Financial Exposure

—An Empirical Analysis Based on Data of Real Estate and Stock Market in China With Eviews Software

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Abstract—This paper explores the interaction mechanism between asset price volatility and financial exposure by using prices of real estate and stock market. To this end, some dynamic econometric methods such as cointegration, IRF and so on are used to analyze the data based on Eviews software. Results show that inter-influences have been found between real estate prices and banking credit, with the former over-depending on the latter. The relationship between stock market and banking credit is not significant. Real estate and stock markets have a certain degree influence upon each other in short term. In addition, the interest rate mechanism has little role in the relationship between asset prices volatility and banking credit.

Index Terms—Asset price; Banking credit; Eviews software; Real estate price; Stock price; IRF

I. INTRODUCTION

The development of modern computer technology has vigorously promoted the process of scientific research, which eventually made the research on economics extremely convenient as well. For instance, excel can easily process a great deal of economic data. Statistic software of various types can swiftly conduct fitting of specific econometric models. In this paper, excel is applied to make tendency chart as required by the analysis. And EViews6.0 dynamic quantitative analysis tool was applied with priority to perform empirical inspection on the relationship among the above mentioned economic variables.

In modern economy, financial risk is an issue that has drawn close attention from all around the world.

Expansion and shrinkage of bank credit as well as violent fluctuation of asset price act as a stimulator of extreme financial risk (financial crisis). Financial unbalance caused by the combination of bank credit and fluctuation of asset price is one of the radical causes of the instability of macro economy. In recent years, such phenomena as constant growth of investment, rapid rise of asset price, evident expansion of bank credit and continuous increase in inflationary pressure have become increasingly evident in Chinese economy. Accordingly, appropriate and reasonable management of financial risk and macro regulation are faced with great challenges. Bank credit plays a vital role as a linkage in capital market. The priority in the management of financial risk lies in regulation of bank credit. Along with the rapid development of capital market and real estate industry, asset price is increasingly becoming an essential factor in credit regulation. Consequently, identifying the correlation between bank credit and asset price in financial risk system is of extreme significant.

II. THEORY REVIEW

As financial risk exists continuously and always engulfs banks, especially commercial banks, bank credit regulation and financial crisis have presented as important research thesis. In the 1930s, Hayek, the representative figure of Austrian economic school, proposed the theory of Monetary Economy Cycle. He made initial explanation to financial crisis and asset price bubbles and pointed out that the monetary policy at that time was overemphasized on price stability. However, he neglected the overgrowth of credit and abnormal fluctuation of asset price in economic cycle. If short-term rate of interest is excessively low, it will result in excessive credit expansion and investment, thus stimulating the generation of asset price bubbles in financial market. Based on the model of asset price

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bubbles caused by credit expansion, Allen and Gale (1998)^[1] revealed the relationship between credit and asset price. Asset price bubbles are mainly decided by two factors—debt financing scale and uncertainty degree of asset market, whose increase will possibly stimulate the generation of asset price bubbles. Furthermore, Allen and other scholars (2000)^[2] proposed the theory of Three Phases of Financial Crisis. Phase I begins with financial deregulation. Central bank's ease of credit regulation results in credit expansion, which, together with the craze in stock and real estate markets, leads to constant inflation of price bubbles. In Phase II, price reaches a peak and bubbles break. In Phase III, lots of borrowers fall into breach of contract and bank run happens, resulting in liquidity crisis or even bankruptcy. Obviously, there is a close relationship among credit expansion, asset price bubbles and financial risk. Bernanke and other scholars (2000)^[3] emphasized on financial accelerator. According to their point of view, when enterprise's asset-liability situation deteriorates and bank's credit capital decreases, total credit supply and demand will be affected. Particularly, reduction of enterprise's net value during breakage period of asset price bubbles will enhance multiplier effect and result in acceleration of credit shrinkage and economic downturn. For this reason, close attention should be paid to asset price fluctuation in monetary policy.

Theories about demonstration of the relationship between bank credit and asset price have been quite mature. Some empirical research also indicates that asset price and bank credit are in close relation. Hilbers, Lei, Zacho and other scholars (2001)^[4] demonstrated by adopting Regression Approach and other quantitative approaches that bank credit and real estate price were mutually influential. Ibrahim and other scholars (2006) demonstrated the one-way causation between bank credit and stock price through using VAR model which contains multiple variables such as credit, output, interest rate, commodity price and stock price. Stock price imposes remarkable influence on bank credit. However, the opposite is not true. In this paper, the author analyzed the dynamic relationship between Chinese bank credit and asset price and then probed into the internal connection between asset price fluctuation and financial risk, with real estate price and stock price as the incision.

III. INTERACTIVE MECHANISM OF ASSET PRICE AND BANK RISK

A. Mechanism for Influence of Asset Price on Bank Credit

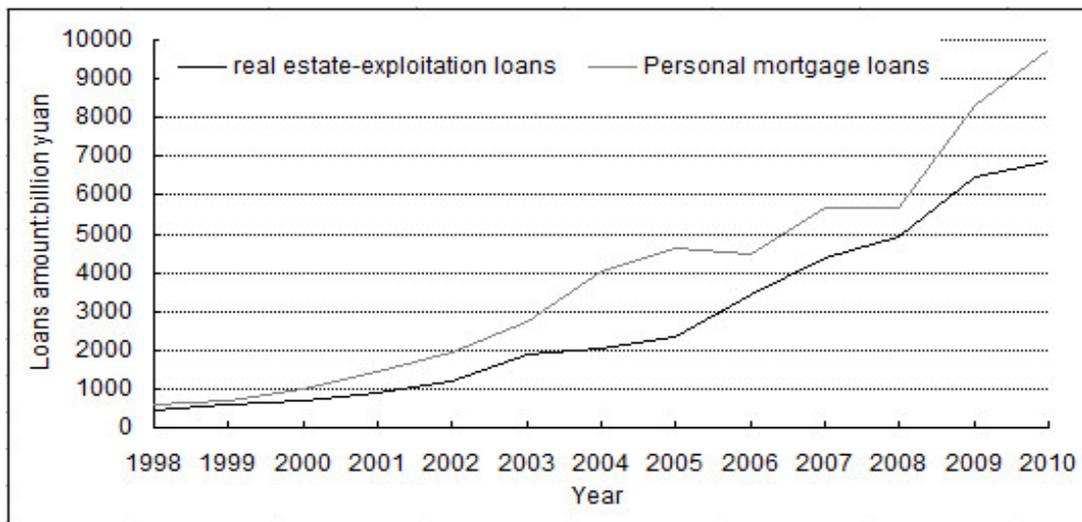
Asset price fluctuation obviously changes enterprise's asset-liability situation. Changes in external financing

cost will affect enterprise's financing capacity and credit rating. In periods of economic prosperity, rise of asset price tends to raise the value of collateral asset (real estate or security), improve enterprise's asset-liability situation, and reduce its external financing cost, which will increase the demand for bank loans. The opposite is true in periods of economic depression. Detailed analysis can be conducted from the perspective of real estate market and security market (mainly stock market).

a. Influence of Real estate price on Bank Credit and Risk

The influence of real estate price on bank credit is reflected on credit demand and credit supply. Considering that demander's (borrower's) house is taken as important collateral, changes in real estate price will directly affect borrower's fortune and borrowing ability and therefore affect his borrowing tendency. When real estate price rises, borrower's total fortune will increase and his expenditure within a specific scope will grow under marginal effect, which will jointly result in the increase of credit demand. Meanwhile, real estate enterprises will enhance their real estate development and investment and thus enlarge the credit scale. From the perspective of loan supplier (bank), fluctuation of real estate price will affect its loan supply by directly affecting the value of mortgaged real estate. In periods of real estate boom, the expected yield of real estate is high and the supply of real estate loan tends to be active. Increase of real estate price will raise the market value of mortgaged house. Accordingly, banks are willing to loosen loan conditions and provide more real estate loans.

At present, the financing channel in Chinese real estate market is unitary. Real estate development and individuals' house purchase depend excessively on bank loans, which results in commercial bank's suffering from price risk in various linkages. Fig.1 shows that bank's housing loan has increased year by year since 1998. The growth rate of domestic loans for real estate development and individuals' mortgage loan was accelerated remarkably in 2009, reaching 31.6 percent and 46.6 percent respectively, an increase of 19.4 percent and 46.7 percent over 2008. Banks hold a great deal of assets, that is, mortgaged real estate, which results in this natural cycle—"Rise of real estate price → enlargement of bank capital scale → credit expansion → rise of real estate price", thus generating bubbles in real estate price. Once the bubbles break, liquidity risk of banks will prick up. Meanwhile, bubbles in real estate price will expose those real estate enterprises with weaker capital strength and poorer capacity of risk resistance, who count greatly on bank loan, to considerable potential liability risk, which will increase the bad debt risk of banks.



Data sources: China's economic information network statistics database

Fig.1 Loans of real estate-exploitation and personal housing mortgage from the year of 1998 to 2010 in China

b. Influence of Stock Price on Bank Credit and Risk

Different from the influence of real estate price on bank credit, the influence of stock price on bank credit in China is mainly reflected in the influence on demand for bank credit¹. When stock price grows continuously, investors will have optimistic expectations for market quotation, and individuals and enterprises will increase their stock investment. However, most of the capital invested in stock market comes from bank credit. The year 2006 and 2007 witnessed the bull market in China. Statistic data show that the increment of residents' RMB deposit in Chinese financial institutions at the end of 2007 was decreased by RMB 959.8 billion on year-on-year basis, which is mostly fixed deposit. This indicates that there was an evident tendency of current deposit. The growth rate of residents' loans in the same period is 9.3 percent up from the previous year. The amount of loans provided to non-financial enterprises and other departments was increased by RMB 2.5 trillion, an increase of 13.1 percent over the same period of the previous year².

Bank credit is relatively passive in its relation with stock price. As it is impossible to judge the specific scale of credit capital entering into stock market (including unlicensed entry) due to restrictive conditions, there are enormous barriers in financial supervision.

B. Mechanism for Influence of Bank Credit on Asset Price

¹ The influence of stock price on bank credit supply is mainly reflected in the influence on capacity of bank credit supply via capital channel and the influence on inclination of bank credit via confidence channel (Kimetal, 1994). However, due to the divided operation of Chinese commercial banks, which can not directly invest in stock market, capital channel is not applicable. In addition, due to the nonconformance between the tendency of Chinese stock market and Chinese macro economy, it is hard to extend the confidence channel as well.

² Data source: 4Q Monetary Policy Report, 2007

Credit regulation affects borrowers' financing cost via changes in loan interest rate and conditions for loan, etc., thus influencing capital demand and the level of asset price. In periods of economic prosperity, bank credit is expanded, while conditions for credit supply is loosened, borrowers' financing cost is reduced and their demand for capital is increased, which result in the rise of asset price, and vice versa in periods of economic depression. Detailed analysis can be conducted from the perspective of real estate market and stock market as well.

a. Influence of Bank Credit on Real estate price

The influence of credit scale on real estate price can be explained via general equilibrium analysis. Take enterprise as an example, bank loan is the major mode of enterprise's investment and the primary financing channel for its real estate development. The interest paid is exactly the financing cost. Marginal cost of financing will grow constantly along with the increase of loan fund (refer to Fig.2 <left>). The scale of loan fund used in real estate investment depends on the expected profit rate and marginal cost of capital. Only when expected profit rate is higher than marginal cost of capital could investment be made. In Fig.2 <right>, the investment items on the left of intersection point E are feasible. I* stands for uniform investment level, which decides the supply-demand situation of real estate and therefore decides real estate price. Through changing credit conditions, banks can change the curve of capital marginal cost and then the equilibrium point E. The new investment level can further decide the new equilibrium price of real estate.

b. Influence of Bank Credit on Stock Price

The entry of bank credit capital into stock market will increase the amount of capital in capital market and thus promote the rise of stock price. As a matter of fact, increase of credit does not mean increase of borrowers' demand for investment in stock market. It is very hard to

measure the scale of credit capital pumped into stock market in the practice. For example, the amount of loans provided by the Bank of China kept growing from June 2001 to December 2005, but the month-end closing price of Shanghai Securities Composite Index in the same period dropped from 2218.02 o'clock to 1161.06 o'clock

and rebounded only for a while during the period from November 2003 to March 2004. A great deal of research demonstrates that entry of credit capital into stock market depends on investment subjects' expectation for future stock price.

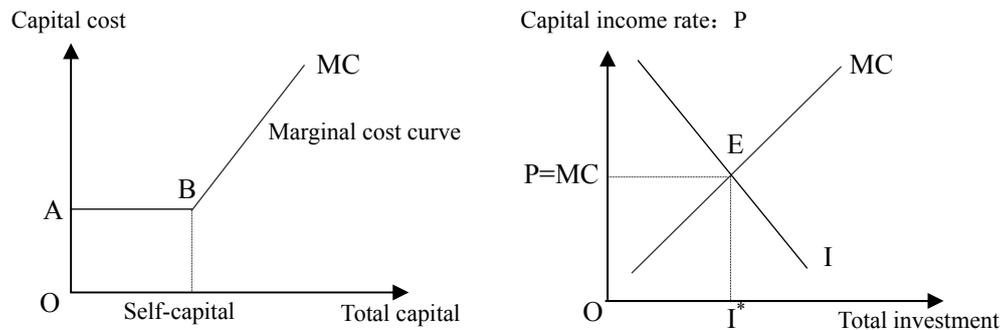


Fig.2 Financing cost and the equilibrium of investment

Another indirect macro mechanism for the influence of bank credit on stock price is: When bank credit expanded, various investment projects with positive net present value can acquire effective financing channel, and listed companies can benefit from credit support and thus promote price rise in stock market. In fact, credit capital is not identical with hot money. In periods of macro economic prosperity, the expanded part of credit is not necessarily associated into stock market on a large scale. There are, in addition, no evident financing restrictions on Chinese listed companies. The financing structure of listed companies obviously prefers equity financing, which largely reduces the influence of credit impact on the operation of listed companies, thus indirectly weakens the influence of bank credit on stock price. As a result, the rationale for the raising of stock price by bank credit expansion is not sufficient. Lots of empirical research also demonstrates that bank credit does not impose apparent influence on stock price.

IV. QUANTITATIVE INSPECTION BETWEEN ASSET PRICE AND FINANCIAL RISK

Most of empirical analysis has been performed to verify the relationship between asset price and bank credit through mere research on real estate market or stock market, which is quite unilateral. The influence of real estate price and stock price on financial risk is investigated as well in this paper. Multi-variable dynamic quantitative approach with VAR model is adopted in the actual quantitative inspection.

A. Structure of Indexes and Data Explanation

In this paper, real estate selling price index is used as the proxy variable of house price (HP), closing price of Shanghai Securities Composite Index at the end of period as used as stock price (SP), and ending balance of medium/long-term loan of financial institutions as used as financial credit (FC). In addition, considering the influence of interest rate, 7-day interbank offered weighted average interest rate is taken as market interest rate (R). The sample data are of 161 months from January 1998 to May 2011. The original data come from the statistical database of China Economic Information Network. To eliminate inflation factors, all data other than interest rates were adjusted with CPI. To eliminate possible heteroscedasticity, all data other than interest rates are natural logarithms.

B. Quantitative Inspection and Analysis

a. Unit Root Test

Stability must be considered in the quantitative analysis of time sequence variable. Different processing modes were adopted according to time sequence data of different natures. To enhance the reliability of inspection, ADF test and PP test were conducted at the same time. The test result of the unit root of every variable was reported in Table 1. The level values of variable serial HP, SP, FC and R were not stable, which all became stable series after first order difference. Therefore, they all submit to $I(1)$.

TABLE.1
UNIT ROOT TEST OF ALL VARIABLES SERIES

variables	ADF-statistic		PP-statistic	
	t	D(t)	t	D(t)
HP	-3.1147	-7.8548***	-2.9213	-7.8435***
SP	-1.6181	-6.5385***	-2.154	-11.4021***
FC	-1.3081	-2.3295**	-1.6116	-6.8624***
R	-0.8544	-7.3899**	-0.7949	-8.2317***

t and D(t) respectively denote the raw data's and the first-order differential data's test statistics under each unit root test method; *** and ** respectively denote rejection of the hypothesis of existence of unit root (not smooth) at the 0.01 level and 0.05 level.

b. Cointegration Test

A certain stable linear combination possibly exists between unstable variables of same-order integration, which reflects the long-term equilibrium relationship between variables, namely, the cointegration relationship. The cointegration test approach based on VAR model of Johansen (1995) was adopted to verify the long-term equilibrium relationship between asset price and bank credit in China.

VAR model was established first. It is found after multiple tests based on AIC and SIC rule were conducted

that VAR (2) model which is two orders backward is the most appropriate. All latent roots were in the unit circular curve when stability inspection was conducted on VAR (2) model, which indicates that VAR (2) model is a stable system. Additionally, autocorrelation inspection (with Q statistics and LM statistics), heteroscedasticity test and normality test (with JB statistics) were conducted on the residual error item of VAR (2) model. The results reveal that it can be considered autocorrelation and heteroscedasticity do not exist under the significant level of 5 percent. The residual error can also meet the requirement for normality.

Cointegration test was then conducted on the basis of VAR (2) model. Test with intercept item and trend item was chosen. Table 2 shows that both test of trace statistics and test of maximum latent root demonstrate the existence of cointegration relationship between variables.

TABLE.2
RESULTS OF COINTEGRATION TEST

Hypothesized	Eigenvalues	Trace Statistic (p-values)	Max-Eigen Statistic (p-values)
None **	0.1873	57.6887 (0.0300)	30.2878 (0.0479)
At most 1	0.1124	27.4009 (0.2569)	17.4177 (0.3077)
At most 2	0.0524	9.9833 (0.4821)	7.8561 (0.6188)
At most 3	0.0145	2.1272 (0.1447)	2.1272 (0.1447)

** denotes rejection of the hypothesis at the 0.05 level.

c. Impulse Response Analysis

As VAR (2) model is a stable system, impulse response analysis can be performed on the basis of this model. The standard deviation of impulse response function is calculated by using Progressive Analytical Method. The number of tracing period of response function is set as 10. Table 3, Table 4 and Table 5 represent the response traces of a standard deviation innovation impact of all variables of bank credit and asset price against other variables including interest rate.

Response of bank credit to other variables. Table 3 shows that with other factors remain unchanged, if the index of real estate price rises by a standard deviation, bank credit will present positive response in the first five months and reach peak value in the third month, but the overall response degree will remain at a fairly low level, if the index of real estate price rises by a standard

deviation. This indicates that Chinese real estate price imposes certain influence on bank credit, but no evident influence on bank credit. When Shanghai Securities Composite Index rises by a standard deviation, bank credit will present a stable low-level positive response from the second period, which reveals that the influence of stock price on bank credit is unapparent but comparatively stable and that Chinese stock market dose not attract credit input on a large scale. As for the impact on interest rate, the response trace of bank credit always remains negative to a fairly low degree, which conforms to the theories and practice. Rise of interbank offered interest rate promotes the shrinkage of bank credit to a certain extent, but such influence is not remarkable due to the imperfection of Chinese interest rate regulation mechanism.

Response of real estate price to other variables.

Table 4 reveals that the response of real estate selling price index to a standard deviation impact of bank credit is obviously positive in the first three periods and reaches peak value in the third period. After the third period, the response degree is somewhat lowered but still remains positive in a long period. This demonstrates that Chinese real estate market relies on bank credit and that financial risk in real estate has largely converted into operating risk of banks. The response of real estate price to the impact of stock price is obviously positive in the first four periods and reaches peak value in the fourth period. After

ninth period. This indicates that Chinese stock market does promote real estate market to a certain degree over a short time, but the influence is smaller than the influence of bank credit. The response of real estate price to the impact of interest rate is similar to the response of bank credit to the impact of interest rate, but the response degree of the former is higher than that of the latter. As Chinese real estate market depends excessively on the support of bank credit, it is fairly sensitive to interest rate. The influence is even greater than the one imposed on the banks themselves by interest rate.

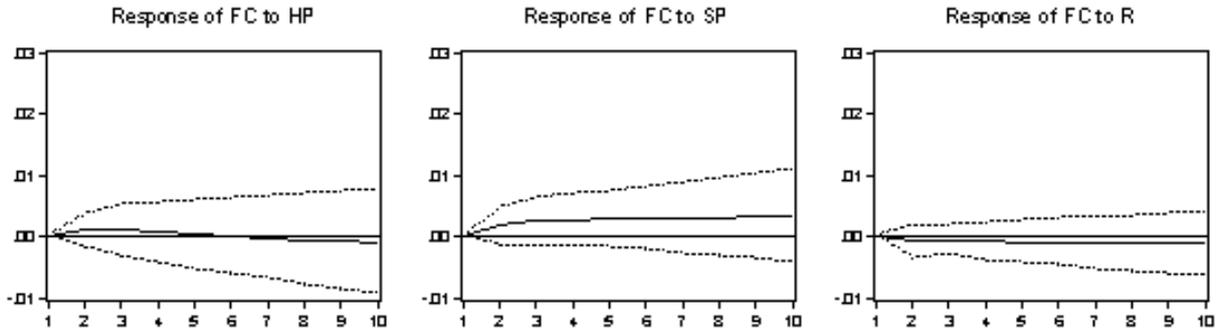


Fig.3 Responses of FC to one S.D Innovations

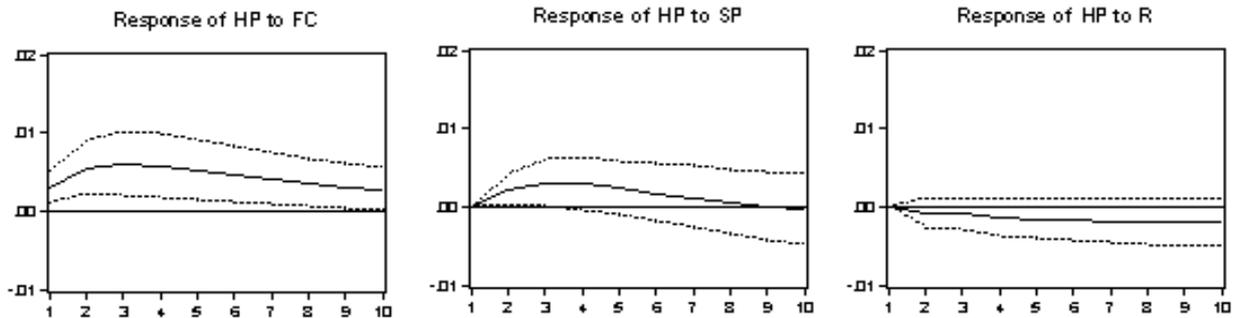


Fig.4 Responses of HP to one S.D Innovations

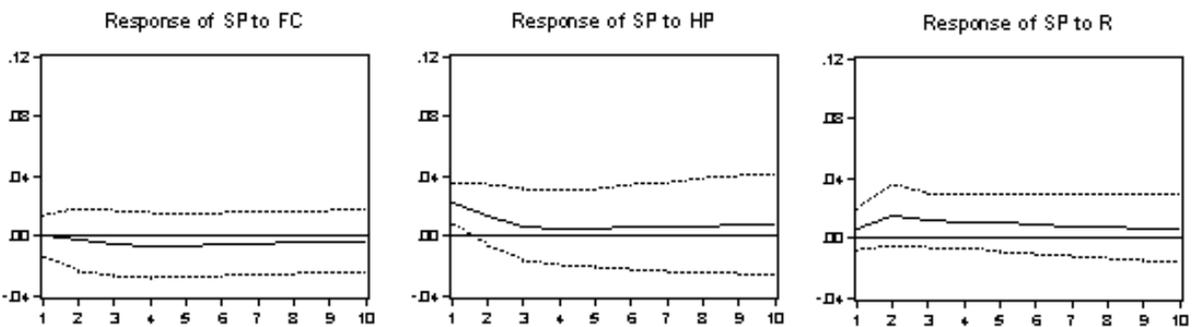


Fig.5 Responses of SP to one S.D Innovations

Response of stock price to other variables. Table 5 indicates that the response of Shanghai Securities Composite Index to a standard deviation impact of bank credit is negative, but the response to interest rate is positive, both with minimal response degree. This demonstrates that the operating mechanism of Chinese stock market is unsound and its coordination with

financial support and macro economy is poor. The response of stock price to a standard deviation impact of real estate price is apparently positive in the first three periods and remains unremarkably positive after that. Inflation of house price promotes the boom in stock market over a short time. The combination of risks in real estate market and those in stock market enhances the

unbalance in financial development and the difficulty in financial supervision.

V. CONCLUSIONS AND POLICY ENLIGHTENMENT

With the rapid development of social economy and the deepening of economic theory, it become increasingly closer between economic analysis and computer technique, especially, computer software. Eviews is an econometrics software package which observe the quantifier rule between economic society and economic activity. They are the core of quantitative research that is design model, data collection, estimation model, model checking, application model (structural analysis, economic forecasts, policy evaluation). Eviews is a essential tool to complete these tasks. So, this paper use the Eviews software effectively to empirical analysis the data that come from Chinese real estate and stock market, so as to find out dynamic law and characteristics between asset price volatility and financial risk.

Cointegration test and impulse response analysis based on VAR model verified the mutual influence of Chinese asset price fluctuation and bank credit risk. The results show that Chinese real estate price and bank credit are mutually influential and that the latter's influence on the former is relatively evident. Chinese real estate market depends excessively on bank credit. The relationship between stock market and bank credit is unapparent. At present, the fluctuation of Chinese stock price mainly results from the influence of its own systems. Chinese real estate market and stock market affect each other to a certain extent in the short run. The financial risk generating from the combination of the price fluctuation of two kinds of assets should be under the object of financial supervision. The mechanism for interest rate plays an unremarkable role in the relationship between Chinese asset price and bank credit. In general, the degree of the intervention of Chinese bank credit in real estate market is more obvious than that in stock market. Accordingly, the risk in real estate market is worthy of closer attention.

The regulation of asset price in China should not depend excessively on interest rate instrument. The input of large-amount credit and money imposes the most direct and evident influence on asset price. Stabilization of the quantity of bank credit is extremely crucial to the regulation of asset price fluctuation. Much effort should devote to perfecting the financial system for real estate and controlling the risk in bank credit. At present, the financing channel for real estate is unilateral, which tends to prick up the risk in bank credit. China should vigorously expand the direct financing channel for rest estate investment, so as to realize diversification of capital sources and decentralize the increasingly severe risk in real estate credit that banks are facing. Banks should establish risk evaluation model of real estate and asset business, correctly evaluate the value of mortgaged house, and control the proportion of real estate loan, so as

to avoid excessive load supply in periods of real estate boom and excessive shrinkage in periods of loan shrinkage and to weaken the negative influence of periodic fluctuation in real estate industry. As for stock market, we should establish multi-level capital market, expand corporate bond market and growth enterprise market, and enlarge the scale of stock market. Meanwhile, we should crack down insider trading, intensify risk education directed at investors, give guidance on rational investment, and prevent abnormal fluctuation in stock market to the utmost.

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