Dynamic Correlations between Real Estate Prices and International Speculative Capital Flows: An Empirical Study Based on DCC-MGARCH method

Zhi Dong, Xiuting LI, Di Wu, Xiaoxin Liu

Abstract: This paper employs DCC-MGARCH to calculate the dynamic correlation coefficient between international capital flows and real estate prices. Then it uses VAR to analyze the relationship between the dynamic correlations between international capitals flows and real estate prices. The empirical study shows that there is a steady positive correlation between real estate prices and international short-term capital flows. When the real estate prices go up, the correlation coefficient is higher and when the prices suffer a downturn, the correlation coefficient is lower. The Higher will lead the short-term international capital to entry and the lower will lead it to quit. The entry of short-term international capital will contribute to the increase of the real estate prices.

Key Words: real estate prices, international speculative capital flows, dynamic conditional correlation coefficient, VAR

1. Introduction

The rapid appreciation of housing prices and the growth of investment-oriented housing purchases have been continuing in the past few years. Lured by the rising prices of housing and the steady revaluation of the Chinese currency, renminbi (RMB), foreign funds entered the real estate markets in some popular regions, such as Shanghai and Beijing, through various channels. The entry of international capital brings huge capital and advanced management experience, helps accelerate an increase of supply in real estate market directly and indirectly. (Prasad &Wei, 2005) reported that starting from 2003, there has been huge capital inflows into China that can't be explained by trade surplus or foreign direct investment. Zhang&Fung(2006)indicated the speculative capital inflow is believed to have fueled inflation, driven up stock prices, and helped accelerate a worrisome bubble in the real estate market.

The real estate market is one of the pillars of the Chinese economy
and its development has fueled the economic growth and promoted a restructuring of the economy. The fluctuation of real estate prices relate to cities’ potential development ability and competition, and moreover influences the stability of financial system and the establishment of macroeconomic policy. It is indicated that the international capital flow could easily produce a bubble and be one of the reasons of the collapse of housing bubble. Coupled with the sudden increase in China’s foreign exchange reserves in the past several years, the domestic real estate market experienced a protracted bull run during the same period, causing many to wonder whether China may be the next country to suffer sharp real estate price declines, or whether it may escape relatively unscathed.

Under the background of real estate prices inflation, it will help to formulate supervision polices of foreign investment, reduce the negative effect caused by international capital flow and stabilize the real estate prices to promote the sustainable, healthy and stable development of real estate industry.

The remainder of this paper is organized as follows: Section 2 we offer some background discussions on international capital inflows resulting from the financial liberalization in China and the relevant literature review. Section 3 resents the theoretical background. Section 4 describes the data and the empirical methods. We provide the empirical results and their implications in Section 5. The last section summarizes the main findings and draws some relevant policy implications.

2. Literature review

2.1 The reason resulting in international capital flow

According to interest rate parity theory, the difference of interest rate is the main season that results in the short-term international capital flow. The capitals will inflow the country with higher interest rate when the difference of interest rate can make up capital gains tax and this currency will continue. Fleming (1962) indicated that the international capital flow is more sensitive to floating interest rate than fixed interest rate. Mundell (1962) demonstrated that the international capital flows are responsive to interest rate differentials. Branson (1968) suggested that the short-term
international capital flows depends on the imports and exports balance, interest-rate and exchange rate. Calvo (1993) argued that the capital inflows into Latin America are partly explained by conditions outside the region. The importance of external factors suggests that a reversal of those conditions may lead to a future capital outflow, increasing the macroeconomic vulnerability of Latin America economics.

2.2 The Effect of international capital flows

Owing to capital premium in stock market and real estate market that affects the short-term international capital flows, the correlation of them has become a new research focus. As indicated in Kim and Singal (2000), the movements of speculative funds, particularly in emerging markets, are allegedly highly sensitive to differences in interest rates, expectations of currency revaluations, and expected returns from holding securities. Wensheng Peng (2005) studies the relationship between residential property prices and bank lending in Hong Kong and suggest that excessive bank lending was not the root cause of the boom and bust cycles of the property market in Hong Kong. A more plausible hypothesis is that changing beliefs about future economic prospects led to shifts in the demand for property for investment and other purposes. In turn, and given a highly inelastic supply schedule, this led to large swings in prices. With a rising demand for loans and collateral values, bank lending naturally responded. Chari and Kehoe (2003) indicated the nature of the portfolio investments is that they are very yield sensitive, volatile, of shorter duration and are easily exposed to some information frictions, expectations, and herd behaviour of the investors in comparison to other forms of capital flows. Standard debt default problems of the host government also enhance the sudden withdrawal of foreign capital which then leads the host country to a financial crisis. Jansen (2003) examines the effects of private financial (non-FDI) capital inflows in Thailand in the pre-crisis period (1980:I – 1996:IV). Private capital inflows are found to be associated with higher asset prices, lower lending rates, surges in bank lending and domestic spending driven by higher investment, higher output, modest inflation, and modest real exchange rate appreciation. Inflows are also associated with a greater vulnerability to a liquidity crisis,
but not with greater external solvency risk. Current account deficits are temporary, thus sustainable, as exports catch up with higher imports within two years.

Meanwhile, in the past few years the effervescent Chinese real estate market has been surging rapidly. Chu and Sing (2004) believe that the growth of real estate prices in China is largely because of significant influx of foreign capital into the market. In an effort to quell the speculation on residential properties, since 2005 the Chinese central government has imposed, along with other supply regulations, an idle land tax, a land appreciation tax and a business tax on properties held for less than five years, but the effects appeared to be little. Real estate prices continued to rise with vigor until early 2008, when some signs of slowdown have appeared. Xiaohong Meng (2006) studied influence mechanism of international capital flows on real estate prices and found that the fluctuation of international capital flow would lead to the fluctuation of real estate prices. Qunshun Xia (2007) classified the foreign investment and indicated that short-term international capital invested in central cities would boost the housing price and lead to the bubble of real estate. Feng Guo (2010) investigated the extent of the impact from “hot money” or speculative capital inflow on the fluctuations of China's real estate market and stock market and indicated that hot money had driven up property prices as well as contributed to the accelerating volatilities in both markets due to its enormous size and its short-term characteristic of investing. In particular, hot money ranks as the second largest contributor in the fluctuations of China's real estate prices. In the “risky” regime, which corresponds to more inflows and higher volatility of hot money, the effects are even more prominent. Wensheng Zhao (2011) establishes a VAR model and analyze the impulse responses and its intensity degree of short-term international capital flows to China’s foreign exchange market, monetary market, stock market and the real estate market and established a Threshold model and analyze the threshold effect under different variables as threshold variables. Through the empirical researches, it found that the impulse responses to diverse shocks are different both in the transient and in the permanence.
price is the most strongest and those to ex change rate and interest rate are mo derate. Then the intensity responding to stock price is the weakest. The exchange rate and house price have obvious threshold characteristic, which can separately divide the short-term international capital flows into high and low status.

There is little evidence in the extant literature on the role of speculative capital inflow in the recent evolvement of China's real estate market and the empirical question as to what extent the speculative capital factor is transmitted to the behavior of housing prices remains unaddressed. Therefore, we intend to explore and shed more light on this issue, which not only warrants a timely study but also could be of considerable concern to scholars and policymakers worldwide. Toward this end, we utilize a dynamic conditional correlation multivariate GARCH model and a multivariate vector autoregressive (VAR) model. Our empirical results demonstrate that there is a steady positive correlation between real estate prices and international short-term capital flows. When the real estate prices go up, the correlation coefficient is higher and when the prices suffer a downturn, the correlation coefficient is lower. The Higher will lead the short-term international capital to entry and the lower will lead it to quit. The entry of short-term international capital will contribute to the increase of the real estate prices.

3. Theoretical background

3.1 The view of money supply theory

In an open economy, the money supply can be written as:

\[ M_s = kMB = k(R+W) \]

where \( M_s \) is the money supply, \( k \) is the money multiplier which tells us what multiple of the monetary base is transformed into the money supply. \( MB \) is the money base which equals currency \( W \) plus reverse \( R \). Under fixed exchange rate system, the exchange rate, \( e \) is a constant, and \( R \) equals the foreign exchange reverse times the exchange rate:

\[ M_s = k(eU + W) \]

The international capital flows will make the change of foreign
exchange reverse. The number of money supply will change in the multichange through the multiplier effect of base money. One unit change of international capital flows will lead to the Ke uint change of money suppl -y. We will investigate how the international capital flows act on the real estate prices through the channel of money supply with IS-LM and AS-AD model under the situation of international capital inflows.

As figure 1 shown, i is the interest rate and Y is the output. The IS curve is the equilibrium line of product market and the LM curve is equilibrium line of money market. The equilibrium point is the intersection point of LM line and IS line. In this point, the economy is in the equilibrium status in that the supply equals to the demand. Initially, the equilibrium is at point $E_0$. The interest rate is at point $i_0$ and the output is at point $Y_0$. If the money supply increases steadily owing to the international capital inflows, the aggregate $LM_0$ curve shifts rightward to $LM_1$. At the new equilibrium, point $E_1$, the interest rate level has increased from $i_0$ to $i_1$ and the output level has increased from $Y_0$ to $Y_1$. 

![IS-LM model](image-url)
In figure 2, P is the aggregate price level and Y is the equilibrium output. The aggregate supply curve AS will keep unchangable. When the output increases to point $Y_1$, the aggregate demand curve AD shifts rightward from $AD_0$ to $AD_1$. At the new equilibrium, point $E''$, the price level has increased from $P_0$ to $P_1$. The aggregate price level will increase by the excess money supply owing to the international capital inflow. Meanwhile as part of property prices, the real estate prices will follow the currency or lead to the inflation.

In recent years, the rapid increase of foreign exchange reverse makes the central bank issue lots of money, which leads to excessive liquidity and enlarge the scale of debt of commercial bank. The capital will look for the profit chance owing to expansion of credit debt. With the commercial reform of commercial bank, considering the profit and risk the commercial bank would provide more and more debt to the housing buyers and real estate developers aiming at the maximization of their interests. The excessive capital aggregation in real estate industry will increase the real estate prices and boost the real estate bubble.

3.2 The view of terms of trade

With development of economical integration process, there is a relationship of mutual development between international capital flows and trade liberalization. The international capital flows have an influence on
the commodity prices of the country with trade liberalization. We utilize
the terms of trade to analyze the impact that the international capital
flows have on real estate prices.

In figure 3, we will analyze the consumption effects of price change.
T is trade goods that can be traded in the international market. Its price is
an endogenous variable depended on the international market. N is
non-tradable commodity that can’t be trade in the market and its price is
depended on the domestic market that is an exogenous variable. The
house belongs to one of non-tradable commodities. The line $PP''$ is the
curve of production capacity. $U_1, U_2$ are the indifference curves of
consumers. $I$ is budget line of domestic consumers that is depended on
the consumers’ income level and commodity prices. We can write it as

$$I = T \times eP_T + N \times P_N$$

where $e$ is nominal exchange rate under the indirect quotation method, $q$
is real exchange rate, $P_T$ is the international price of tradable commodity
and $P_N$ is the price of non-tradable commodity that can be written as:

$$q = \frac{eP_T}{P_N},$$

a rise in $q$ means devaluation of domestic currencies. Accord-

According to the international economics theory, the international capital flow
will have an influence on the real exchange rate. Because the prices of
tradable commodity are depended on the international market, the internat-

-ional capital will have an impact on the prices of non-tradable commodit-

-y under the fixed interest-rate system.

Initially, the economy equilibrium is at point A where the aggregate
expenditure equals to the aggregate output. The quantity is measured by
the value of tradable commodity, $E$ which can be written as: $E = T_\alpha + eP_T$.
In this sense, the economy reaches to internal equilibrium. Meanwhile
owing to no trade deficit, the economy reaches to external equilibrium. At
point A, the production possibility curve $P$ is tangent to the indifference
curve $U_1$ to realize the maximization of efficiency. Now considering the
international capital inflows, the international capital inflows make the
demand of money increase, which makes the domestic currencies
valuation. Under the fixed interest-rate system, $P_T$ is depended by the
supply and demand of international market, which makes a rise in $P_N$. 
We can write the above equation as $T = \frac{1}{eP_T} \cdot \frac{P_N}{eP_T} - N$, where the absolute value of slope of income curve is the inverse of real interest-rate $q$. As Figure 3 shown, the income curve $I$ shifts from $I_1$ to $I_2$ and the new equilibrium is at point B. At point B, the income line and utility curves shift to $I_3$ and $U_2$ in a parallel way owing to the international capital inflows. At point C, the real consumption of tradable commodity is $T_c$ and $T_c - T_b$ means the trade deficits BC. We can conclude that the capital flows will have an impact on non-tradable commodity and the long-term capital inflows will make the prices of non-tradable commodity rise. As part of non-tradable commodity, the rise of real estate prices could be illustrated by the machism of “the international capital flows-the rise of non-tradable commodity”.

![Figure 3 Terms of Trade](image)

It is observed that the interest rate gaps between China and some developed economies have been widening in recent years. For example, while the US Fed cut federal funds rate nine times to a 2% by the end of 2007, the People's Bank of China raised the benchmark one-year deposit rate twice to 4.14%. In addition, the RMB has appreciated in value by about 22% since July 2005 when a managed float exchange rate regime was adopted. The real exchange rate of RMB is expected to keep a strong position against the US Dollar in the near future (Huang & Guo, 2007). Therefore, the combined effects have stimulated a strong influx of international capital into the country. Meanwhile, in the past few years the
effervescent Chinese real estate market has been surging rapidly. Chu and Sing (2004) believe that the growth of real estate prices in China is largely because of significant influx of foreign capital into the market. In an effort to quell the speculation on residential properties, since 2005 the Chinese central government has imposed, along with other supply regulations, an idle land tax, a land appreciation tax and a business tax on properties held for less than five years, but the effects appeared to be little.

In long term, the international capital inflows could be regarded as temporary loan, but this kind of loan will outflow the market by the way of profit remittance or divestment. Once it occurs the reverse of economy, the capital inflows will turn to capital outflows, which will make the prices of property up and down. It will interfere the economic order and economic environment seriously and even result in the financial crisis.

4 Data and Methodology

4.1 Data and preliminary analysis

We turn now to define and present relevant data in this section. Monthly data from January 2003 to December 2011 are utilized for the study, instead of the annual or quarterly data employed by the earlier studies which may suffer from considerable size distortion and loss of power. Using higher frequency data allows us to better capture the fluctuations of international capital flows in driving the property market during periods of policy changes in China. The economic variables included in the analysis, which are retrieved from the CEIC Database, are defined as follows:

International Speculative Capital Flows (ISC) — Following Martin and Morrison (2008) and Zhang and Fung (2006), we calculate the amount of hot money inflow as follows: (change in foreign exchange reserves) minus (trade and service balance) minus (foreign direct investment). In the analysis, the ISC is International Speculative Capital inflow measured in billion RMB in the preceding month.

Housing price (HP) — It is defined as the national average selling price of commodity building per square meter. This is the only available
monthly time series to reflect property prices for long-term analysis, because there are no official aggregate real estate price series or indices in China until the very recent past.

We adjust the housing completion (HC) variable to account for their exhibited seasonal volatility. ISC, HP measured in nominal terms, are deflated by the consumer price index (CPI, 2000=100) to reflect the real activity in these areas. Table 1 provides some summary statistics for International Speculative Capital (ISC), housing price (HP).

It indicates that, over the sample period, all the series evidence significant skewness and kurtosis. Jarque–Bera test statistic suggests rejection of the null hypothesis of normal distribution. Furthermore, the Box–Pierce Q and Q-squared statistics with 6 and 12 lags show a strong degree of autocorrelation in these variables.

Table 1
Summary statistics of international speculative capital and housing price.

<table>
<thead>
<tr>
<th></th>
<th>International Speculative Capital</th>
<th>Housing Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>507.5110</td>
<td>3863.564</td>
</tr>
<tr>
<td>Std.dev</td>
<td>2003.385</td>
<td>1025.769</td>
</tr>
<tr>
<td>Max</td>
<td>5276.270</td>
<td>6436.990</td>
</tr>
<tr>
<td>Min</td>
<td>-5417.270</td>
<td>2254.230</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.578398</td>
<td>0.271884</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>4.889626</td>
<td>2.053755</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>22.08990</td>
<td>5.359789</td>
</tr>
<tr>
<td>BP(6)</td>
<td>42.598***</td>
<td>75.845***</td>
</tr>
<tr>
<td>BP(12)</td>
<td>52.962***</td>
<td>161.01***</td>
</tr>
<tr>
<td>BP2(6)</td>
<td>58.788***</td>
<td>98.805***</td>
</tr>
<tr>
<td>BP2(12)</td>
<td>68.554***</td>
<td>195.81***</td>
</tr>
</tbody>
</table>
Fig. 4 displays the movements of key variables of interest over the sample period. Overall, we see that behaviors of housing price and ISC were quite similar. Fig. 1 also shows that China's real estate market has been booming for the past several years, despite a slight price adjustment in 2008. The swift rise in China's real estate prices is believed to be affected by rapid economic growth and the process of urbanization (Fung et al., 2006). The speculative funds tend to have substantial volatilities after 2006. In particular, it jumps to extremely high levels between 2008 and 2010, reflecting possible increased sudden speculative attacks on China's markets.

4.2 Methodology

4.2.1 DCC-MARCH Model

The aim of this paper is to gauge the dynamic correlations between international speculative capital and housing price in China. This can be achieved by the application of a dynamic conditional correlation multivariate GARCH model.

Consider a multivariate time series of observations $Y_t$

$$Y_t = E[Y_t | \Omega_{t-1}] + \epsilon_t$$
where \( \Omega_{t-1} \) is the information set at time \( t-1, Y_t = (Y_{1t}, ..., Y_{Nt})' \), \( \varepsilon_t = (\varepsilon_{1t}, ..., \varepsilon_{Nt}) \) the conditional-correlation matrix of random residual can be written as:

\[
H_t = E(\varepsilon_t \varepsilon_t' | \Omega_{t-1})
\]

The next question is how to specify the dynamic correlation, Parameterizations. Tse, Tsui and Engle proposes an estimator called dynamic conditional correlation model or DCC. The dynamic correlation model differs only in allowing \( R \) to be time varying giving a model:

\[
H_t = D_t R_t D_t = \rho_{ij} \sqrt{h_{ii} h_{jj}}
\]

Where \( D_t = \text{diag}(h_{11}^{1/2}, ..., h_{NN}^{1/2}) \), where \( r_t \) is a correlation matrix containing the conditional correlations as can directly be seen from rewriting this equation as:

\[
R_t = (1 - \theta_1 - \theta_2) R + \theta_1 \Psi_{t-1} + \theta_2 R_{t-1}
\]

The parameters \( \theta_1 \) and \( \theta_2 \) are assumed to be nonnegative with the additional constraint that \( \theta_1 + \theta_2 < 1 \), \( R \) is a (time-invariant) positive definite parameter matrix with unit diagonal elements, \( \Psi_{t-1} \) is the correlation matrix of \( \varepsilon_t \) at \( t-M, t-M+1, ..., t-1 \), which can be written as

\[
\Psi_{ij,t-1} = \frac{\sum_{m=1}^{M} u_{i,t-m} u_{j,t-m}}{\sqrt{(\sum_{m=1}^{1} u_{i,t-m}^2)(\sum_{m=1}^{M} u_{j,t-m}^2)}}
\]

Where \( u_{it} = \varepsilon_{it} / \sqrt{h_{ii}} \).

The structure of DCC(E) is similar to the DCC(T), but the difference is the set of the matrix. In DCC(E) model,

\[
R_t = \text{diag}(q_{11}^{1/2}, ..., q_{NN}^{1/2}) Q_t \text{diag}(q_{11}^{1/2}, ..., q_{NN}^{1/2})
\]

where \( Q_t = (q_{ij,t}) \) and it is a \( N \times N \) symmetric matrix:

\[
Q_t = (1 - \alpha - \beta) Q + \alpha u_{t-1} u_{t-1}' + \beta Q_{t-1}
\]

\( Q \) is a unconditional correlation matrix, and the parameters \( \alpha \) and \( \beta \) are assumed to be nonnegative with the additional constraint that \( \alpha + \beta < 1 \). Although there is little difference between DCC(T) and DCC(E), it is not sure which is more fit to measure the dynamic correlation.

4.2.2 Estimation of DCC-MARCH model
1 Estimation Results

The DCC model was designed to allow for two stage estimation, where in the first stage univariate GARCH models are estimated for each residual series, and in the second stage, residuals, transformed by their standard deviation estimated during the first stage, are used to estimate the parameters of the dynamic correlation.

① Conditional Correlation

The GARCH(1,1) model can be depict the volatility of the housing prices and international speculative capital movement, which can be used to analyze the conditional variance of samples. Prior to the identification of possible long-term relations of the variables specified in GARCH model, it is necessary to verify that all variables are stationary since lack thereof can make any empirical results deceptive. The housing price in natural logarithm in levels is I(1) and the ISC in all levels is I(1). It seems to be appropriate for analyzing the GARCH model consisting of ISC, $\ln(HP)$. The estimation results show that there exists conditional heteroskedasticity for housing price and international speculative capital series. The parameter of GARCH is higher the parameter of ARCH for each series, which means that the conditional variances are effected by the prior ones for sample series. Meanwhile, the parameters $\alpha$ and $\beta$ are nonnegative with the additional constraint that $\alpha + \beta < 1$.

| Tabel 2 Time-varying volatility of housing price and international speculative capital |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Housing Price GARCH(1,1)                      | ISC GARCH(1,1)  |
| Coefficient                                  | CONSTANT | ARCH | GARCH | CONSTANT | ARCH | GARCH | CONSTANT | ARCH | GARCH |
| Coefficient                                  | 0.001    | 0.367 | 0.616 | 25765.18  | 0.1526 | 0.8287 | 0.001    | 0.0017 | 0.000  |
| Std.dev                                      | 0.001    | 0.243 | 0.140 | 19674.16  | 0.0818 | 0.0626 | 0.001    | 0.0017 | 0.000  |
| T-value                                      | 0.946    | 1.506 | 4.411 | 1.3095    | 1.9857 | 14.0308| 0.343    | 0.001   | 0.000  |
| P-value                                      | 0.343    | 0.001 | 0.000 | 0.1903    | 0.0017 | 0.000  | 0.001    | 0.0017 | 0.000  |
Figure 5 shows the conditional variance for housing price and ISC. It shows that the volatility of conditional variance for ISC is smooth from 2003.1 to 2007.6. After 2007, the volatility of conditional variance for ISC is larger, which means that the international speculative capital inflows or outflows more frequently. Meanwhile, the real estate industry of China experienced a protracted bull run during the same period.

2 The Dynamic Correlation Coefficient

According to the parameters of GARCH model, we utilize DCC-MGARCH model to analyze the dynamic correlation between housing price and international speculative capital. The method to estimate the parameters is to maximize the Logarithm likelihood function. The result is shown as:

\[ Q_t = 0.413 \bar{Q} + 0.132 \varepsilon_{t-1} \varepsilon_{t-1} + 0.455 Q_{t-1} \]

\((0.945)\quad (10.203)\)

the parameters \(\alpha\) and \(\beta\) are nonnegative with the additional constraint that \(\alpha + \beta < 1\). The \(\beta\) is 0.455, which the current conditional heteroskedasticity is affected by the prior one. According to the results, we can draw the graph for the time-varying conditional correlation coefficient between ISC and Housing Price.

Figure 6 shows that the time-varying conditional correlation coeffici-
ent between ISC and housing price. The maximum and minimum of the

time-varying conditional correlation coefficient is 0.36 and -0.21 respectively. The correlation coefficient is positive except few months. Expect

for the market factors, the reasons for the negative correlation coefficient

are that the exchange rate of RMB rose from 8.2765 to 8.0702 from

2005.6 to 2005.12 and the return profit of real estate market in China
decreased from 2008.6 to 2008.12. The correlation between internati

-onal speculative capital can be divided into three stages:

Stage One: From 2003.1 to 2005.8, it is the initial period of reformati

-on of real estate market in China. The aggregate housing price was in a

steady level. The correlation coefficient is in a lower level except few

months and the average is about 0.13.

Stage Two: From 2006.6 to 2008.6, the fixed asset investment and the

real estate development investment kept rising in this period. Some real e

-state enterprise developed quickly in the scale and capital. The correlatio

-n coefficient is in a higher level comparing to stage one and the average

of correlation coefficient is about 0.15.

Stage Three: From 2009.1 to 2011.5, the real estate industry of China

experienced a protracted bull run during the period. The housing prices in

some cities such as Beijing, Shanghai, Guangzhou, Shenzhen experised

rapid growth. And the speculative demand factors influence the real estate

price. It is the asset bubble period. The correlation coefficient during this

period reached a higher level comparing to the prior two stages. The

average of correlation coefficient reached 0.21.

Above all, in the asset bubble period, the dynamic correlationship

between international speculative capital and housing price is obvious

and positive.
4.3 Empirical Result based VaR

4.3.1 VaR model

To further study on the dynamic correlation between international speculative capital and housing price, we establish the VaR model consisting of housing price and international speculative capital. The estimation result is shown as:

\[
\begin{bmatrix}
D(HP) \\
D(ISC)
\end{bmatrix} = \begin{bmatrix}
-0.567863 \\
-0.147869
\end{bmatrix} D(HP)_{t-1} + \begin{bmatrix}
-0.452316 \\
1.073974
\end{bmatrix} D(HP)_{t-2} + \begin{bmatrix}
0.096395 \\
0.576141
\end{bmatrix} D(HP)_{t-3}
+ \begin{bmatrix}
0.0123753 \\
-0.669153
\end{bmatrix} D(ISC)_{t-1} + \begin{bmatrix}
0.00019319 \\
-0.454862
\end{bmatrix} D(ISC)_{t-2} + \begin{bmatrix}
-0.001861 \\
-0.1017986
\end{bmatrix} D(ISC)_{t-3} + \begin{bmatrix}
49.71959 \\
-107.0892
\end{bmatrix}
\]

The VAR model above is stationary through the test. Owing to the variables in 1 difference level, we can not make the illustration for the economic meaning of variables through the coefficients. But we can make an initial judgement to the short-term dynamic correlation relationship of housing price and international speculative capital through observing the coefficients.

Through the equations above, the changes of housing price in short term are affected by itself. The international speculative capital inflows...
hava an positive effect on the rise of housing price, but it is not the main reason. The rise of housing price has a positive effect on international speculative capital inflows in short term obviously. The international speculative capital is only affected by the number in t-1 time, which shows the characteristic to chase the profit.

4.3.2 Impulse Response Results

The impulse response results are shown in figure 7. We conclude that the response of housing price to a shock of itself is an instant and positive response, while the response of international speculative capital to a shock of housing price is is not significant. The response of housing price to a shock of international speculative capital is no significant, while the response of international speculative capital to a shock of itself is very significant, but it can not continue for a long time.

The change of international speculative capital in the first time is negative, which is opposite to the normal. But we think that although the international speculative capital has the feature to chase the high profit,
the response of international speculative capital to a shock of housing price is lagged owing the decision delay and capital supervision and regulation. After one month, the effect will be significant.

5 Comparison

Compared to Feng Guo(2010), this paper focuses on the dynamic correlationship between housing prices and international speculative capital while Feng Guo(2010) in his paper just analysed whether the hot money influence the real estate price and found that hot money ranks as the second largest contributor in the fluctuations of China's real estate prices. In the “risky” regime, which corresponds to more inflows and higher volatility of hot money, the effects are even more prominent. In China's real estate market, the long-term issue that needs to be resolved is that housing price is primarily driven by demand-side rather than the supply-side factors due to the massive rural migration to urban areas. He did not analyse the currency of the influence or the dynamics nature and just identified the influence on real estate price. The dynamic correlation between real estate price and international speculative capital will better illustrate the change of influence. And for policy-makers, they can make some measures to constraint the international speculative capital inflow.

And Shen Yue(2011) used the FAVAR model to denote from the research that the financial liberalization has a positive impact on the change in the total house price, and the effect of the international capital flow, loosening of the housing credit and the opening—up of the domestic capital market is strengthen successively. The financial liberalization has a positive impact on the change in the ordinary house price, but a weaker negative impact on that in the economic and suitable house price. The fluctuation of the impact on the change in the high—grade house price is greater and relatively complex. With the financial liberalization process, it is the urgent to identify the correlationship between the international speculative capital and housing price. It is, therefore, concluded that while the financial liberalization plays a direct driving role in the change in the house price in China, with the purpose of restraining the too rapid increase in the house price, it is of great importance to steadily and orderly promote financial liberalization.
process, intensify the prudent supervision over residential investment, control in a good way the credit gate, guide the reasonable flow direction of foreign capital, and increase the supply of the guarantee nature houses.

6 Conclusion

This paper utilize the theory of money supply-demand and terms of trade to analyze the effect of international speculative capital on housing price. We employ DCC-MGARCH to calculate the dynamic correlation coefficient between international capital flows and real estate prices. Then it uses VAR to analyze the relationship between the dynamic correlations between international capitals flows and real estate prices. The empirical study shows that there is a steady positive correlation between real estate prices and international short-term capital flows. When the real estate prices go up, the correlation coefficient is higher and when the prices suffer a downturn, the correlation coefficient is lower. The Higher will lead the short-term international capital to entry and the lower will lead it to quit. The entry of short-term international capital will contribute to the increase of the real estate prices.

Above all, in short time, the rise of housing price will make the international speculative capital inflow and the inflows of speculative capital will lead the housing price to rise. The dynamic correlation between them will increase the volatility of housing price. The over-inflows of international speculative capital will boost the real estate bubble. It is urgent to how to utilize the foreign capital to protect negative effect of the over-inflows of international speculative capital on real estate market.

Our findings have at least a couple of important implications for policymakers regarding the real estate market in China, so as to avoid any reckless lack of oversight. First, they should carefully examine and uncover the underlying primary driving forces in housing price which is unique to the Chinese economy, and take precautions against the potential risk factors in making future policy decisions. Second, it is critical for policymakers to guide investors to pay special attention to those unexpected factors, in particular the seeping in and out of the economy of speculative money.
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