External dependent Economy and Real Estate Bubbles: The case of China

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Abstract:

The research explores the relationship between external dependent economy and real estate bubbles in China. By extending the Caballero and Krishnamurthy (2005)’s dynamic model, we show how surplus monetary liquidity resulted from foreign asset accumulation in export-driven economy leads to real estate bubbles in the incomplete financial systems and managed exchange rate system. Employing monthly data of 28 Chinese provinces over the period 2004-2005, we test whether real estate bubbles are caused by foreign asset accumulation controlling other possible factors.

Our empirical findings show that the growth of private savings in the banking sector will ferment real estate bubbles regardless of the different development level across the 28 provinces.

JEL:

Keyword:

Managed exchange rate, Surplus monetary liquidity, rational bubble, ripple effect
1. Introduction

There are two prominent phenomena in the world economy in recent years, namely, surplus monetary liquidity and asset price bubbles across the world (BIS, 2004; UN, 2006; OECD, 2006). In the past, the western dominant industrialized countries experienced different kinds of bubbles, for example, IT stock bubbles from 1996 to 1999, bond price bubbles from 2000 to 2002, and real estate bubbles from 2002 till now. Although each bubble had specific characteristics (Hunter, Kaufman and Pomerleano, 2005), latest researches show that surplus monetary liquidity is an indispensable factor explaining recent price bubbles in capital markets, e.g., stock markets, bond markets, and real estate markets (Issing, 2002; Gouteron and Szpiro, 2005).

The co-movement of surplus monetary liquidity and asset price bubbles began to attract economists’ attention as early as 1929 when the Great Depression broke out. At that time, economists all agreed that lending boom would stimulate bubbles in capital markets (White E.N., 1990). Specifically for the case of the Japanese bubble economy in late 1980s, many Japanese scholars also pointed out that the Japanese government’s expanded monetary policy during yen appreciation resulted in stock and real estate bubbles. Actually, Japanese economy was suffering from depression because of the crash of bubble (Okina and Shiratsuka, 2005). On the other hand, many other researches explain that either tight or bubble crunching monetary policy may induce the collapse of financial markets (Friedman and Schwartz, 1982; Bernanke, 2002; Posen, 2006). Many of recent empirical researches, however, reveal that there is no direct causality between the central bank’s monetary policy and asset price bubbles (Bordo and Jeanne, 2002; Mishkin and Eugene, 2002; Detken and Smets, 2004). In this sense, monetary policies may be neither the cause nor the cure of asset price bubbles.

Nevertheless, monetary liquidity is now obviously surplus all over the world. So the key point is to uncover the main cause of this phenomena and its relationship with asset bubbles. In recent years, many scholars explained the mechanism of surplus liquidity. Ortalo-Magne and Rady (2005) argues that the impact of business cycles on personal income will induce changes in monetary liquidity, which in turn influences the housing demand, bringing surges of the real estate price. Additionally, the lack of investment channels will force investment concentrated in well behaved markets so that speculative bubbles in these markets become increasingly pervasive (Ventura, 2004; Caballero and Krishnamurthy, 2005). Some other scholars found that in the bank-based countries, both real estate bubbles and collapses are common, which is an outcome of the myopic behavior of banks: when the economy is booming, bank will increase lending for real estate purchase on seeing hiking prices and cut lending when estate prices are falling. Thus, banks’ myopic behavior intensifies price fluctuation (Herring and Wachter, 2005).

Surplus monetary liquidity in China is also fierce and the growth rates of M1 and M2 are much greater than that of GDP (People’s Bank of China, 2006). Yuan, Zhigang, et al (2003) and the research group of China Real Estate Chamber of Commerce (2006) report that surplus monetary liquidity indeed leads to real estate bubbles, although it does not bring about high

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2 There are many researches on the issue of real estate bubbles recently. Most of them focus on the following aspects: the cause and measurement of real estate bubbles, its impact on real economy and supervision and regulation of the government on real estate investment. Some excellent surveys are included in the book listed in brackets.

3 The beginning investigations about housing reform and relative questions on the late 1990s could take Zhou(2003), Sato(2006) as references. It is obvious that the abundant individuals involved in real estate speculation nowadays are partial the consequence of government distributed affordable house in the early reform period.
inflation in commodity markets as the central bank worried about. Sun, Lijian (2006) indicates that the mechanism of real estate bubbles in China is significantly distinct from that in western industrialized countries. Therefore, the objective of this paper is to explore the reasons of surplus monetary liquidity in China and its impact on the real estate price. Based on the stylized fact illustrated by fundamental macroeconomic indices and the overlapping generation model (OLG) explaining the high saving ratio of the young generation (Tirole, 1995), using empirical analysis of provincial panel data, we made three contributions. First, we comb the logic behind real estate bubbles in China, that is, surplus monetary liquidity, as the root of real estate bubbles, is a result of the increasingly external dependent economic structure. Second, surplus monetary liquidity does not stimulate private consumption because the residents are less confident of their income. On the contrary, it increases the burden of the banking system by too much private savings as a result of inefficient capital markets. Third, real estate bubbles are a result of private precautionary savings. While each agent, including banks and individuals, tries to invest in assets with safe and high returns, the aggregate result of it is overinvestment in these assets. The risk of “credit crunch” thus increases and the social welfare is impaired.

Admittedly, some scholars have also investigated the influence of surplus in the balance of payment on asset prices in emerging markets. For instance, Park and Park(1995) takes the example of financial liberalization in South Korea which leads to foreign capital inflows in the 1990s and applies the Keynesian general equilibrium model to explain how the appreciation of nominal exchange rate accompanied by capital inflows influences the relative price of tradable goods and non-tradable goods. They found that although the real interest rate level is very high because of tight monetary policies, the optimistic expectation towards the real estate market offset the effort to restrict the money supply, in the end, leading to real estate bubbles. The common point in these articles is that the real estate bubble results from huge capital inflows, which alter the nominal exchange rate and the domestic price level, distorting the real exchange rate. Talking of the case of Chinese economy, however, our paper argues that even if nominal exchange rate does not change and the capital account remains strictly regulated, real estate bubbles may also occur as long as the foreign reserve driven by export keeps growing and the financial system is underdeveloped. Collyns and Senhadji(2002) found in the empirical analysis of southeast Asian monetary crisis that foreign investors’ over-optimism and the fragile financial system will also incur bubbles in stock markets and real estate markets. This research is also a reflection about the opening of the capital account in a vulnerable financial system. Still, it cannot be explained by the above researches on the fragility of financial systems why bubbles occur only in real estate markets without the opening of the capital account in such countries as China (Ogawa and Sun, 2001), while our paper validated the relationship between surplus monetary liquidity and real estate bubbles in China’s current economy based on our theoretical model about private saving and investment behavior and related empirical analysis.

Of course, the real estate bubble is so complicated an issue that scholars have not yet achieved agreements on its causes, features and influences (Hunter, Kaufman and Pomerleano, 2003). Accordingly, there are conflicting policy suggestions (Meltzer, 2003, Trichet, 2005 and

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4 Charles Kindleberger(1987) defined asset bubbles this way, “a sharp rise in price of an asset or a range of assets in a continuous process, with the initial rise generating expectations of further rises and attracting new buyers—generally speculators interested in profits from trading rather than in its use or earning capacity. The rise is then followed by a reversal of expectations and a sharp decline in price, often resulting in severe financial crisis—in short, the bubble bursts”.

- 5 -
In this paper, we are not so ambitious as to explore a complete set of related economic indices or an integrated one affecting real estate bubbles. In this sense, monetary liquidity is just one of many important factors causing real estate bubbles and our research is complementary to other researches in this field. However, the index of surplus monetary liquidity emphasizes the effect of imbalance in the economic structure on real estate bubbles, which has not been studied systematically before. On the other hand, many factors revealed by former researches explaining bubbles are actually related to surplus monetary liquidity, such as monetary illusions (Brunnermeier and Juilliard, 2006), incomplete information (Morris and Shin, 2002; Favara and Song, 2006), inelastic house supply (Gyourko, Mayer and Sinai, 2006), optimistic expectations (Herring and Wachter, 2003; Case and Shiller, 2003) and incomplete financial markets (Stein, 1995; Ortalo-Magne and Ray, 2006).

To fully reflect the influence of structural surplus monetary liquidity on real estate bubbles, we made several improvements on previous literature. First, we find that surplus monetary liquidity results from twin surplus (the capital account and the current account) in the balance of payments under the rigid exchange rate system, rather than from expanding monetary policies, which is derived from fundamental principles of open macroeconomics and related macroeconomic indices commonly accepted by scholars (Calvo, et al., 1993, Agénor and Montiel, 1999). Second, excessive savings of consumers will lead to overinvestment in bubble assets in an incomplete financial market where bubbles are expected, according to the OLG model for private savings and investments behaviors (Caballero and Krishnamurthy, 2005). Third, we select bank deposit as the index for surplus monetary liquidity rather than bank loans used by former researches, which is based on the phenomena that savings accompanied by the growth of foreign reserve increases rapidly and banks over-invest in real estate assets. Last but not least, we create an index for liquidity spillover effects to identify the influence of liquidity differences across provinces on real estate bubbles.

In conclusion, our research shows that in the case of real estate bubbles in today’s China, the savings index is statistically more significant than the loan index, which manifests the structural surplus monetary liquidity to be an indispensable reason behind real estate bubbles. Therefore, our policy suggestion is that the radical method to appease the surge of real estate bubbles in China is to solve the structural imbalance in Chinese economy, specifically, the conflict between the advancement of trade and the fragility of financial systems.

Section 2 describes the stylized fact of the external dependent economy and the accompanying surplus monetary liquidity. Section 3 establishes a simple OLG model with real estate bubbles to uncover the channel for surplus monetary liquidity into real estate markets. Section 4 introduces the selection of data, related variables and empirical models. Section 5 analyses the empirical result and its implications. Section 6 concludes and lists issues to be solved in the future.

2. The External Dependent Economy and Surplus Monetary Liquidity

The fast-growing economy of today’s China has following features (People’s Bank of China, 2006). First, extensive fixed investment (I) grows very fast. Second, domestic demand level led by individual consumption (C) remains mild, while, at the same time, residential disposable income keeps increasing and private savings (S) in the bank thus grow proportionally\(^5\). That is

\[^5\] Recently, enterprise savings are increasing gradually, because profits are declining and RMB is expected to
to say, investment in China is surplus compared with domestic consumption but insufficient compared with domestic savings since S-I>0. Third, though net export (EX-IM) is increasing substantially, its scale is still limited. But China’s gross export accounts for over 60% of GDP, which is much larger than the figure in such countries as European countries, United States and Japan (the ratio of net export to GDP is an commonly used index for the external dependence of an economy). Most of the export is products of processing trade of foreign owned enterprises (see charter 2 for an illustration of the correlated increase of FDI and trade), the increase of which is accompanied by the import of high value-added intermediate goods (IM). The last characteristic is that the fiscal policy of Chinese government tends to be conservative (T>G)

From a basic principle of open macroeconomics, the combination of superfluous domestic savings and conservative fiscal policy will lead to structural trade surplus.

\[(S-I)+(T-G)\equiv(EX-IM)\]  

(2.1)

Chart 1

Growth rate of resident savings

Source: Wind database.

In fact, with the persistently fast growing Chinese economy and the increasingly external dependent economic structure accompanying the growth (dependent on both export and FDI), the structural twin surplus in the balance of payment is inevitable accordingly. Therefore, in a stable exchange rate system, lasting surplus in both the current account (CA), led by trade surplus (EX-IM), and capital account (KA), led by FDI, trigger foreign reserve to reach its historical height once and once again (see formula 2.2 and chart 2).

\[CA+KA\equiv RE\]  

(2.2)

Chart 2

appreciate.

6 Though the contribution of net export to GDP is low, the processing trade enterprises absorb numerous low-cost workers and the export help relieve the deflation pressure from the growth of production capacity.

7 If the price adjusting monetary policy is effective, exchange rate adjustment may better inhibit surplus monetary liquidity than the contractionary monetary policy in the current situation of the twin surplus. However, due to fragility of Chinese financial system and external dependent economy, the central bank cannot actively employ price adjusting policies. (Mckinnon, 2005 and Frenkel, 2004)
Surplus liquidity (uncontrollable increase in monetary supply, \( M \)) resulting from the expanding foreign reserve will restrain the “miracle” of lasting fast economic growth in an external dependent economic structure. In order to keep the price competitiveness of domestic enterprises, the central bank has to take contractive monetary policies\(^8\) (we define the contractive monetary policy as lowering forcibly domestic credit \( DC \) to stabilize monetary supply, \( M \)^\(^9\). see Chart 3\(^{10}\)).

Specifically, we employ the equation of the central bank’s balance sheet to show the mechanism of money supply:

\[
M \equiv DC + RE
\] (2.3)

Although the combination of tight monetary policy, persistently growing fixed investment, and consumers’ over-saving behavior effectively relieve the pressure of inflation in the commodity market, the fragile banking system is facing the challenge of surplus monetary liquidity (See Chart 3). For instance, confined by the macro control policy and institutional restrictions, banks cannot freely expand loans to enterprises and adjust deposit and credit interest rates. Hence, the boosting deposit (see Chart 1 and M2 in Chart 3) deteriorates the imbalance of commercial banks’ balance sheet.

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8 The inflation pressure brought by surplus monetary liquidity may intensify polarization between the rich and the poor.
9 The central bank also actively applies the sterilized monetary policy in the foreign exchange market during 2003 to 2005, although the intervention is weaker compared with the surges of capital inflows. However, the government’s burden will become large if the sterilization is used for a long time.
10 \( M1 \) stands for cash and demand deposit, M2 includes saving deposit and M1.
Once banks try to balance their balance sheets, they would have to pursue high return asset\textsuperscript{11} such as real estate loans. On the demand side, Chinese consumers have to suppress current consumption and save most of their increasing income in the bank in order to invest in safe and value-added assets\textsuperscript{12} for future health insurance, pensions, educational expenditures and unemployment insurance. The expanding supply and demand of liquidity can easily boost real estate price (see Chart 4\textsuperscript{13}).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{chart4.png}
\caption{Growth rate of real estate price}
\end{figure}

Source: Wind database

In summary, it is the external dependent economic structure (export dependent and FDI dependent) that brings surplus monetary liquidity (private savings or M2), rather than relaxed monetary policy (the inflation of M1 or DC) as in developed countries. Will surplus monetary liquidity from external dependent economic structure cause real estate bubbles as the relaxed monetary policy does in developed countries? What is the mechanism and feature of it? We will answer these questions through formal theoretical models in Section 3.

### 3. A simple OLG model

We use an OLG model\textsuperscript{14} to analyze the inherent connection between the external dependent economy and real estate bubbles, grasping the coexistence of lack of social security, lagged development of financial systems and fast growth of private savings in China. Muth (1961), Brock (1975) and Garber (1990) setup the rational bubble mechanism. And the pioneering paper of Tirole

\textsuperscript{11}In circumstances of interest rate regulation, banks have no right to lower the saving interest rate. Even if banks can, most people may also put surplus liquidity in banking system for real estate investment with safe and higher returns.

\textsuperscript{12}Assets with safe and higher returns refer to assets with rational bubbles in this paper. Currently in China, bubbles occur most easily in those assets well supported by government policies and by optimistic expectations in the market. As long as the market believes the boom sustainable, safe and higher returns will persist. Real estate bubbles in today’s China illustrated the mechanism.

\textsuperscript{13}From Chart 4, the price decline from 2005 is due to government’s stricter regulation on the entrance of foreign capital into the real estate market. Therefore, a part of foreign hot money left this market, which is consistent with the phenomena of hot money flight from China as displayed in Chart 2, which shows negative net short-term capital inflow. This positive correlation between monetary liquidity and real estate price is in accordance with our theory and empirical result.

\textsuperscript{14}Blanchard and Fischer covered various theoretical mechanisms of OLG models using three chapters in Lectures on Macroeconomics, (1989). Ljungqvist and Sargent explain the application of OLG in the second edition of the famous Recursive Macroeconomics Theory, (2004). There are also some classical papers on OLG models. For instance, we can categorize OLG models according to asset attributes into the following types: the OLG model with money(Samuelson,1958), with corporate bonds (Diamond,1965), with both corporate bonds and bubble assets (Tirole,1985), with equity and corporate bonds(Abel, et al.,1989), with government bonds(Barro, 1973), with pension funds(Diamond and Mirrlees,1974).
(1985) introduced the rational bubble mechanism into the OLG model to study asset price bubbles, which shows that in a dynamically inefficient economy with excessive capital accumulation, rational bubbles would reduce the excessive capital accumulation and thus realize Pareto improvement\textsuperscript{15}. However, the model of Caballero and Krishnamurthy(2005) and our paper all suggest that in an external dependent (dynamically inefficient) economy, the rational bubble may lower social welfare\textsuperscript{16} by “credit crunch” in the banking system when bubbles burst, although it may stimulate enterprises to expand their production when real estate market booms. While Caballero and Krishnamurthy (2005) focuses on foreign debt dependent economies, we focus on economies depending on export and FDI growth, which is exactly the case in today’s China. So, we believe that our model can better explain the story behind surplus monetary liquidity and real estate bubbles in Chinese economy.

3.1 Model Setup

First, we assume that there exists an external dependent economy of two overlapping generations. Specifically, the young generation born at the beginning of period $t$ works in foreign enterprises which are export oriented and grows with a constant rate of $g$. For precautionary incentives mentioned above, the young generation saves all their income $F_t$ in the form of foreign savings or investment in the real estate market (the only two instruments with safe and higher returns) in order to get higher and smoothed income. Total assets of the old generation in period $t+1$ mounts up to $F_{t+1}$, which the old generation use either to produce as entrepreneurs or to fund entrepreneurs’ production as bankers\textsuperscript{17}. For simplification, income from the old generation’s career will cover the consumption of the whole society. In addition, the fixed asset $K_t$ owned by the old generation will be bequeathed to the young generation at the end of their life.

Obviously, income difference between the young generation in period $t$ and period $t+1$ is determined by the growth rate of export, since the young all work in export oriented enterprises,

$$F_{t+1} = (1 + g)F_t \quad (3.1)$$

If the young generation invests $\delta$ part of their income into the real estate market and the annual return of real estate investment is $r^b$ (a stochastic variable), then, the total foreign asset\textsuperscript{18} of the old generation in period $t+1$ accumulated from period $t$, when they are young, is

$$F_{t+1} = F_t[\delta(1 + r^b) + (1 - \delta)(1 + r^e)] \quad (3.2)$$

Furthermore, the old generation entrepreneurs collateralize their fixed assets $K_t$ to borrow bankers’ fixed assets for manufacturing and use their foreign assets (marked as $F_{t+1}$) to import raw materials.

\textsuperscript{16} King and Ferguson (1993), Saint-Paul (1992), Grossman and Yanagawa (1993), while studying economic growth, point out that bubbles may also occur in a dynamically efficient economy, which may lower investment ratio in real capital and technology advancement slows down accordingly. Thus, economic growth is hampered and social welfare decreased.
\textsuperscript{17} Such setup is to emphasize “investment” instead of “consumption”. Adding consumption behavior into the model like Tirole(1985) will not change the result of our paper.
\textsuperscript{18} We assume that the fixed exchange rate is 1 for simplicity and domestic currency is convertible through the current account.
materials from abroad. The rates should be above 1, denoted as \( R \) and \( \bar{BL}_{t+1} \) respectively. All funds are utilized to manufacture domestic nondurable products, which in turn brings return of \( R \) per unit of investment. (\( R \) is determined exogenously by productivity.) Therefore, the \textit{ex post} trade surplus at period \( t \) is equal to the export of the young generation minus the import of the old generation,

\[
F_{t+1} - F_{t+1,t} = [(g - r^*) - \delta (r^b - r^*)]F_t
\]

(3.3)

Namely, trade surplus increases with the growth rate of export, while decreases with the investment scale and return in real estate market.

With the equilibrium of the credit market, bankers’ maximum lending should be equal to entrepreneurs’ maximum borrowings,

\[
\bar{F}_{t+1,t} = \frac{\rho R}{\bar{BL}_{t+1}}K_t
\]

(3.4)

in which, \( \rho \) is the valuation coefficient for the collateralized fixed assets given by bankers (\( \rho \) is a positive number usually smaller than 1 since banks will not lend as much as the collateralized value). Entrepreneurial value is determined by production technology, return on investment and capital cost, so the return is

\[
RK_t + \bar{F}_{t+1,t} + (R - \bar{BL}_{t+1}) \frac{\rho R}{\bar{BL}_{t+1}}K_t
\]

(3.5)

Bankers’ profit is from rent of their real estate and interest of lending so that they will receive at the end of period \( t+1 \)

\[
RK_t + \bar{F}_{t+1,t} \bar{BL}_{t+1}
\]

(3.6)

Since the probability for the young generation to become bankers or entrepreneurs is 50% to 50%, the young will choose their house investment ratio to maximize their expected incomes in the future,

\[
\max_{0 \leq x \leq 1} \left\{ RK_t + \bar{F}_{t+1,t} + \frac{R + \bar{BL}_{t+1}}{2} + \frac{R - \bar{BL}_{t+1} \times \rho R}{\bar{BL}_{t+1}}K_t \right\}
\]

(3.7)

Second, about the mechanism of bubbles in the real estate market, we assume that the intrinsic value of real estate is zero. This simplification focuses our attention on the “bubble side” of the real estate market. Since the intrinsic value of real estate is stable when bubbles emerge in the market, we believe this simplification to be reasonable. When the young generation in period \( t \) believes that the purchased real estate can be sold to the next generation for sure at a higher price, speculation will prevail and the self-fulfilling rational bubble will come into existence. In this setting, the growth rate of real estate price is determined by the growth rate of the young generation’s earnings and export. More specifically,

\[
r^b = g
\]

in which \( r^b \) represents the growth rate of real estate prices.

In this model, we see that \textit{the “structural” twin surplus of the balance of payment (see}
Formula 2.1, 2.2 brings about surplus liquidity, which in turn forms bubbles in the real estate market. The young would sell their assets in advanced altogether\(^{19}\), only when the external shock forces bubbles to expand too rapidly \((r^b > g)\). So people begins to consider that the income growth cannot sustain the bubbles and bubble do burst by their selling action. If the probability of bubble burst is \(\pi\), then the expected return of real estate investment \((r^b)\) is:

\[
1 + r^b = (1 - \pi)(1 + g)
\]

(3.8)

Since we focus on consumers’ motivation for real estate investment and the corresponding real estate bubble, we assume the expected return of real estate investment to be always greater than foreign savings,

\[
r^b - r^r = (1 - \pi)(g - r^r) - \pi(1 + r^r) > 0
\]

(3.9)

In addition, the movement of real estate price may influence the loan supply and demand in the credit market (see formula 3.2, 3.4), which in turn influences bankers’ lending rate. Therefore, during the bubble economy, lending scale is \(F^B_{t+1,t} = [1 + r^r + \delta(g - r^r)]F_t\) and the loan rate is \(\bar{r}^B_{t+1} = r^B_t\); during the bubble crash, the lending scale will be \(F^C_{t+1,t} = (1 + r^r)(1 - \delta)F_t\) with lending rate assumed to be \(\bar{r}^C_{t+1} = r^C_t\)\(^{20}\).

3.2 The Optimal Portfolio Allocation of the Young Generation

The first order condition of the optimization problem (3.7) is

\[
(1 - \pi)\frac{g - r^r}{1 + r^r}(R + r^B_{t+1}) - \pi(R + r^C_{t+1}) = 0
\]

(3.10)

The optimal allocation parameter \(\delta\) does not appear in the first order condition. The economic meaning is that as long as the lending rates \((r^B_{t+1} and r^C_{t+1})\) under the condition of bubble sustaining and bubble collapse is determined in advance by the young generation, they can always maximize their expected income and they are indifferent about the portfolio allocation, since the potential loss (return=-1) of bubble collapse (the probability is \(\pi\)) is always offset by the potential gain \((g-r^*)\) of bubble sustaining (the probability is 1-\(\pi\)). Here, \((R + r^B_{t+1})\) is the normal return of bankers in bubble sustaining period and \((R + r^C_{t+1})\) in bubble collapse period.

On the other hand, we need to make sure that the credit market is clear. Utilizing the equilibrium of the credit market (equation 3.4), we can get the equilibrium lending rate when bubbles sustain

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\(^{19}\) The fall of real estate price in 2005 in China cannot be interpreted as the burst of bubbles. It is just a temporary effect of macro control policies. (Currently, \(r^b < g\))

\(^{20}\) Although the lending rate is rigid, credit rationing is popular in China. In this sense, the latent lending rate is changing.
\[ r_{t+1}^B = \max \left\{ 1, \frac{\rho R}{1 + r^* + \delta(g - r^*)} \right\} \]  

(3.11)

For simplification, we let \( F_i = K_i \), and assume \( \rho R < 1 \). Obviously, \( r_{t+1}^B = 1 \) means that the savings in the young generation are so abundant that supply of loans of the old generation forces the lending rate to the bottom line.

Likewise, the lending rate when bubbles collapse is

\[ r_{t+1}^C = \max \left\{ 1, \min \left[ \frac{\rho R}{(1+r^*)(1-\delta)}, R \right] \right\} \]  

(3.12)

The equation means that when bubbles collapse, savings of the young generation contracts, so does the lending scale of the old generation. Thus, the lending rate hikes. Of course, the lending rate should be no smaller than 1 and no greater than the return of production \( R \).

Using the first order condition (3.10), together with \( r_{t+1}^B = 1 \) and (3.12), we can get the ex ante optimal portfolio allocation \((\delta^*)\).

According to the individual optimal portfolio allocation, we can confirm the conclusion of existing references in the introduction that bubbles do stimulate real investment. However, the increase of real investment does not necessarily justify the allocation. In the next part, we will judge the appropriateness of the optimal allocation, \( \delta^* \), according to its influence on the social welfare.

### 3.3 Evaluation of Social Welfare and Overinvestment in the Real Estate Market

With references to formula 3.7, in bubble economy, since the asset value of the young generation is elevated by the bubble, the value of the entrepreneurs’ capital and the bankers’ loan scale both increase. The total social output is:

\[ Q^B = \frac{R + 1}{2} F_i[1 + r^* + \delta(g - r^*)] + \frac{1}{2} (R - 1) \rho RK_i + RK_i \]  

(3.13)

However, there would be two possibilities when bubbles collapse. The first one is without credit crunch, featured by \( r_{t+1}^C = 1 \), the total social output is:

\[ Q^{C,S} = \frac{R + 1}{2} F_i(1 + r^*)(1-\delta) + \frac{1}{2} (R - 1) \rho RK_i + RK_i \]  

(3.14)

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21 Lacking of efficient credit risk management, banks in emerging markets would greatly discount collateral assets.

22 There are two extremes situations. If \( r_{t+1}^C = 1 \), according to formula (3.9),

\[ (1 - \pi) \frac{g - r^*}{1 + r^*} (R + 1) - \pi (R + 1) > 0 \]

The optimal investment ratio should be \( \delta^* = 1 \), that is, to put their whole income in the real estate market. On the contrary, if \( r_{t+1}^C = R \) and when

\[ (1 - \delta)(g - r^*) - \delta(1 + r^*) \frac{2R}{1 + R} < 0 \]

Dumping all real estate assets would be the optimal choice, in other words, \( \delta^* = 0 \). However, the credit market is not clear in these two situations, so these two solutions do not hold.
The second one is with credit crunch, featured by \( r^c_{t+1} > 1 \). The total social output is:

\[
Q^{C,L} = RF_t(1 + r^*)(1 - \delta) + RK_t
\]  

(3.15)

Comparing the three formulas on aggregate output (3.13, 3.14, 3.15), we can find that bubbles have two sides. One is to stimulate production (3.13), the other is to retrain production (3.14, 3.15). Therefore, the government will maximize the expected social output taking both sides into account. Notice that the object function of social welfare is different from that of individual expected income:

\[
\max_{\delta \in [0,1]} \pi Q^C + (1 - \pi)Q^B
\]

The first order conditions do not hold and we get the corner solution. For the first inequality, the model has assumed that the expected return of bubble assets is greater than the foreign deposit rate. To the other inequality, since this is when the loss of social output reaches maximum, the inequality is still acceptable. Besides, bank credit rates are rigid in the two extreme points, which indicates that the increase of real estate investment ratio do not affect the lending rate in the two extreme points but the real estate investment ratio has positive monotone correlation with the credit rate in the middle area. If we denote \( \delta^I \) and \( \delta^L \) as the critical values for the conditions of “middle term=1”\(^{23} \) and “middle term=R” respectively, we can then conclude (see formula 3.16, 3.17) that government optimal preference investment ratio \( \delta^G \) is always \( \delta^I \) in both conditions.

And \( \delta^G \) is always lower than the individual optimal ratio \( \delta^* \). This means that individual investment in the real estate market is speculate and from the perspective of social welfare, individual rational investment in real estate markets is excessive.

\[
\delta^G = \delta^I < \delta^*
\]  

(3.18)

In short, the model demonstrates that with an incomplete financial market, the surplus monetary liquidity brought by export increase will be transformed into individual motivations to invest in the real estate market, resulting in rational bubbles, or speculative bubbles. From the viewpoint of social welfare, the investment is excessive. Following the stylized fact and the OLG model,

\(^{23}\) The middle tern equals to \( r^c_{t+1} = \frac{\rho R}{(1+r^*)(1-\delta)} \)
quantitative analysis will be given below.

4. Data, Variable Selection and Empirical Modeling

This section intends to quantitatively confirm the two important questions: one is whether surplus monetary liquidity is the main contributor to real estate bubbles in China; the other is whether there is speculative investment in the real estate market.

We adopt panel data analysis based on the regional data from 28 provinces in China rather than the time series analysis using the macroeconomic data. This is because surplus monetary liquidity is a new phenomenon that emerges only in recent years. Therefore, the time series analysis cannot identify the bubble for lack of enough data (Kalra, et al, 2000).

The cross-provincial panel data in this paper is from February, 2004 to December, 2005. Even if year on year adjustment is conducted to ensure the consistence of empirical analysis with the theoretical model and to relieve the trouble of time series characteristic, each variable still has as many as 308 observations. We further study the ripple effect (Cameron, et al, 2006), that is, to introduce the spillover liquidity variable in order to discuss the influence of cross-provincial liquidity differences on local real estate prices. It is an important criterion of speculative investment (the second issue to be tested) uncovered by the stylized fact and the theoretical model whether the ripple effect is statistically significant.

Since we want to examine the real estate bubble resulting from the external dependent economy, use the difference between the growth rate of the real estate price in China minus the short-term bond rate of U.S. as the dependent variable in our empirical model, according to the theoretical model (see formula 3.9). As the real estate price is not directly obtainable, we calculate the price from the division of the sales revenue and sale price of commercial houses.

When selecting independent variables, we choose the growth rate of savings rather than of bank loans or monetary supply because we want to emphasize the role of monetary liquidity. As a matter of fact, banks are regulated with respect of the ratio of deposit to loan during the sample period, the scale of loans are therefore determined by that of savings. And the down payment of individuals and the autonomous lending of enterprises, while not included in credit variables, are reflected in savings. So, the growth rate of savings can better illustrate real estate bubbles. The spillover effect variables are measured by the difference between the growth rate of local savings and aggregate savings. This index can examine whether capital will flow from capital rich areas to capital deficient areas. With cross-provincial capital flows, the growth rate of real estate prices all over China may tend to converge. As for other independent variables that need to be controlled, we choose variables according to the survey on empirical works about real estate bubbles, Cameron, et al(2006), and the availability of Chinese data. Specifically, these variables are the growth rate of residential income, enterprise profits, loss of loss making enterprises and land prices. Residential


25 The reform of housing markets in China started less than 10 years ago. Time series data of real estate prices is very limited.

26 Since data about the asset allocation variable in the theoretical model is unavailable, we use the spillover variable as the proxy for the portfolio allocation to see if there is speculative behavior.

27 Data on the RMB counterpart of foreign reserve is not accessible required by our theoretical model.

28 There are some other import control variables, such as demographic structure, the grow rate of population, the
income and enterprise profits can reflect fundamentals of the economy, but can control the influence of cross-provincial differences of economic development on real estate prices as well. The variable of loss of loss making enterprises is related to a new argument that enterprises with low productivity and profitability tends to speculate in the real estate market (Ventura, 2004). Construction cost is also factor of fundamentals that cannot be omitted. But since the regional data of this variable is not accessible, we use land price as its index. We got the land price in the same way as the real estate price.

Therefore, the panel data model we employ go as follows:

\[
\text{[the rate of change in real estate price after adjustment]}_t = \alpha + \beta_1 \text{[growth rate of personal savings]}_t + \beta_2 \text{[growth rate of corporate savings]}_t + \beta_3 \text{[growth rate of personal income]}_t + \beta_4 \text{[growth rate of corporate profits]}_t + \beta_5 \text{[growth rate of residential overflow savings]}_t + \beta_6 \text{[growth rate of entrepreneurial overflow savings]}_t + \beta_7 \text{[growth rate of corporate losses]}_t + \beta_8 \text{[growth rate of land price]}_t + \epsilon_t.
\]

For each variable in the model, we examined its characteristics, from which we can get intuition about the influence of surplus monetary liquidity on real estate bubbles (See Appendix).

Most of the monthly data in this paper are from Wind Database and data of provincial savings are from the Statistics Monthly published by the People’s Bank of China. All variables are adjusted to eliminate seasonal effects (the year on year growth rate) as well as inflation (adjusted by CPI). And U.S. interest rate is no exception is adjusted by the U.S. Consumer Price Index.²⁰

5. Results of Empirical Analysis.

Table 1 shows the estimation of the empirical model of panel data discussed above. Model 1 and model 2 are analyzed in order to test the robustness of the general model 3, especially to sign and significance of the indices for surplus monetary liquidity. In model 1, we only consider the impact of scale of savings on real estate prices. Model 2 further examines the spillover effect of surplus monetary liquidity.

Obviously, no matter in the general model or in the simplified models, the growth of local savings (monetary liquidity) also has a positive influence on the real estate price. In the sample period we selected, the money liquidity of local enterprises has a larger influence on the real estate price. Interestingly, after controlling the liquidity indices, although the sign of the estimated parameters of the growth rate of residential income, land price and enterprise profits are consistent with the general economic principles, none are statistically significant. For the growth rate of losses of loss making enterprises, the parameter is also insignificant and even the sign of the parameter is incorrect.³¹ Therefore, the surplus monetary liquidity is probably the dominant factor

banks’ mortgage rate, the stock of real estate and the portfolio allocation to securities. Monthly provincial data of these variables are not available. So we put them into the constant because we suppose these variables are relatively stable in the short term.

²⁹ \( \epsilon_i = k_i + u_i, \) i represents the cross-sectional information, t represents time, \( k \) is the fixed effect. Hausman test will be conducted to determine which one of the two effects, fixed and random, is relevant for our panel data analysis. (Hsiao, 2003)

³⁰ We abandon the data from Qinghai, Xinjiang and Xizang for great incompleteness. For two missing observations of the land price and the residential income, we use smoothing modification.

³¹ The reason of insignificance of residential income is that people can easily access the speculative real estate market by borrowing to cover the down payment. Similar mechanisms can explain the insignificance of enterprise profits and losses of loss making enterprises. Even if land prices can affect real estate prices, transaction cannot be
supporting real estate bubbles. This result answered the first question raised at the beginning of Section 4.

As for the spillover effect indices, only the enterprise savings spillover variable has a significant effect on the real estate price, while residential savings spillover variable does not contribute to the bubbles. This result confirms the speculative behavior of the enterprises in the real estate market since we believe the cross-regional capital flows are, to a large extent, speculative. Thus, we answered the second question.

The constant is significant, which shows that those important variables we put into the constant do have influence over real estate bubbles. Since we use growth rates for all the variables in the regression, the determinant coefficient (R square) is relatively low.

In order to insure the precision of panel data analysis method, we apply the Breusch-Pagan LM test and the Hausman test to the sample, the result of which can be seen in the note 2 of table 1. From the random effect model we choose, we can see that the regional characteristics of real estate price growth is not “fixed”, which may be a result from the overflow effect of monetary liquidity.

### Table 1 Estimation of Random Effect

<table>
<thead>
<tr>
<th>dependent variable:</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>house price adjusted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Explanatory Variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(all in annual growth rate)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Savings</td>
<td>0.487***</td>
<td>1.284***</td>
<td>1.263***</td>
</tr>
<tr>
<td>(0.174)</td>
<td>(0.348)</td>
<td>(0.368)</td>
<td></td>
</tr>
<tr>
<td>Enterprise Savings</td>
<td>1.709***</td>
<td>2.075***</td>
<td>2.179***</td>
</tr>
<tr>
<td>(0.212)</td>
<td>(0.493)</td>
<td>(0.501)</td>
<td></td>
</tr>
<tr>
<td>Residential Savings Spillover Effect</td>
<td>0.307</td>
<td>0.226</td>
<td></td>
</tr>
<tr>
<td>(0.542)</td>
<td>(0.554)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise Savings Spillover Effect</td>
<td>1.727***</td>
<td>1.839***</td>
<td></td>
</tr>
<tr>
<td>(0.518)</td>
<td>(0.525)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Income</td>
<td>0.048</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.110)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Price</td>
<td>0.023</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.017)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise Profit</td>
<td>0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.043)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of Loss-Making Enterprises</td>
<td>-0.015</td>
<td></td>
<td>-0.285***</td>
</tr>
<tr>
<td>(0.031)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>-0.137***</td>
<td>-0.274***</td>
<td>-0.285***</td>
</tr>
<tr>
<td>(0.034)</td>
<td>(0.050)</td>
<td>(0.051)</td>
<td></td>
</tr>
</tbody>
</table>

reached without enough liquidity. Therefore, land prices are not significant after controlling monetary liquidity. Intuitions behind such contrast may be that individual cross-provincial investment is much more inconvenient and costly than enterprise investment, because enterprises can freely borrow and lend from each other and thus indirectly enjoy the high return of real estate investment in other areas.
6. Conclusions

In the second section about stylized fact, we explain according to the basic principles of the open macroeconomics how an external dependent economic structure brings about surplus monetary liquidity under a rigid exchange rate system. Liquidity of this kind is totally different from that of the western countries’, which is the result of loose monetary policies during the depression period of their economy.

Secondly, we extends C-K’s saving-investment model to uncover that surplus monetary liquidity may incur rational bubbles in real estate markets. This is because in an incomplete financial market, people tend to speculate in the real estate market out of the precautionary savings motivations of smoothing their income. This mechanism is not covered in the current literature about Chinese real estate bubbles (Wang Lina, 2005; Yi Xianrong, 2005; Yang Fan, 2005). Even foreign studies about the influence of surplus monetary liquidity on real estate price have not paid enough attention on the relevant effect of the external dependent economic structure on real estate bubbles.

Thirdly, we select savings and spillover variables of savings to test the mechanism of real estate bubbles introduced by basic macroeconomic principles and the OLG model. Through panel data analysis of 28 provinces, we found that the real estate bubble in today’s China is mainly caused by the external dependent economic structure which results in surplus monetary liquidity. Enterprise savings and their spillover effect play more important roles than their residential counterparts.

Based on the results above, our policy suggestion to solve the problem of surplus monetary liquidity is that in the short term, the government should intensify the regulation on speculative real estate investment(e.g. increase the capital adequacy ratio of the banks and raise the investment tax in real estate) to restrain individuals’ rational expectations on the surge of real estate price and in the long term, the government should change the current rigid exchange rate system, develop the Chinese financial markets, improve the social security systems and adjust the external
dependent economic structure. \(^{33}\)

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Cameron, Gavin, Muellbauer, John and Murphy, Anthony, (2006) ”Was there a British House Price Bubble? Evidence from a Regional Panel”, CEPR Discussion Paper No. 5619


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\(^{33}\) As long as people’s worry about future income persists, surplus savings will not disappear even if RMB appreciates and residents’ disposable income increases.

\(^{34}\) Due to the immense quantity of referenced literature, only a part is listed here. Please email the authors if interested in the unlisted.
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Appendix: description of data characteristics

The time variable is on the horizontal axis, ranging from 2005.2 to 2005.12. Other variables are on the vertical axis.

a) The adjusted real estate price growth rate. The cross-sectional heteroskedasticity of adjusted real estate price decreases with time, which could be explained by cross-provincial capital flow. We use spillover variables to test the effect of cross-provincial capital flow.

b) The enterprise savings spillover proxy variable: This variable shows great cross-sectional variance. We use the cross-sectional difference of savings growth rate to represent the reason of capital flow. To sustain a homogeneous real estate bubble, capital may tend to flow from those places with higher savings growth to those with lower. The same can also be true for residential savings. This idea will be tested in the empirical part.

c) The enterprise savings growth rate: The local enterprise savings growth rate will contribute to the local real estate price growth, which complies with the theory.
d) The residential savings spillover proxy variable: Like enterprise savings spillover index, residential savings spillover index shows great cross-sectional variance, too.

![Graph showing variance](image1)

e) The residential savings growth rate: cross-sectional variance is smaller than that of the enterprise savings growth rate, while the grow rate increase steadily up across the year.

![Graph showing growth rate](image2)

f) The residential income growth rate: The income growth is relatively steady and less variant across provinces.

![Graph showing income growth](image3)

g) The land price growth rate: Land price growth, like estate price growth, shows a convergence tendency as for the growth rate variance across provinces. But overall, the cross-sectional variance of land price growth is much smaller than that of estate price growth.

![Graph showing land price growth](image4)
h) The growth rate of enterprise profit. There are great cross-sectional difference in this variable.

i) The loss growth rate of loss-making enterprises. There is also large cross-sectional variance without convergence in time dimension. Increasing loss may give enterprises the incentive to risk investing in real estate. This is why we include the variable in the empirical test.