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A Theoretic Approach to China's Housing Market Boom and Down Payment Loans

Man Xu and Qing Shi*

In this paper, we theoretically model the dynamic credit-financed real estate market, from a micro point of view, to show how the interaction between expectation of higher house price and down payment loan (DPL), even without changes in economic fundamentals, could result in price boom. Further, we find that the elastic house supply, due to developers timing the market, could add to the problem. Our model offers a good interpretation to the 2015 house price boom witnessed in China. Also, we dig into the potential consequences of the real estate boom and corresponding policy implications.

Key Words: House price; Moral hazard; Financial accelerator.
JEL Classification Numbers: D11, D82, G10.

1. INTRODUCTION

Since 2015, China has witnessed a significant house market boom, first from first-tier cities such as Beijing, Shanghai and Shenzhen, and then spread all over the country. Many participants have linked the surge of house price to the use of down payment loans (DPL) rather than changes to the fundamental side. Is there any rationale behind this judgement? Moreover, DPL is not a new instrument. It could be dated back to around 2008 when the house market was cool due to the world-wide financial crisis. If DPL has lead to the price boom since 2015, why it has seemingly little effect before? These questions are very important since the real estate sector has huge impact on financial system and real economy, and thus deserve further analysis.

In this paper, we theoretically model the dynamic credit-financed real estate market, from a micro point of view, to show how the interaction between expectation of higher house price and DPL, even without changes

* Xu: Shenzhen University, No.3688 Nanhai Road, Shenzhen, China. Email: Ivymann.xu@szu.edu.cn; Shi: Corresponding author. Shenzhen University, No. 3688 Nanhai Road, Shenzhen, China. Email: shiqing.thu@gmail.com

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in economic fundamentals, could result in price boom. Our model offers a good interpretation to the 2015 house price boom witnessed in China. Also, we dig into the potential consequences of the real estate boom and corresponding policy implications.

The general idea behind our model is as follows. Due to the problem of moral hazard, financial intermediaries (FI) need to make sure that the credit-financed house buyers have enough incentive to keep the ownership of the house so that buyers would be willing to repay the loan in the future. Moreover, buyers' incentive of repaying the loan depends not only on present house price but also on the expectation of future house price. Consequently, the down payment requirement set by FI, which determines the total demand of house, also depends on the expectation of future house price as well as current house price. This formulate the basic feedback mechanism and the dynamic process of house prices. However, with certain technology improvement such as Big Data and Deep Learning, the incentive problem may be reduced, at least apparently. This in turn loosens the down payment requirement and increases the house demand rapidly. Further, with developers hold up inventories to their advantage, a elastic house supply may add to the sharp increase in house price. The real estate boom is in place.

The remaining paper is organized as follows. Section 2 is a briefing on related literature. Section 3 describes a basic model with fixed house supply, where there exists a stable steady state under equilibrium. Section 4 presents the full model. First, DPL is introduced. Second, fixed house supply is replaced with elastic house supply. We show that the introduction of DPL may change the dynamic of house price to a non-stationary one, resulting in a price boom. And elastic house supply could even worsen the problem. Section 5 discusses the importance of speculative demand in driving the result in Section 4 and the potential consequences of DPL-induced real estate boom and policy implications. Section 6 concludes.

2. RELATED LITERATURE

From the micro perspective, this paper is closed related to the asymmetric information literature, especially on moral hazard. The inspiring work by Holmstrom and Tirole (1997) on financial intermediation is a good example. In their model, entrepreneurs were required by external investors a minimum proportion of equity to fund the intended project due to informational asymmetry. It was shown that all forms of capital tightening and credit crunch (a collateral squeeze, or a savings squeeze), hit poorly capitalized firms the most. Based on their work, Fedele and Mantovani (2014) investigated how public financial institutions can mitigate a credit crunch

problem caused by the financial crisis. Different from the above works, our paper extend the two-period model into a multi-period dynamic one.

From the macro perspective, the paper is also related to financial-accelerator models which could be dated back to the seminal work by Kiyotaki and Moore (1997). They emphasized the role of financial factors (e.g. housing prices) in amplifying and propagating economic shocks due to collateral value and borrowing constraint. Based on their work, some have studied the fiscal accelerator concerning the unique feature of China's economy and housing market (Li *et al.*, 2017).[1] Although they found a significant "fiscal accelerator" effect of land supply on land prices, little has been found on house prices, indicating that boom in land prices alone could not fully account for the house market boom. Our model tries to look at the problem from another perspective.

Unique to China's market, high saving rates may draw attention. Chen, Li, and Qiu (2013) construct a life cycle model with housing demand and incomplete market to explore the relationship between housing demand, accompanied with underdeveloped housing finance and the household saving rate in China. Wei and Zhang (2011) provided detailed evidence of a competitive savings motive for children's marriage in China, contributing to Chinese households buying second homes, which could have driven up the house price. Recent research has compared U.S house market and China's from 2000 to 2013 (Glaeser *et al.*, 2017). They pointed out four differences between the housing booms in China and the United States, and concluded that, although with distinct features between these two markets, bursting real estate bubbles traditionally did great harm to society and important step should be done to secure the financial system.

Our Paper is also inspired by the following papers: Allen and Gorton (1993), Dilip and Brunnermeier (2003), Scheinkman and Xiong (2003), Brunnermeier and Nagel (2004), Allen, Babus and Carletti (2009), Mian and Sufi (2009), Glaeser (2013), Glaeser, Gottlieb and Gyourko (2010), Goldstein and Razin (2013), Lam, Liu and Maliszewski (2015), Fang *et al.* (2015), Wu *et al.* (2016).

3. BASIC MODEL

Consider a discrete-time dynamic credit house market with two types of agents: potential house buyers (HB) and financial intermediaries (FI). For simplicity, all participants are assumed to be risk neutral and protected by limited liability. We will describe the structure of the two types of agents in detail in the following sections.

[1]More on China's unique feature of fiscal policy could be found in Cai, Henderson, and Zhang (2013), Shen, Zhao and Zou (2014), Wu, Feng and Li (2015).

TABLE 1.

Buyer's Choice

Lifestyle	Hardworking	Lazy
Private Benefit	0	B
Probability of Repay	$P_H(I_t)$	$P_L(I_t)$

3.1. The Structure of Potential Buyers

A continuum of two-periods lived buyers, with a total population of N, enter the house market at each period t.[2] Buyers are assumed to be identical (same income and belief) except that they are endowed with different total initial liquid asset A_{it}. The distribution of A_{it} across buyers follows the cumulative distribution function $F_t(A)$ on the support of $(0, \infty)$ at time t. Assume the distribution is stationary, i.e., $F_t(A)$ can be reduced to the form of $F(A)$.

Denote $I_t > 0$ as the market price of houses at time t. When the buyer's total liquid asset is less than the market price $A_{it} < I_t$, the buyer needs at least $I_t - A_{it}$ mortgage from external finance to buy a house. Only qualified buyers can get access to mortgage and sign the loan contract with banks at time t. The criteria for choosing qualified buyers will be explained later in the paper. Those who can not get mortgage exit the market immediately. While qualified buyers sign the loan contract with FI in period t.

After qualified buyers sign the mortgage contract, it is assumed that they can choose from two lifestyles: lazy or hardworking. As illustrated in Table 1, if a buyer chooses to be lazy, he will get a private benefit of B. For example, he can enjoy more leisure or consume more. Meanwhile, the probability to repay the loan $P_L(I_t)$ would be lower. If he chooses to be hardworking, he will get no private benefit but a high probability $P_H(I_t)$ of repaying the loan. Note that both P_L and P_H depend on the current market price of house I_t. More specifically, they both decrease in I_t. Denote $\Delta P(I_t) = P_H(I_t) - P_L(I_t)$. We assume that $\Delta P(I_t)$ increases in I_t. The rationale for this assumption is as follows. When the house price is relatively low, lifestyle does not matter for the repay probability. Extremely, $\triangle P(0) = 0$. When the house price is relatively high, the repay probability will be much higher for a hardworking buyer than that of a lazy buyer.[3]

[2]Although the buyers are two-periods lived, the real estate market is a long lived one.

[3]We do not consider the situation when house price is too high for buyers to repay. In that case, our assumption on ΔP would be unnatural because probability of repaying the loan would be very low no matter choosing "lazy" or "hardworking". Further, it is not rational for FI to provide mortgage to buyers in this situation. We treat this case as trivial in real life.

If the qualified buyer can successfully repay the loan in the next period $t+1$, he would get the ownership of the house and exit the market. In this case, he would enjoy the market value of the house I_{t+1} . Otherwise, the buyer defaults and exit the market. The house would be taken by the FI according to the loan contract.

3.2. The Structure of Financial Intermediary

The FI offers mortgage contracts to qualified buyers at time t. A contract consists of two elements: the down payment ratio α_t and the gross interest rate $R_{m,t}$. Assume the FI is either fully repaid or gets nothing at time $t+1$.[4] Since from the FI's perspective, it is strictly better off if the buyer repays the loan than defaults. To maximize the FI's interest, he would like the buyer to choose the "hardworking" lifestyle. However, the lifestyle is unobservable to the FI, leading to the problem of moral hazard. Therefore, the FI would ask for a minimum down payment ratio α_t in the loan contract so that these screened buyers would strictly choose the lifestyle of hardworking in their own interest. In the next section we will explain this incentive compatible condition and how α_t is determined.

3.3. Incentive Compatible Condition for the Buyer

Obviously, the buyer would choose the lifestyle of hardworking only if it is better off than the other option, lazy lifestyle. That is the expected payoff of choosing hardworking is higher than that of lazy lifestyle. Then the incentive compatible (IC) constraint for the buyer should be as follows:

$$P_H(I_{t+1} - R_{m,t}(1-\alpha_t)I_t) \geq P_L(I_{t+1} - R_{m,t}(1-\alpha_t)I_t) + B \qquad (1)$$

The left hand side of (1) is the expected value of choosing "hardworking" and the right hand side is the expected value of choosing "lazy". With this IC condition, the buyer would choose the lifestyle of hardworking in the interest of both the bank and himself. Rearrange (1), we get the following constraint for the down payment ratio:

$$\alpha_t \geq 1 - \frac{I_{t+1} - \frac{B}{\triangle P(I_t)}}{R_{m,t}I_t} \qquad (2)$$

This inequality determines the minimum down payment ratio as

$$\alpha_t = 1 - \frac{I_{t+1} - \frac{B}{\triangle P(I_t)}}{R_{m,t}I_t} \qquad (3)$$

[4]In the real world, the FI would get control of the house when the buyer defaults. Then the FI would sell the house in a public auction. This sale price would be at great discount rate d. If d is relatively small, for simplicity we could assume it to be zero without losing generality.

Only buyers who have enough initial assets to satisfy this minimum down payment requirement can be qualified as a borrower.

From (3), the minimum down payment ratio α_t decreases with I_{t+1} and increases with the private benefit B. The intuition is that if the expectation of future house price I_{t+1} is higher, the buyer would be more willing to repay and relax the down payment constraint.[5] While if the private benefit B is higher, the buyer would be more likely to choose the lazy lifestyle. Therefore, the bank has to strengthen the constraint.

We assume that $B/\triangle P(I_t) < I_{t+1} < B/\triangle P(I_t) + R_{m,t}I_t$ so that the down payment ratio $\alpha_t \in (0,1)$. Besides, when $I_{t+1} < R_{m,t}I_t$, the buyer is better off without entering the housing market. That is, if the expectation of the house price is not increasing from an inflation-adjusted perspective, the speculative demand will not exist. Therefore, we restrict our analysis to the following assumption:

Assumption 1

$$\max\left(\frac{B}{\triangle P(I_t)}, R_{m,t}I_t\right) < I_{t+1} < \frac{B}{\triangle P(I_t)} + R_{m,t}I_t$$

3.4. Participation Constraint for the Financial Intermediary

The expected value of the mortgage contract to the FI is as follows:

$$V = P_H(I_t)R_{m,t}(1-\alpha_t)I_t - R_f(1-\alpha_t)I_t$$

where R_f is the FI's cost of capital, or market risk-free interest rate. For the FI to rationally offer the mortgage contract, the expected value should be non-negative. That is, the individual participation constraint for the FI is given as

$$R_{m,t} \geq \frac{R_f}{P_H(I_t)} \tag{4}$$

Suppose the mortgage market is fully competitive, (4) should be binding. Therefore, the mortgage interest rate is derived as

$$R_{m,t} = \frac{R_f}{P_H(I_t)} \tag{5}$$

It is easy to see from (5) that $R_{m,t}$ increases in I_t. Since when house price is higher, the default probability is also higher. FI has to require a higher mortgage interest rate to compensate the risk.

[5]In this model, we do not feature aggregate uncertainty. Given rational expectation, all the agents have perfect foresight about the future house price. That is, without unanticipated shocks, the expectations of future price will realize itself.

3.5. House Market Clear and The Equilibrium Condition

In the basic model, we assume that the house supply is inelastic each period. [6]

$$H_s = \bar{K} \tag{6}$$

Assumption 2

The house supply on market is less than the total population $\bar{K} < N$.[7]

With the minimum down payment ratio α_t, only buyers with initial assets larger than $\bar{A}_t$ can afford the down payment. $\bar{A}_t$ is given as

$$\bar{A}_t = \alpha_t I_t = I_t - \frac{I_{t+1} - \frac{B}{\triangle P(I_t)}}{R_{m,t}} \tag{7}$$

Down payment decreases in I_{t+1} and increases in I_t. This is because the buyer's opportunity cost of being lazy increases in I_{t+1} and decreases in I_t. The set of qualified buyers at time t is given as $\{A_{it} \geq \bar{A}_t\}$. Therefore, the total demand is derived as

$$H_{d,t} = \left(1 - F(\bar{A}_t)\right) N$$

When market clears, $H_s = H_{d,t}$, i.e.,

$$\bar{K} = \left(1 - F(\bar{A}_t)\right) N$$

Rewrite the above equation we have

$$F^{-1}(1 - \frac{\bar{K}}{N}) = \bar{A}_t = I_t - \frac{P_H(I_t)\left(I_{t+1} - \frac{B}{\triangle P(I_t)}\right)}{R_f} \tag{8}$$

which can be further rearranged as

$$I_{t+1} = g(I_t) = R_{m,t}\left(I_t - F^{-1}(1 - \frac{\bar{K}}{N})\right) + \frac{B}{\triangle P(I_t)} \tag{9}$$

(9) is the house price transition equation and $g(\cdot)$ is the state transition function. Substitute $I_{t+1} = I_t$ into the transition equation, in steady state, the house price I^* satisfy the following equilibrium condition

$$I^* = g(I^*) = R^*_m\left(I^* - F^{-1}(1 - \frac{\bar{K}}{N})\right) + \frac{B}{\triangle P(I^*)} \tag{10}$$

To investigate further, we consider the first-order approximation.

[6] It is assumed that the houses on the market are identical for simplicity.

[7] The house supply consists of default houses and new houses.

Assumption 3

Assume that the transition equation $g(\cdot)$ takes the form $g(I_t) = \eta I_t + k$ and that

$$\frac{\kappa}{1-\eta} > 0$$
$$0 < \eta < 1$$

Then the house price in steady state I^* can be reduced to

$$I^* = \frac{\kappa}{1-\eta} \tag{11}$$

4. FULL MODEL

4.1. Down Payment Loans

In this section, we consider the case in which down payment loans (DPL) are offered. DPL is made possible due to the development of BIG DATA technology which financial intermediaries can use to monitor borrower's (the house buyer) lifestyle and creditworthiness. Assume that when a borrower is monitored, his private benefit of being lazy, denoted by B_L is lowered, i.e., $B_L < B$. As monitoring is costly, banks charge a higher interest rate $R_{s,t} > R_{m,t}$.[8] The incentive compatible (IC) constraint for mortgage with advanced monitoring is now as:

$$\triangle P(I_t)\left(I_{t+1} - R_{s,t}(1-\alpha_{s,t})I_t\right) \geq B_L \tag{12}$$

It is easy to derive the minimum down payment ratio

$$\alpha_{s,t} = 1 - \frac{I_{t+1} - \frac{B_L}{\triangle P(I_t)}}{R_{s,t}I_t} \tag{13}$$

Again, we impose the following assumption:

Assumption 4

$$\max\left(\frac{B_L}{\triangle P(I_t)}, R_{s,t}I_t\right) < I_{t+1} < \frac{B_L}{\triangle P(I_t)} + R_{s,t}I_t$$

Although the increase in interest rate has a positive effect on the minimum down payment ratio. The decrease of private benefit would have a negative

[8]Monitoring cost c is assumed to be lower than bank's benefit $R_{s,t}(I_t - A_{s,t})$ to ensure the expected value is non-negative to the financial intermediary.

effect on $\alpha_{s,t}$. Hence, with costly monitoring, DPL may be viable.[9] The mortgage with DPL is in essence a mortgage which requires lower down payment $\alpha_{s,t}$ and higher interest rate $R_{s,t}$. Less qualified buyers can have access to the credit housing market who otherwise could not.[10] The minimum initial asset for a buyer to be qualified for mortgage with DPL is thus

$$A_{s,t} = \alpha_{s,t} I_t = I_t - \frac{I_{t+1} - \frac{B_L}{\triangle P(I_t)}}{R_{s,t}}$$

which is lower than in the normal mortgage. Buyers with initial asset in the range of $(A_{s,t}, A_t)$, who could not get financed in the normal case, can now get access to external financial market and be financed with DPL. Now the total demand of house is

$$H_{d,t} = (1 - F(A_{s,t}))\, N$$

When market clears, $H_{d,t} = H_{s,t}$, i.e.,

$$\bar{K} = (1 - F(A_{s,t}))\, N \tag{14}$$

The new transition equation of house price with subprime mortgage is

$$I_{t+1} = g_s(I_t) = R_{s,t} \left(I_t - F^{-1}(1 - \frac{K}{N}) \right) + \frac{B_L}{\triangle P(I_t)} \tag{15}$$

where $g_s(\cdot)$ is the new state transition function regarding mortgage with DPL.

Use first-order approximation, $g_s(\cdot)$ takes the following form:

$$g_s(I_t) = \eta_s I_t + \kappa_s$$

since $R_{s,t} > R_{m,t}$ and $B_L < B$, it is obvious that $\eta_s > \eta$. When $\eta_s > 1$, the transition equation is non-stationary, making the process of housing price explosive. This may offer a good explanation to the rapid price growth in China's house market after 2015.

[9] Another way to interpret why the subprime mortgage ask for lower down payment ratio could be that banks securitize the mortgage assets so that they become off balance sheet. In this way, the cost of default would be lower to the bank, i.e., the remaining value of the mortgage asset to the banker would be higher (in the normal mortgage case, we assume the remaining value to be zero) when the buyer defaults. Hence, the minimum down payment ratio could be lower.

[10] Harvey S. Rosen has explained that "The main thing that innovations in the mortgage market have done over past 30 years is to let in the excluded: the young, the discriminated-against, the people without a lot of money in the bank to use for a down payment."

4.2. Elastic House Supply

In analysis above, we assume inelastic house supply which is simple but not realistic. In this section, we relax this assumption to elastic house supply. More specifically, we assume that the house supply $H_{s,t} = K(I_t)$ is increasing in I_t. The rational behind is that when I_t is high, developers are eager to sell more houses to take advantage of the high price. Otherwise, they hold up inventories and delay sales until a more favorable circumstance.

Assumption 5

$$K'(I_t) > 0, K"(I_t) < 0, K(0) = 0, K(\infty) < N$$

The above assumption indicates that the house supply increases in house price at a diminishing speed.

With similar rationing process as in Section 4.1, it is straightforward to derive the price transition equation regarding mortgage with DPL and elastic house supply:

$$I_{t+1} = \hat{g_s}(I_t) = R_{s,t}\left(I_t - F^{-1}(1 - \frac{K(I_t)}{N})\right) + \frac{B_L}{\triangle P(I_t)} \tag{16}$$

where $\hat{g_s}(\cdot)$ is the transition function. Using first-order approximation, assume

$$Q(I_t) = -R_{s,t}F^{-1}(1 - \frac{K(I_t)}{N}) = \theta I_t + \upsilon$$

Now the transition equation can be rewritten as

$$\hat{g_s}(I_t) = (\eta_s + \theta)I_t + (\kappa_s + \upsilon)$$

Since $K(I_t)$ increases in I_t, it is easy to see that $Q(I_t)$ also increases in I_t, i.e., $\theta > 0$. Therefore, the transition process become even more explosive. The conclusion could be understood from the following rationale. Suppose the economy is in its steady state. Consider a positive shock $\triangle$ to the current house price I_t in period t. The down payment would increase, reducing the eligible buyers and lowering total demand. In the inelastic supply case, the expectation of future house price I_{t+1} has to rise, by $\eta_s\triangle$, to lower the down payment ratio and increase the eligible buyers back to the original level. While with elastic supply, the house supply also increases when a positive shock hit I_t. Therefore, I_{t+1} has to increase even more, by $(\eta_s + \theta)\triangle$, to clear the market. In other words, elastic house supply would amplify the impact of a small shock to the house price and make the process even more divergent from the steady state.

5. DISCUSSION AND POLICY IMPLICATION

5.1. DPL and Speculative Demand

The down payment loan was firstly introduced as an instrument to attract more potential buyers around 2008 by developers when the house market is cold. However, it has only rocketed the house price since 2015. The main reason is due to the demand structure underlying the market with different expectations. If the house price is believed to experience a moderate increase or even decrease, i.e.,[11]

$$I_{t+1} < R_{s,t} I_t$$

Speculative buyers would all exit market. The dominating buyers become those with inelastic demand. The value of the home ownership at period $t+1$ is irrelevant to the market price I_{t+1} but the so-called use value, say V. Therefore, the absence of speculative demand cut the feedback channel from I_{t+1} to I_t, and in turn the effect of DPL on the transition equation, which is the case before 2015. Nevertheless, the expectation of house market turns significantly when I_{t+1} is believed to be always larger than $R_{s,t}$, the speculative demand dominates, making $\hat{g_s}(\cdot)$ effective in place. Thus, it is the interaction of belief and DPL rather than DPL alone that boosts the house price after 2015.[12]

5.2. Potential Bubble Bust and Policy Implication with DPL

This process in (16) can not go on forever in reality for many reasons. First, the aggregate capital capacity in the financial system is not infinite. In most case, the mortgage originator and the offerer of DPL are different,[13] which makes the mortgage originator (commercial banks) difficult to monitor the cash source. And the macro-prudential method would fail to ensure the aggregate financing capacity is growing at a sustainable pace. When the limit of financing capacity does occur from unregulated place in the financial system, the house market is unable to clear and the price bubble may burst abruptly and become out of control.

Second, the growth rate in demand may be slower than that of supply at some point. The initial asset requirement, with DPL, for eligible buyers may become so low that almost all potential buyers have entered into the market,[14] which may significantly slow down the growth rate in demand. This argument may be supported by the evidence from the subprime crisis

[11] Assumption 4 is thus broken.

[12] Belief is always at the core of any extreme market, for example, Shiller (2000) and Case, Shiller, and Thompson (2012) have emphasized that one key factor which gave rise to the subprime crisis is people's expectation of a never going down house market.

[13] The mortgage originator is usually the regulated commercial banks in China, while the offerer of DPL may be financial companies, real estate agency and even developers.

[14] The freeze of demand could also be due to a population and demographic change.

in the United States. When the subprime market soured in 2004, the house-ownership rate also increased simultaneously. While when the subprime mortgage continued increasing in the successive two years from 2005 to 2006, the house-ownership rate not only didn't increase but decreased. On the other hand, DPL reduces the opportunity cost for developers to build up inventories until the most favorable time. Therefore, the supply may increase abruptly, at a very fast speed, when the sustainability is in doubt. The gap between demand growth rate and that of supply makes it impossible for market to clear, leading to a crash.

To some extent, DPL may benefit buyers with inelastic demand in the short term, realizing their dreams of owning a house. However, the potential bust of the pricing bubble may do great harm to the society and have adverse influence on the buyers themselves in the long term. Therefore, it is justified for the government to regulate the DPL and has an anchor to windward.

6. CONCLUSION

In this paper, we theoretically modeled the dynamic credit-financed real estate market. It was shown that the interaction between the belief of a fast growing house market and down payment loans (DPL) to mortgage could change the transition process of the house price from a stable process to an unstable one. That is, a temporary small shock to the price of real estate can persist into future, amplify itself for a very long time and make the convergence path impossible. We also found that elastic house supply would worsen the situation and make the price dynamic even more volatile.

The limitations of the model include, but not constrained to, the following ones. First, this model does not consider fundamental shocks.[15] The stochastic framework would make the analysis more complex and interesting for further research. Second, in this paper we did not analyze where the default houses would go. According to the mortgage contract, banks would take these houses. We merely assume that those houses go to a segmented second-hand houses market and have no effect on the economy. However, if foreclosures do matter, when the economy experiences a big negative shock, there may be a large amount of defaults. These houses, as extra supply, in turn makes economy even harder to clear, hence house price would go down even faster.

[15]This also emphasizes the face that even without changes in fundamentals, the DPL mortgage structure could be unstable.

REFERENCES

Allen, Franklin, Ana Babus, and Elena Carletti, 2009. Financial Crises: Theory and Evidence. *Annual Review of Financial Economics* **1(1)**, 97-116.

Allen, Franklin and Gary Gorton, 1993. Churning Bubbles. *Review of Economic Studies* **60(4)**, 813-36.

Brunnermeier, Markus K. and Stefan Nagel, 2004. Hedge Funds and the Technology Bubble. *Journal of Finance* **59(5)**, 2013-2040.

Cai, Hongbin, J. Vernon Henderson, and Qinghua Zhang, 2013. China's Land Market Auctions: Evidence of Corruption? *Rand Journal of Economics 44(3)*, 488-521.

Case, Karl E., Robert J. Shiller, and Anne Thompson, 2012. What Have They Been Thinking? Home Buyer Behavior in Hot and Cold Markets. NBER Working Paper 18400.

Chen, Yanbin, Fangxing Li, and Zhesheng Qiu, 2013. Housing and Saving with Finance Imperfection. *Annals of Economics and Finance* **14(1)**, 207-248.

Dilip, Abreu and Markus K. Brunnermeier, 2003. Bubbles and Crashes. *Econometrica* **71(1)**, 173-204.

Fang, Hanming, Quanlin Gu, Wei Xiong, and Li-An Zhou, 2015. Demystifying the Chinese Housing Boom. NBER Working Papers **30 (1)**, 105-166.

Fedele, Alessandro and Andrea Mantovani, 2014. Credit Availability in the Crisis: which Role for Public Financial Institutions? *Annals of Economics and Finance* **15(1)**, 161-183.

Glaeser, Edward L., 2013. A Nation of Gamblers: Real Estate Speculation and American History. *American Economic Review* **103(3)**, 1-42.

Glaeser, Edward L., Joshua D. Gottlieb, and Joseph Gyourko, 2010. Did Credit Market Policies Cause the Housing Bubble? *Policy Briefs* **5**.

Glaeser, Edward L., Wei Huang, Yueran Ma, and Andrei Shleifer, 2017. A Real Estate Boom with Chinese Characteristics. *Journal of Economic Perspectives* **31(1)**, 93-116.

Goldstein, Itay and Assaf Razin, 2013. Review of Theories of Financial Crises. NBER Working Papers 18670.

Holmstrom, Bengt and Jean Tirole, 1997. Financial Intermediation, Loanable Funds, and the Real Sector. *The Quarterly Journal of Economics* **112(3)**, 663-91.

Kiyotaki, Nobuhiro and John Moore, 1997. Credit Cycles. *Journal of Political Economy* **105(2)**, 211-48.

Lam, Chivakul M., Xiaoguang Liu, and Wojciech Maliszewski, 2015. Understanding Residential Real Estate in China. IMF Working Paper, 15/84.

Li, Zhennan, Yu Song, Man-Keung Tang, Maggie Wei, and Andrew Tilton, 2017. China's Housing Sector and the Fiscal Accelerator. Internal Report of Goldman Sachs.

Mian, Atif and Amir Sufi, 2009. The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis. *Quarterly Journal of Economics* **124(4)**, 1449-96.

Scheinkman, Jose A. and Wei Xiong, 2003. Overconfidence and Speculative Bubbles. *Journal of Political Economy* **111(6)**, 1183-1219.

Shen, Chunli, Xiaojun Zhao, and Heng-fu Zou, 2014. Fiscal Decentralization and Public Services Provision in China. *Annals of Economics and Finance* **15(1)**, 135-160.

Shiller, Robert J., 2000. *Irrational Exuberance.* Princeton University Press.

Wei, Shang-Jin and Xiaobo Zhang, 2011. The competitive Saving Motive: Evidence from Rising Sex Ratios and Savings Rates in China. *Journal of Political Economy* **119(3)**, 511-564.

Wu, Guiying L., Qu Feng, and Pei Li, 2015. Does local governments' budget deficit push up housing prices in China. *China Economic Review* **35**, 183-196.

Wu, Jing, Joseph Gyourko, and Yongheng Deng, 2016. Evaluating the Risk of Chinese Housing Markets: What We Know and What We Need to Know. *China Economic Review* **39**, 91-114.