# Real estate price and heterogeneous investment behavior in China

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## ARTICLE INFO

## ABSTRACT

We study the dynamic link between real estate prices and firms' investment behaviors in China using a new Keynesian dynamic stochastic general equilibrium model. The model features heterogeneous production sectors in which private firms face discriminatory borrowing constraints while state-owned firms are not. Fitted to China's quarterly data from 2005Q3 to 2014Q4, the quantitative general equilibrium model enables us to identify the driving forces behind and the macroeconomic variables interacting with land price. It confirms the existence of the "collateral channel" in the private sector without bearing the potential endogeneity problems in empirical studies. More importantly, we identify a "crowding out" channel between private and state-owned firms caused by discriminatory financial constraints. The "crowding out" channel implies a negative relationship between real estate prices and the investment of state-owned firms, which has been documented in empirical research but short of explanation so far.

## 1. Introduction

The remarkable long-lasting boom and the recent upheaval in housing and land markets in China has generated extensive interest in the relationship between real estate prices and firms' financing capacities. The so called "collateral channel", a practice of pledging collateral such as owned real estate can allow firms to borrow more and invest more under contract incompleteness (Barro, 1976; Stiglitz and Weiss, 1981; Hart and Moore, 1994; Fazzari et al., 2000), and can amplify the business cycle (Kiyotaki and Moore, 1997; Bernanke and Gertler, 1989). Empirical evidences on the United States and Japan (Chaney et al., 2012; Liu et al., 2013; Cvijanovi, 2014; Gan, 2007a,b) suggest the collateral channel leads to a positive correlation between real estate prices and firms' investment. For instance, Chaney et al. (2012) find U.S. firms raises their investment by six cents for every dollar increase in real estate collateral value.

However, the story may be different when it comes to China. A distinctive feature in China's economy is the heterogeneity in borrowing constraints between private firms and state-owned firms. Before starting the reform and opening up in 1979, China was in a highly centralized planned economic system. All the funds were allocated by the Central Planning Commission, a branch of the central government, and private firms were strictly restricted if not forbidden at all. After 1979, restrictions on private firms have been gradually relaxed. There have been massive entries of private firms and privatization of state-

owned firms since then. By the end of 2015, private firms account for 64% of total fixed-asset investment and 60% of GDP, and contribute 80% of employment. However, private firms are still financially discriminated by state-owned banks. Pye and Lardy (2002) and Allen et al. (2005) argue that reforms in the financial markets have been much slower than those in the goods market and the labor market. Lin and Tan (1999) and Bai et al. (2006b) document that state-owned firms inherit some types of policy burdens from the previous planned economic system which can be used as a leverage to bargain with the government and state-owned banks for policy favors, among them the easy access of bank loans. Evidence provided by Brandt and Li (2003) shows that private firms have less access to bank loans on which more collateral is required compared to state-owned but their explanation is that state-owned banks have developed good channels for obtaining credit information about state-owned firms through their long business relationship. Cull and Xu (2005) find that State-owned firms continue to receive a disproportionately large share of the credit extended by the state-owned banks. Cull et al. (2015)'s empirical results suggest that state-owned firms have tight government connections and hence face substantially less severe financial constraints. Hale and Long (2010) also show that state-owned firms continue to enjoy significantly more generous external financing capabilities than other types of Chinese firms, and that private firms face more financial constraints. Poncet et al. (2010) employ a Chinese firm-level data with more than 20,000 firms to test whether firms face different credit constraints depending

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on their capital ownership. They find that private firms are credit constrained while state-owned firms are not. The severe financial impediments faced by private firms have drawn attention not only from academic, but also the Chinese leadership. For example, the current Premier of China, Keqiang Li, has reiterated this problem on many occasions, promising to "making efforts to ease financing difficulties for private firms" multiple times.[1] However, the discrimination persists and will exist in the foreseeable future due to China's special situation and historical burden. Therefore, different from the developed countries such as the United States and Japan, there are significant heterogeneous financing conditions between state-owned and private firms in China.

Given this distinctive situation, it is natural to inquiry whether the "collateral channel" exists and how it functions in China. Using an annual dataset of hundreds of listed firms from 2003 to 2011, Wu et al. (2015) find a statistically insignificant relationship between the real estate price and firms' borrowing and investment, implying no evidence of a collateral effect for the firms included in their data, whether firms are private or not. However, it is argued that since most of China's listed firms are either large corporations or state-owned, their financing activities rely less on collaterals. Chen et al. (2015) employ a much larger sample on an annual basis over the period of 1999–2007, mainly composed of non-listed firms without an equity financing channel and using bank loans as a proxy for firms' financial capacity. They find positive correlation between real estate price and bank loans obtained by private firms, and hence confirm the existence of collateral channel for the private sector. However, their baseline estimation also indicates negative correlation between real estate price and bank loans obtained by state-owned firms, which cannot be explained by the collateral channel and remains unanswered up to this point.

To explain these salient features of the micro data in China, we build a dynamic stochastic general equilibrium (DSGE) model to analyze the interplay between real estate prices and private/state-owned firms' investment. In our model, land is considered as a production input, so real estate price goes side by side with wage and capital price as the marginal cost for production. Our model assumes that private firms in China are suffering from borrowing constraints while state-owned firms are not. As pointed out by aforementioned literature, this is distinctive to China's financial and economic structure. The model also incorporates price stickiness to analyze the effect of monetary policy shocks on the real estate price and firms' investment behavior. In this respect, it is an improvement over Liu et al. (2013)'s real business cycle model with financial friction, which ignores the heterogeneity of production sectors and the effect of monetary factors on real macroeconomic variables.

It is worth noting that existing empirical methods have endogeneity problems in the sense that the dependent variable "investment" may impact the price and ownership decision of the real estate, which are key determinant factors of the independent variable "real estate value". Although instruments and separation strategy can be applied to deal with these endogeneity, it is difficult to find firm-level instruments that predict real estate ownership (Chaney et al., 2012). On the other hand, the dynamic stochastic general equilibrium framework can avoid this problem since it describes the behavior of the economy as a whole by analyzing the interaction of many microeconomic decisions in a dynamic setting. Therefore, this paper reveals new insights in the "collateral channel" literature through a quantitative general equilibrium model.

The results of our model feature a positive correlation between real estate price and the investment level of private firms, as well as a negative correlation between real estate price and the investment level of state-owned firms. By fitting our model to China's quarterly data

from 2005Q3 to 2014Q4 using Bayesian techniques, we confirm the existence of collateral effect for private firms, in a way without endogeneity problems as mentioned above. What's more, we identify a "crowding out" channel through which the real estate price can exert an impact on the investment behavior of the state-owned firms. The concept "crowding out" originally arises from research of fiscal policy effectiveness, describing that a rise in public spending drives down or even eliminates private investment by increasing real interest rate.[2] There are other studies about the "crowding out" effect of FDI on investment (Moosa, 2002), foreign reserves accumulation on investment (Reinhart et al., 2016), government debt on investment (Traum and Yang, 2015), financial sector growth on real economic growth (Cecchetti and Kharroubi, 2015) and so on.

In this paper, we use this term to summarize our finding that an increase in land price alleviates private firms' financial constraint, leads to high demand of capital good for private firms, and thus raises the price of capital, so in consequence "crowd out" the investment of state-owned firms. This "crowding out" channel causes a negative relationship between the land price and state-owned firms' investment. So it provides a theoretical explanation to Chen et al. (2015)'s empirical conclusion. To the best of our knowledge, this is the first work that identify such "crowding out" channel for state-owned firms in China which fits into empirical findings.

Two "crowding out" channels for bank lending behavior related to our research has been found in Chakraborty et al. (2016) for the United States and Poncet et al. (2010) for China. Alongside confirming Chaney et al. (2012)'s results, Chakraborty et al. (2016)'s empirical study document a negative relationship between housing price and the depending firm's investment levels. In their story, financially constrained U.S. banks which are active in strong housing markets increase mortgage lending and hence "crowds out" commercial lending, leading to a reduction of the depending firm's investment. Poncet et al. (2010) find that stronger presence of state-owned firms makes it more difficult for private firms to access capital, suggesting that the external financing capability of private firms is crowded out by the state-owned firms. In stead of emphasizing the "crowding out" channel for bank lending, our paper focuses on the heterogeneous effect of financial constraint on the manufacturer sector in China, underlining that a relief of the private firms' financing constraint due to the appreciation of real estate price leads to an increase of their investment and crowds out the investment of state-owned firms. To this respect, our results adds new insight to the research concerning the crowding out effects.

The rest of the paper is organized as follows. Section 2 introduces the settings and the model. Section 3 presents the calibration and economic implication. Conclusion remarks are provided in Section 4. The appendix includes the details of the log-linearized equations, tables and figures containing the results of the calibration, variance decompositions and simulations.

## 2. The model

### 2.1. Households

A representative household derives utility from consumption $C_{H,t}$, land services $L_{H,t}$ and disutility in labor supply $N_t$, and aims to maximize his expected long-term utility:

$$E_t \sum_{j=0}^{\infty} \beta_H^j U\left(C_{H,t+j}, L_{H,t+j}, N_{t+j}\right) \tag{1}$$

where $\beta_H$ is the discount factor for the household and $U\left(C_{H,t}, L_{H,t}, N_t\right)$ takes the form of:

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[1] For example, see http://english.gov.cn/premier/news/2016/06/22/content_281475377697645.htm.

[2] See Sen and Kaya (2014) for a detailed literature review.