The Crowding-out Effects of Real Estate Shocks – Evidence from China*

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Abstract

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Abstract

We investigate the impacts of real estate price changes on firms' investment and financing using detailed real estate transaction data in China. China witnessed the real estate prices rise for more than a decade and recent "housing purchase restriction" policies enforced in 46 cities generated negative price shocks. Using both IV and DID approaches, we document that the rising real estate price causes land-holding firms to borrow more and invest more while the policy shocks work in the opposite direction. Further decomposition of investment into land and non-land investments shows that the rising real estate prices cause firms to only increase investment in land, especially commercial land, while decrease non-land investment. We next focus on a subsample of non-land owners and show that these firms borrow less and invest less if they are affected more by real estate price rise and the effects are reversed due to policy shocks. The results are consistent with the existence of a crowding-out effect. First, rising real estate price fosters more investment into the real estate sectors, which crowds out non-real estate investment. Second, rising real estate price enlarges the financial constraint gaps between firms with land and firms without land, which cause resource misallocation. To understand the aggregate effect, we investigate investment efficiency changes. We show that the increased investment associated with land price rises in fact reduces investment efficiency while policy shocks improve investment efficiency. The evidence showing that net effect would be negative calls for caution in the policy debate that advocates for investment stimulation through real estate boom.

I. Introduction

The boom and burst of the real estate market closely relate to macroeconomic fluctuations (e.g. Liu, Wang and Zha, 2012). The recent financial crisis in the US was triggered by the collapse of the real estate market and most people believe that the bursting of the real estate bubble is a primary culprit in the prolonged stagnation in Japan. Understanding the real impacts of real estate price fluctuation on firms' and households' behavior are thus an important component in understanding the long run economic growth and business cycles. It also has important policy implications on how government should respond to restrain bubbles or to intervene when the market collapses.

Existing studies have documented an important collateral channel through which real estate price fluctuations can affect firms' investment. Gan (2007) shows that the Japanese land-holding firms reduce their investment after the burst of the real estate bubble. Chaney, Sraer and Thesmar (2012) document that US firms with land holding benefit from real estate price rises through the collateral channel by increasing investment with the rise of real estate value. The collateral channel suggests that the rise of collateral value can help mitigate financial constrains faced by firms.

Recent bubble literature has modeled a potential resource misallocation effect due to the bubble in the real estate market.[1] Miao and Wang (2011) argue that a bubble in one sector attracts more capital to be allocated to that sector, which will crowd out the investment in other sectors. Chen and Wen (2014) model how a self-fulfilling growing housing bubble can create severe resource misallocation. Bleck and Liu (2014) emphasize on the credit misallocation channel in that more credit will be allocated into the bubble sector, which crowd out the credit available for other sectors. A recent study by Chakraborty, Goldstein and MacKinlay (2014) document that US banks that extend more mortgage leading during the housing bubble period decreases commercial lending, suggesting the existence of crowding out effects. In the end, the aggregate

[1] There are plenty of studies on the stock market bubble and its real impacts (e.g. Morck, et. al, 1990, Barro, 1990, Chirinko and Schaller, 1996, Campello and Graham, 2010). Stock market bubble is fundamentally different from real estate market bubble because firms can control the supply of overpriced securities through stock issuances, while no such effects in real estate market.

welfare effect will depend on the interplay between the relaxed financial constrained effects and resources misallocation effects.

In this study, we use China real estate market as a laboratory to investigate the crowd-out effects of real estate price increases. China provides a unique setting for this study for two reasons. First, the real estate sector investment, which accounts for 14% of GDP, has become an important part of the Chinese economy.[2] China has experienced fast GDP growth over the past debate and so is real estate price. There are hot debates recently among government officials, researchers and practitioners regarding the potential endangerment of China following Japan's path to enter into recession when the real estate market collapses. Studies also show that movements in real estate prices alone, in a sample of 18 OECD countries plus China, explain half of the variation in trade deficits (Laibson and Mollerstrom, 2010). Understanding the consequences of China's real estate boom and potential burst is not only important for China, but also relevant for understanding the global economy. Second, the "housing purchase restriction" policies in recent years in China provide a natural experiment in investigating the impacts of real estate price fluctuations. Unlike the aggregate shock such as the bursting of the Japanese real estate bubble thoroughly explored in Gan (2007), the purchase restriction policy is only enforced in 46 cities, allowing us to construct a better control group to gauge the heterogeneous effects.

Our data are hand-collected and cover real estate transactions in 369 cities in China from 1998 till 2012. We match the transaction data with Chinese listed companies to construct firm-year land value variables. We document that the land value rise is related to the increased investment in land-holding companies. This result holds when we use supply elasticity as an IV for real estate prices. Further, we exploit the policies of "housing purchase restrictions" as a natural experiment and show that landholding firms experience lower investment in cities affected by the policies than in those unaffected. This evidence is consistent with the key findings documented in Gan (2007) and Chaney, Sraer, and Thesmar (2012). A contemporaneous study by Deng, Gyourko and Wu (2014) also investigate the impact of real estate price change on firms' investment using China data but find no result. We differ because our data cover 369 cities while they use 35 cities.

[2] The data is from China Statistics Yearbook (CSY) 2013.

After decomposing investment into non-land investment and land investment, we show that the land value appreciation leads to more investment on land, especially commercial land, and less investment on non-land uses. This evidence lends support to the notion that a real estate boom may attract more investment on the real estate sector and crowd out investment on other sectors, as emphasized in the literature (Miao and Wang, 2011; Bleck and Liu, 2014; Chen and Wen, 2014).

We then look into another type of crowding-out effect arising from real estate price increases: due to the credit rationing, firms with a high land value are better positioned to borrow money from banks than those with low land value, and thus their increased investment may crowd out some investment of the latter. However, identifying this crowding out effect is challenging because comparing investments between firms with high-land value and low land value is not enough and can be confounded by the collateral effect. Firms with low land value can borrow less and invest less, *relative* to firms with high land value. But this is exactly what a collateral effect would generate. To differentiate the crowd-out effect from the collateral effect of a real estate boom, we focus on a subsample of non-land owners. As real estate prices increase, landholding firms can leverage more borrowing and investment through the collateral channel, but the collateral value for non-land firms remains constant. In the meantime, the rising real estate prices make non-land owners face even tougher financial constrains if more credit is allocated to their land owner peers.

Using both IV and DID approach, we find that non-land owners tend to borrow less and invest less if they are exposed to higher real estate prices. Similarly, non-land owners are shown to have larger investment and borrowing in cities experiencing the negative policy shocks than in those cities unaffected by the shocks. These findings suggest that while the real estate boom boosts the investment of land-holding firms through the collateral channel, it may crowd out the investment of non-land firms.

Comparing land owners with non-owners reveals that that land holding companies are less likely to be financially constrained and are more likely to be state-owned enterprises (SOEs), and more importantly, landholding companies are more likely to be inefficient than no-land owners. The existing literature also document consistent evidence that financially unconstrained SOEs in China are less efficient than the constrained non-SOEs. (Hsieh and Klenow, 2009; Liu and Siu, 2011; Dollar and Wei, 2014). We investigate the aggregate effects of a real estate boom on investment efficiency. The empirical results show that both firms' investment-Q sensitivity and total factor productivity are lower if these firms are exposed to the real estate price rise and higher if they experience the policy restrictions on housing purchases.

Combining this finding on land and non-land owners with our previous empirical results on crowding-out effects yields interesting implications for the nature and consequences of crowd-out effects in China's context. First, the rising price of the real estate enlarges the financial constraint gaps between land owner and non-owner, especially between SOEs and non-SOEs. Since these financially unconstrained firms are more likely to hold lands and benefit more from the real estate boom, a thriving real estate sector actually worsens the credit constraint of those financially constrained firms, mostly non-SOEs which are supposed to be more efficient. The credit misallocation existing in the Chinese economy is made even worse by the real estate boom. Second, even for the land owners which are more likely inefficient SOEs, the rising price of the real estate fosters more investment into the real estate sector, especially the commercial land which is unlikely to be related to firms' main operation. It may generate a bubble, crowding out the non-real estate investment. This crowding-out effect adds an additional source of inefficiency into the real estate boom.

In sum, we find strong evidence on crowding-out effects of a real estate boom which can produce inefficiency in the real economy. Our study calls for caution in the policy debate that argues that real estate boom can stimulate investment. We document the existence of a crowding out effect associated with real estate market boom and show that the net effect would be negative.

The paper is organized as follows. Section II introduces the background of China's real estate market and the purchase restriction policies; Section III discussed the data and empirical results; and finally Section IV concludes.

II. Background of China's real estate market and the "Housing purchase restrictions"

Last two decades has witnessed the boom of China's real estate market and the government's stimulus package to fight the effects of the Global Finance Crisis may have fueled it in 2010.

Under such condition, the State Council of China issued "Notice of the State Council on Resolutely Curbing the Soaring of Housing Prices in Some Cities", named "No. 10 of the State Council" on April 17, 2010. It says that "…there has emerged a momentum of excessive rise in housing and land prices in some cities recently, and speculative purchase of housing has become active again, to which we need pay great attention". The notice ordered that local governments to take actions to "resolutely curb the soaring of housing prices in some cities, and effectively solve the housing problems of urban residents".

Following the guidance, on April 30, 2010, Beijing issued a rule restricting that only one additional property purchase per household in the city, becoming the first city adopting the "Housing purchase restriction". It was soon followed by more local governments. Up till the end of 2011, 46 cities have adopted the property purchase restriction policy. Appendix A shows a list of these cities and the announcement dates of the purchase restriction policies.

III. Data and Empirical tests

1. Data

Our land holding data comes from State Bureau of Real Estate Administration, which keeps records of information of land transactions between public firms and local government including buyer, land area and transaction price. We hand-collected the data from 1998 to 2012, which covers 32,153 land transactions. The total areas of land involves in these transactions is 1,871,781 hectare while total size of payment is 1,660 billion RMB (equal to 301 billion dollars at current price) accounting for 11.53% of the total land payment local governments received in the same period. We aggregate the transaction data to construct the land holding variable. The value of land held by each firm is measured as follows:

$$LandValue_{i,t} = \sum_{j}\sum_{k} LandArea_{j,k,i,t} * LandPrice_{j,k,t}$$

where $LandArea_{j,k\ ,i,t}$ is the Area of k type of lands owned by firm i, in city j. at year t; $LandPrice_{j,t}$ is average auction price of same k type of lands at year t, in city j. Based on usage of the land, we classify two types of land: industrial land and commercial land. The different usage of the land is assigned by the government when the land is listed out for sale. It is very difficult to change the usage once assigned, if at all possible.[3] We construct these variables at annual level to obtained firm-year observations. A firm's financial information is from the China Stock Market & Accounting Research Database (CSMAR), maintained by GTA Information Technology. Following the literature (Chaney et al., 2012 for example), we exclude firms in finance, insurance, real estate, construction, and mining industries. We use annual data for the main results and quarterly data for the DID analysis. Given the house purchasing restriction policy was published after the September of 2010 and our firm data is ended at 2012, quarterly data allows for more sensitive test on the policy effect. Our annual sample has 20,325 firm-year observations from 1998 to 2012 representing 2,346 unique firms. The variable definitions are summarized in Appendix B.

To quantify the effect of asset price boom on firm, Chaney et al. (2012) novelly proxy for the change of value of real estate asset holding by firms using the price shock in the headquarter cities. The limitation of the approach as Chaney et al. themselves acknowledge is that it relies on the strong assumption that the real estate assets show in the firm's book are mostly located in the cities where headquarters are located. It may be true for the case of the US, but it is not necessarily true for China. Figure 1 shows firms' land holding across different provinces in China. Following Abel and Sander (2014)'s visualization on global bilateral migration flows, we use two circular plots to link the public firm's original location and the destination where they bought land. We use two circular plots to link the public firms' original headquarter location and the destination where they bought lands. The segments around the circle represent the 31 provinces in China. The upper panel of the figure quantifies the size of land transaction by total amount of payment (in term of *yuan*). And color-coded arcs linking two segments represent the size of land transaction firms made with local government. For example, the segment color-coded red represents all the land owners with headquarters in Beijing. And each of the 31 red arcs represents the size of land these "Beijing" firms bought in each of the 31 provinces. The figure shows that firms with headquarters in Beijing also purchased lands in other provinces such as, Hebei, Tijan, Liaoning and Sichun, while firms with headquarters in Guangdong also own lands in Hubei, Jiangsu, and Zhejiang. The figure suggests that firms do hold a significant

[3] Not only does the developer need the local government's permission for the change of usage, they also need the approval of the upper level Bureau of Real Estate Administration with legitimate reason according to the Land Administration Law first published in 1998. Legitimate reason is required to relate to public interests, such as city planning or public safety etc.

proportion of lands in non-headquarter cities. Given that the land prices vary dramatically across cities, it is important to consider the land holding across cities in order to correctly evaluate the value of firms' land holding.[4]

Table 1 reports the summary statistics of the key variables used in the study. About 63% of firms who ever owned a land parcel in the sample period. The average land value divided by net PP&E, denoted by K, is around 0.44. Property is an important component of firms' asset. Over the sample period, the average land price for land owner firms is 1,146 yuan per squared meters which huge varies, with 90th percentile to be 2,045 and 10th percentile to be 404 yuan per squared meters. This reflects both the time series changes of the land prices and also the land price variations across different cities. In the sample, firms' investment divided by net PP&E is around 33% with median to be around 20% only. The Tobin's Q is around 2.6 and natural logarithm of total asset is around 21.

2. The impact of real estate value on investment and financing

In this subsection, we test whether real estate value change causes firms to change their investment and financing. Firstly, we test this hypothesis using the standard investment-Q regression using firm-year observations in the whole sample. Following Chaney et. al (2012), we use the following regression setting:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha + \beta \times \frac{LandValue_{i,t}}{K_{i,t-1}} + \gamma \times Land\,Price_{i,t} + \varepsilon_i + \delta_t + control$$

Results are reported in Table 2, Panel A. All the regressions have firm fixed effects and time fixed effects, and the standard errors are clustered at firm level. Regression (1) reports the results without any controls, while Regression (2) adds several control variables, including Tobin's Q, CashFlow/K, Size measured by Ln(Assets), and Sales measured in the natural logarithm. Regression (3) restricts the sample to be land owners only by deleting firms which never hold land. A positive β implies that investment responses to land value. The beta estimations are 0.223 in the first regression, suggesting that every *yuan* of real estate value increase causes firms

[4] This cross-county land holding may explain, at least in part, the difference between our results and those documented in Deng et. al (2014), who find no relationship between land value and firm's investment because they consider land holdings in 35 cities only while we have 369 cities in our sample.

to increase their investment by 0.223 *yuan*. Looking from another angle, one standard deviation of land value increase represents 37% (1.648*0.223) of investment increase, while the unconditional mean of the corporate investment is only 33% (see Table 1). The effect is undoubtedly economically significant. These coefficients are 0.125 with controls variables and 0.121 in the land owner sample, both are significant at 1% level. Tobin's Q, size and sales all have positive coefficients, while cash flow is insignificant.

One issue related to this reduced form investment regression is the endogeneity problem. If the land price rises also imply increased investment opportunities, the positive coefficient we documented will just represent investment responds to investment opportunities. To address this issue, we need an instrument variable, which does not relate to firms' investment opportunities. Following Chaney et. al. (2012), we use as IV of LandPricej,t, supply elasticity, e_j*r_t, where e_j measures the proportions of land areas in city j, which are unsuitable for real estate development; r_t is the interest rate at time t. We construct e_j measure for all the cities in our sample following similar approach as used by Saiz (2010). An area is defined as unsuitable for real estate development if it has a slope larger than 15%. The elevation data is obtained from the United States Geographic Service (USGS) SRTM 90m Digital Elevation Database v4.1 at the 90-meter resolution, which typically are spaced at the 90 square-meter cell grids across the entire surface of the earth on a geographically projected map.[5] The IV of $\frac{LandValue_{it}}{K_{t-1}}$ keeps the same functional form of the variable with LandPrice replaced by e*r. We thus have two endogenous variables with two IVs. Regression (4) and (5) report the second stage IV regression results estimated using the whole sample and using land owner subsample, respectively. The land value variables remain significant after controlling for endogenous using the IV approach.

Next, we test the financing channel by exploring whether land value has an impact on firms' borrowing behavior. We measure borrowing using both change of total debt ($\frac{D_{i,t} - D_{i,t-1}}{K_{i,t-1}}$) and new bank loan issued ($\frac{NewLoan_{i,t}}{K_{i,t-1}}$). We report both OLS regression and the IV regression

[5] Data source: http://www.cgiar-csi.org/data/srtm-90m-digital-elevation-database-v4-1

results, as shown in Panel B of Table 2. The results are always significant, suggesting that with land value increase, firms do borrow more debt.

The real estate price was rising most of the time during the sample period. However, the purchase restriction provides a unique opportunity to identify a negative demand shock. In order for the policy to have impacts on firm's behavior, this demand shock needs to have an impact on land price. There are couples of reasons why the policy may not have an impact on land prices. First, the policies may be expected by the firms and investors so that land market has ready reflected the expectation. Second, the market may expect the government to abolish the policy before long so the land transactions may not be affected by the housing market demand. In the end, whether the policy has any effects on land prices or not is an empirical question.

Figure 2 Panel A and B report land prices variation over event time for commercial land and industrial land. Event time 0 is the quarter when a city announces the purchase restrictions policy. This policy is enforced in 46 cities, so we have 46 treated samples. The event time varies city by city, covering about one and half year period. All the other cities are defined as control samples. The figure shows the coefficient β obtained from the following regressions,

$$Land\ Price_{j,t} = \alpha + \sum_{et} \beta_{et} \times Treated_j \times EventTime_{j,t,et} + \sum \lambda_j \times t \times City_j + \varepsilon_t + \gamma_j$$

The subscription et represents event quarter, which takes value -9 till 9, with 0 represents the quarter when the policy is announced. $Treated_j$ is a dummy variable taking value of 1 if city j is one of the 46 cities affected by the policy. $EventTime_{j,t,et}$, takes value 1 if calendar quarter t is event quarter et, and 0 otherwise. There are 19 event time dummy variables in total. The regression controls for city fixed effect, time fixed effects and city-time trend ($\sum \lambda_j \times t \times City_j$).

This regression uses city-quarter observations from 2008 till 2013. The bars in the figure show the estimated value of β and the dotted lines quantify the 95th confidence interval.

In Panel A, it is obvious from the figure that β is close to zero pre-event, suggesting that after controlling for time trend, there is no difference in land prices between treated cities and control cities. However, the difference becomes significantly negative in post-event time, suggesting that the policy has negative impacts on commercial land price in these 46 treated cities.

Given the purchase restriction policy only applied to residential house, this demand shock only applied to commercial land used for real estate development but not to the industrial land which is used as factor for production. Panel B in Figure 2 shows exactly this pattern: unlike the price of commercial land, average price of industrial land in the treated cities does not change after the purchase restriction policy.

Table 3 implements the Diff-In-Diff tests. The regressions are as follows:

$$Y_{i,t} = \alpha + \beta \times Treated_i \times PostEvent_{i,t} + \sum_i \lambda_i \times t \times Firm_i + \varepsilon_i + \delta_t$$

where $Treated_i$ is a dummy variable taking value of 1 if firm i hold any land in at least one of the 46 treated cities and 0 otherwise. $PostEvent_{it}$, takes value of 1 if city i is a treated city and time t is post policy announcement, and 0 otherwise. The regression controls for firm fixed effect, time fixed effect and firm-time trend. β captures diff-in-diff effect.

We use three different control groups. The first control group is all other firms which own land but not in the treated cities or own no land at all. One concern for this large sample as control group is that the purchase restriction policy may change the investment opportunities in treated cities, thus affect firms operated in treated cities. If that is the case, the effects we observed may not be due to the policy, but rather due to the change of investment opportunities. To address this issue, we use a second control group: all non-land owner firms with headquarters in one of the 46 treated cities. This control group has similar investment opportunities as the treated firms but they do not experience the negative shocks on land value as the treated firms do. Another concern with this method is that firms' decision of owning a land is not random, thus the land owners may be fundamentally different from non-owners. To take this concern into consideration, we construct a third control sample: firms owning land but not in the treated cities. The results for using these three control groups are reported in Panel A, B and C respectively.

Regression (1) uses $\frac{LandValue_{i,t}}{K_{i,t-1}}$ as dependent variable; this serves as a rigorous test of what has been visually presented in Figure 2. In order not to be affected by firms' land transaction decisions corresponding to the policies, we use LandArea at 2009 to calculate LandValue post event time. The purpose for doing so is to preclude the effects that firms change their land holding in response to the policies. The Diff-in-Diff effect is -0.096, comparing to the control groups, firms holding land in the treated cities has their land value lost by about 38%[6] The coefficients have similar magnitude when the control group has the headquarters in the 46 treated cities. Using land owner alone as control group keeps the coefficient to -0.079. The evidence suggests that firms with land holding before the policy announcements do have their land value significantly negatively affected.

We next examine whether the negative land value effect affects firms' investment behavior. Regression (2) reports results with $\frac{I_{i,t}}{K_{i,t-1}}$ as dependent variable. Comparing with control groups, treated firms reduce investment by about 0.08, representing about a quarter of the average investment rate. The reduction in investment is not only statistically significant but also economically significant. The effect is even stronger when using land owners as control group.

Next, we explore how firms' borrowing behavior varies over event time. Regression (3) and (4) report results using either the change of debt or new bank loans as dependent variables respectively. Evidence suggests that firms did cut the debt borrowing. The total borrowing is cut by about 13%. At least part of the reduced debt is bank loan. New bank loan is reduced by about 7%. The evidence on the reduction of debt borrowing is consistent with what has been found in the literature such as Gan (2007) and Chaney et. al (2012) that land value has an impact on firm's investment through the collateral channel.

3. Crowd out of non-real estate sectors

The previous section establishes that firms increases investments with real estate market boom and reduces investments due to the purchase restrictions policies. In this section, we look deeper into the investment types to understand whether real estate investment crowd out non-real estate investment.

We decompose investment as land investment and non-land investment and further decompose land investment into commercial land investment and industrial land investment. The investment

[6] The mean of $\frac{LandValue_{i,t}}{K_{i,t-1}}$ at year 2009 in our sample is 0.250, then the percentage lost is appropriately 0.384=0.096*0.250.

variables we have been using so far incorporate all types of investment as it is obtained from cash flow statement. Using the land transaction data, we can construct land-purchase variable. The total investment minus land investment yields non-land investment. In Table 4, we replicate the investment regression by decomposing the total investment into these three components. We report the results using land-owners subsamples while the results are largely similar for the whole sample, which are omitted to save space.

Using both OLS and IV regressions, the results show that firms increases commercial land investment when their real estate value increase, while they actually decrease the non-land investment. The effect on industrial land investment is minimal and becomes insignificant in the IV regression. Industrial land is arguably more likely to be a factor of production and enters into firms' production process. On the other hand, commercial land is less likely to be directly related to firms' main operation for non-real estate firms. The evidence suggests that with the land value rises, firms invest more into commercial land, more likely to be expecting the value appreciation rather than invest to extend production.

The last three column reports second stage IV results with dependent variable to be percentage of different type of investment as of total investment. Similar results hold in that land value rise significantly increases the proportion of commercial land investment and reduces the proportion of non-land investment with no significant impact on the proportion of industrial land investment. This evidence is consistent with Chen and Wen (2014)'s model prediction that firms make more land investment when the value of their real estate holding increase and at the same time, they cut back non-land investment.

To examine the effect of restricting policy, we replicate the DID tests in Table 3 by decomposing investment into three components. As in previous tests, we use three control groups: all other firms, all firms with their headquarters located in 46 cities and all non-owner firms. We report both the investment level as scaled by total fixed asset and proportion of different types of investment. In all three identification, we observe that firms decrease the commercial land investment with the policy shock. The non-land investment shows a positive sign but insignificant. The insignificant results may partially reflect the facts of firms' total investment changes. The proportion regressions controls for the effects of investment size. It shows that with the policy shocks, firms shifted their investment from commercial land to non-land investment.

With the policy shock, the affected firms reduced the proportion of commercial land investment by 13% while increased the non-land investment proportion by similar magnitude. The proportion of industrial land investment remains unchanged. Combining the negative policy shock results with the IV results reported in Table 4 suggests that the real estate price variation has significant impacts on firms' investment structure. The real estate market boom entices firms to shift investment from their main operation into commercial land investment while the negative shocks reverse the effect.

4. Crowd-out effects on non-land owners

The direct identification of crowding out effects is difficult because the comparison between firms with high land value and low land value is only on relative term. Firms with low land value can borrow less and invest less, *relative* to firms with high land value. But this is exactly the same prediction collateral effects would generate. In order to differentiate these two channels, we focus on non-land owners only. Collateral channels should have no prediction on the non-land owner firms as their collateral value doesn't change. On the other hand, the crowding out effects predict that the non-owners which located in cities with real estate market boom will face even more severe constrains and they can borrow even less and invest even less if more credits are allocated to their land owner peers. The purchase restriction policy shocks should work in the exactly opposite direction.

In Table 6 and 7, we focus on this subsample of no-land owners. Panel A uses the average commercial land price in headquarter cities as the main explanatory variable while Panel B uses corresponding industrial land price. The results suggest that commercial land price has significant impact on no-land owners' investment and borrowing. With commercial land price rise, non-owners reduced borrowing by 7% and cut back investment by 15%, as suggested by the IV regression results. However, the industrial land price has no such impact. We interpret this result as a direct evidence of crowding out effects. The rising price of real estate diverts the resource and available credits to land-owners, causing these non-owners to become even more constrained. As a result, they have to reduce investment.

Table 7 investigates the impact of the policy shocks on the non-land owners. The policy shocks represent a negative shock that reverse the crowding out effects. The crowding out effect predicts that the credits previously diverted to the land-owners are now reverted back to non-land owners after the shocks. It predicts that after the policy shocks, non-land owners located in the 46 cities should borrow more and invest more comparing to non-land owners located in other cities. Collateral channels have no such predictions. Non-land owners are grouped into two groups, one with headquarters in citied affected by the policies and the other group with headquarters in non-treated cities. First regression reports results related to corporate investment while the second and third regression is related to borrowing. Results show that the non-land owners located in treated cities are able to borrow more and invest more after the policy shocks.

The increasing borrowing and investment by these non-owners located in treated cities are consistent with the prediction of the crowd-out effects. Due to the policy shock, real estate prices drop causes the financial constrain gaps between the land owner groups and non-owner groups to be smaller, which benefit the non-owner group as they can now borrow more money and invest more. Or in another word, the evidence is consistent with a reverse crowding out effect due to the negative shocks. The result is less likely to be caused by investment opportunities change. If the policy shock affects investment opportunities, it should go in the opposite direction as the policy should reduce the investment opportunities in treated cities. Our estimations thus serve as a lower bound to quantify the reversed crowd-out effects.

5. Investment efficiency

The previous section establishes several consequence of real estate value change, its impact on firms with land, firms without land and its impacts on different types of investment. A more important question is whether the increased or decreased investment with real estate market fluctuation is value created or destroyed. Answering this question has important policy implications and economy meanings. In this subsection, we implement several investment efficiency tests to gauge whether the increased (and later decreased) investment improves or hurt firms' aggregate investment efficiency.

Before implementing direct tests, we first report the firm characteristic difference across land owners and non-owner since we have shown that one effect is that land owners crowding out non-owners. The results are reported in Table 8. Land owners are more likely to be state-owned firms (SOEs), are larger, hire more employees and have lower TFP. Previously literature has shown that SOEs firms, large firms are less financially constrained and have lower TFP (e.g.Hsieh and Klenow, 2009, Liu and Siu, 2011, Dollar and Wei, 2014). The evidence reported in this table suggests that the land owners are precisely groups of firms that are non-financially constrained, but less efficient.

The characteristic comparison suggests a possibility of reduced aggregate efficiency due to real estate market boom. Land owners are less constrained and less efficient. They will be able to borrow even more money with the increased collateral value and make more investment. The aggregate investment efficiency may be reduced.

We directly test the investment efficiency change using two investment efficiency measures. The first measure is investment-Q sensitivity. Firms that invest more efficiently should have higher investment-Q sensitivity. Table 9 reports the results of these tests as follows:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha + \beta \times Tobin'sQ + \gamma \times Tobin'sQ \times \frac{LandValue_{i,t}}{K_{i,t-1}} + \phi \times \frac{LandValue_{i,t}}{K_{i,t-1}} + \lambda \times Land\,\mathrm{Pr}\,ice + \varepsilon_i + \delta_t + control$$

γ<0 suggests that with land value rises, the firms' investment efficiency reduces. The first regression estimate β to be 0.023 and γ to be -0.018, both are statistically significant at 5% significance level. The result implies that, on aggregate, real estate market boom reduces investment efficiency. With γ to be almost 80% of β, the effect of land value change on investment efficiency is economically very important. Regression (2) uses supply elasticity as the IV for land price and reports the IV results. The coefficient γ becomes even larger also associated with larger variance. The larger variance is expected, suggesting that the IV variable does correct the endogeneity issue.

In the Regression (3), we tackle the same issue using DID test as follows:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha + \beta \times Tobin'sQ + \gamma \times Tobin'sQ \times Treated_i \times PostEvent_{i,t} + \varepsilon_i + \delta_t + control$$

γ>0 will imply that after the purchase restriction policy, the affected firms improve their investment efficiency. In this regression, Tobin's Q has a coefficient of 0.018 while the interaction term has coefficient of 0.015. The purchase restriction policy causes affected firms almost double their investment-Q sensitivity. The negative effects of real estate market boom and the positive effects of the restriction policy provide strong evidence that the investment efficiency is affected by the land value. Rising land value causes affected firms to make more inefficient investment; while the restriction policies cause these firms to cut off these inefficient investments.

Our next measure of investment efficiency is total factor productivity (TFP). We measure a firm's TFP using two approaches: Olley-Pakes approach and Levinsohn-Petrin approach. Olley and Pakes(1996) approach uses investment as a proxy for the unobserved shocks on productivity. The advantage for the approach is that it allows for both endogeneity of some of the inputs, selection of exit and the unobserved permanent difference across firms. And the estimator requires that the firm's exit is conditioned on the unobserved productivity. As to our public firm sample, we define a firm to be "exited" if a firm delisted from the stock market. Given delisting in China usually happen when one listed firm cannot fulfill certain financial requirement due to bad management, the exit due to delisting can be considered as highly correlated with firm's performance, and thus fulfill the requirement to adopt the Olley-Pakes approach. Levinsohn and Petrin(2003) approach uses intermediate inputs as proxies, arguing that intermediates may respond more smoothly to productivity shocks. The results are reported in Table 10. Panel A reports results with TFP measured using Olley-Pakes method while Panel B Levinsohn-Petrin method.

Regression (1) uses the whole sample, while regression (2) restricts to land owner subsample only. Regression (3) and (4) report second stage IV results with supply elasticity as IV. Regression (5) implements DID test.

Regression (1) to (4) in both panels show a significant negative coefficients, suggesting that rising land value caused firms to have a lower TFP. Regression (5) have a positive coefficient on DID, suggesting that due to the negative real estate shocks, firms affected by these shocks in fact improves their TFP. The results in both directions corresponding to shocks in two different directions are consistent with the argument that relaxed financial constrained in one group of the firms do not necessarily translate into more efficient investments.

IV Conclusion

Financial crisis is commonly coupled with real estate market collapse and real estate market investment has become an important component of the whole economy. As a result, understanding the real consequence of real estate market fluctuation provides micro-foundations for understanding many macro-economic models.

In this study, we investigate the consequence of real estate market variations on firms' investment and financial behavior, using China's real estate market as a laboratory. We document that firms with land holdings and high land values can borrow more and invest more with real estate market boom, and they cut their borrowing and investment due to the "house purchase restrictions" policies.

However, when decomposing investment into commercial land investment, industrial land investment and non-land investment, we show that with real estate market boom, firms make more real estate investment, especially into the commercial land, and they cut back non-land investment at the same time. Further, the purchase restriction policy reduces affected firms' commercial land investments and fosters no-land investment. Next, using a subsample of non-land owners, we show that the non-land owners who are affected more by real estate prices borrow less and invest less due to real estate price rise and the effects are reversed due to policy shocks. The evidence is consistent with the argument that real estate market boom crowds out non-land investment and it also crowds out non-land owners due to credit rationing.

Finally, to understand the aggregate effect, we implement investment efficiency tests. We show that the increased investment associated with real estate market boom has lower investment efficiency as measured by investment-Q sensitivity and TFP, while the decreased investment associated with the negative policy shocks improves the investment efficiency.

The firm characteristic comparisons show that non owners are more likely to be financially constrained non-SOE firms which are more efficient, while land owners are more likely to be non-financially constrained SOE firms. The reduction in investment efficiency corresponding to real estate market boom is thus a result of resource misallocations.

The evidence is in general consistent with the existence of a crowding out effect. The rising real estate market fosters more investment into real estate sectors, crowding out investment in other sectors. Also, the rising real estate price directs more credits into land owners, which crowds out credits available for non-owners. Our study calls for caution in promoting a policy that intends for real estate boom to stimulate investment as it may also generate negative crowing out effects. The overall net effects of such a policy would be negative.

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Table 1 Descriptive statistics

This table presents summary statistics of the listed firms sample excluding firms operating in the finance, insurance, real estate, construction, and mining industries. The firm's annual financial data is obtained from the CSMAR database. And the land holding data is obtained from the land transaction dataset author constructed. The upper panel of the table reports the summary statistics of the firm variables, land value and land price variable, policy shock variable for the whole sample. And the lower panel reports the corresponding variables for only the land owner firms, defined as firms ever recorded purchasing land in the sample period.

	Mean	Standard Deviation	Median	P10	P90
			All Sample		
Corporate Investment	0.332	0.391	0.203	0.029	0.791
Land Value	0.439	1.648	0	0	0.844
Log of Average Land Price (City Where Firms Purchased Land)	1.390	2.770	0	0	6.900
Average Land Price	224.762	557.999	0	0	975.130
Tobin's Q	2.560	1.802	2.019	1.129	4.555
Cash Flow	1.663	6.756	0.164	-0.431	3.533
Sale	4.821	8.093	2.478	0.699	9.970
Size	21.251	1.220	21.115	19.944	22.741
New Bank Loan	0.048	0.241	0	0	0.059
Change in Total Debt	0.185	1.278	0.013	-0.567	0.904
			Land Owner Sample		
Land Owner (=1)	63.16%				
Corporate Investment	0.339	0.390	0.214	0.038	0.778
Land Value	0.668	1.996	0	0	1.786
Log of Average Land Price (City Where Firms Purchased Land)	2.106	3.182	0	0	7.172
Average Land Price (>0)	1145.608	729.475	987.106	403.840	2044.91
Tobin's Q	2.416	1.659	1.909	1.097	4.285
Cash Flow	1.237	5.113	0.167	-0.414	2.958
Sale	4.650	7.453	2.526	0.745	9.602
Size	21.445	1.257	21.316	20.077	22.993
New Bank Loan	0.066	0.292	0	0	0.122
Change in Total Debt	0.226	1.270	0.037	-0.522	0.922

Table 2, Land price and corporate investment and borrowing behaviors

Panel A reports the empirical link between the value of land holding by firms and the firm's investment. The dependent variable is capital expenditure normalized by lagged fixed asset. Similarly, Land Value and Cash Flows are also normalized by lagged fixed assets. Column (1), (2) and (4) use the whole sample, and Column (3) & (5) use the sample including only the land owner firms. All specifications use year and firm fixed effects and standard errors are clustered at firm level. Column (4) and (5) use 2-stages least squared estimation with the interaction between supply elasticity and national interest rate as instrument. Robust Standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported. Panel B investigates the effect of land value and the firms' borrowing. Column (1) through (4) use the size of new bank loan (normalized by lagged fixed asset) and column (5) through (8) uses the change of total debt (normalized by lagged fixed asset) as dependent variables. Column (1), (3), (5) & (7) uses the whole sample, while Column (2), (4), (6) & (8) uses the sub-sample with only the land owner firms. All specifications use year and firm fixed effects and standard errors are clustered at firm level. Column (3), (4), (7) and (8) report the second stage IV estimation results. Robust Standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

Panel A, Corporate Investment	Corporal Investment				
	OLS			IV	
	(1)	(2)	(3)	(4)	(5)
Land Value	0.223***	0.125***	0.121***	0.434***	0.430***
	(0.041)	(0.037)	(0.037)	(0.122)	(0.125)
Average Land Price (City Where Firms Purchased Land)	-0.001	-0.000	0.000	-0.010***	-0.008**
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)
Tobin's Q		0.022***	0.023***	0.022***	0.023***
		(0.003)	(0.004)	(0.003)	(0.004)
Cash Flows		-0.000	-0.000	-0.001	-0.001
		(0.001)	(0.002)	(0.001)	(0.002)
Sale		0.018***	0.019***	0.017***	0.017***
		(0.002)	(0.002)	(0.002)	(0.002)
Size		0.069***	0.069***	0.077***	0.080***
		(0.010)	(0.012)	(0.010)	(0.013)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Clustered at Firm Level	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap Wald F-statistic				86.557	85.438
Number of Observations	18707	18147	12317	17908	12221
Adj. R-squared	0.304	0.357	0.330	0.0971	0.1001

Panel B, Bank lending	New Bank Loan				Change in Total Debt			
	OLS		IV		OLS		IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land Value	0.122***	0.111***	0.362***	0.367***	0.738***	0.743***	2.257***	2.261***
	(0.036)	(0.036)	(0.132)	(0.136)	(0.132)	(0.130)	(0.358)	(0.365)
Average Land Price (City Where Firms Purchased Land)	0.011***	0.009***	0.005	0.003	-0.044***	-0.029***	-0.089***	-0.070***
	(0.002)	(0.002)	(0.004)	(0.004)	(0.006)	(0.007)	(0.012)	(0.011)
Tobin's Q	-0.003**	-0.005**	-0.002*	-0.004**	-0.010	-0.013	-0.009	-0.012
	(0.001)	(0.002)	(0.001)	(0.002)	(0.012)	(0.012)	(0.011)	(0.011)
Cash Flows	-0.001**	-0.002**	-0.001**	-0.003***	-0.006	0.004	-0.007*	0.003
	(0.001)	(0.001)	(0.000)	(0.001)	(0.004)	(0.006)	(0.004)	(0.006)
Sale	0.002**	0.003***	0.001	0.002*	0.022***	0.024***	0.019***	0.019***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.006)	(0.004)	(0.006)
Size	0.013**	0.017**	0.017***	0.024***	0.438***	0.450***	0.465***	0.488***
	(0.005)	(0.008)	(0.006)	(0.008)	(0.035)	(0.039)	(0.035)	(0.040)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered at Firm Level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap Wald F-statistic			84.416	84.505			86.430	85.760
Number of Observations	18805	12690	18574	12595	19125	12748	18903	12649
Adj. R-squared	0.246	0.257	0.079	0.087	0.102	0.104	0.061	0.062

Table 3 The shock of purchase restriction policy on firms, DID tests

This table investigates the effect of the purchase restriction policy on affected firms. The sample period covers 2008-2012. The treated groups are firms which have ever owned a land in one of the 46 cities affected by the policy. There are three control groups. The upper panel (Column (1) through (4)) includes all other firms as control firms, while the middle panel (Column (5) to (8)) uses only the firms with headquarters in the 46 cities as control group. The lower panel (Column (9) to (12)) uses only all other land-owner firms as control group. The treated group firm is a dummy variable equals to 1 for treated firms and 0 for control firms. Firm-specific policy shock is the interaction of treatment group firm dummy and a post event dummy variable which equals to 1 for the treated firms in the quarters after the policy was enforced in their headquarter cities and 0 otherwise. In Column (1), (5), (9), the dependent variable is the land value of the land parcels firms owned at the end of 2009 (year prior to first city announced the limited purchasing policy). And the dependent variable in Column (2), (6) and (10) is the investment, Column (3), (7) and (11) is the new bank loan and Column (4), (8) and (12) is the change of debt respectively, all dependent variables are normalized by lagged fixed asset. Control variables include Tobin's Q, Cash Flows, Total Sale Revenue and the Size of the firms. All specifications use year and firm fixed effects and includes other control variables and standard errors are clustered at firm level which are reported in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

	Land $Value_{09}$	Corporal Investment	New Bank Loan	Change in Total Debt
	All Sample			
	(1)	(2)	(3)	(4)
Firm-specific Policy Shock	-0.096***	-0.080***	-0.071***	-0.134**
	(0.034)	(0.024)	(0.023)	(0.066)
Treatment Group Firm	0.164***	-0.031	-0.02	-0.086
	(0.027)	(0.023)	(0.018)	(0.067)
Number of Observations	8704	8525	8336	8365
Adj. R-squared	0.735	0.472	0.394	0.211
	Limited Purchasing City (46) Sample			
	(5)	(6)	(7)	(8)
Firm-specific Policy Shock	-0.087***	-0.084***	-0.072***	-0.157**
	(0.034)	(0.025)	(0.024)	(0.068)
Treatment Group Firm	0.190***	-0.021	-0.002	-0.073
	(0.029)	(0.026)	(0.019)	(0.081)
Number of Observations	6491	6362	6204	6208
Adj. R-squared	0.733	0.465	0.405	0.188
	Land Owner Firm Sample			
	(9)	(10)	(11)	(12)
Firm-specific Policy Shock	-0.079**	-0.090***	-0.066***	-0.125*
	(0.034)	(0.025)	(0.024)	(0.068)
Treatment Group Firm	0.119***	-0.075***	-0.022	-0.204***
	(0.033)	(0.028)	(0.022)	(0.076)
Number of Observations	5660	5623	5511	5369
Adj. R-squared	0.733	0.445	0.402	0.191
Control Variables†	Yes	Yes	Yes	Yes
Firm- and Year- Fixed Effects	Yes	Yes	Yes	Yes
Firm-Specific Time Trends	Yes	Yes	Yes	Yes

Table 4. Land price and different types of investments

This table investigates the effect of land value increase on firm's investment behavior using the land-owner sample. We distinguish three types of investments: non-land investment defined as any corporate investment not for purchasing new land property; commercial land investment defined as corporate investment for purchasing new land for commercial usage and finally the industrial land investment defined as corporate investment for purchasing new land for industrial usage. The dependent variable in Column (1) to (2) is firm's non-land investment, and Column (3) and (4) for commercial land investment and Column (5) and (6) for industrial land investment. All dependent variables are normalized by lagged fixed asset. The dependent variable for Column (7) to (9) are the proportions of these three types of investment as of total investment. All specifications use year and firm fixed effects and standard errors are clustered at firm level. Column (2), (4) (6), and (7) to (9) report 2-stages of IV regression with the interaction of supply elasticity and national interest rate as the instrument. Robust Standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

	Land Owner Firms								
	Non-Land Investment		Commercial Land Investment		Industrial Land Investment		%Non-Land Investment	%Commercial Land Investment	% Industrial Land Investment
	OLS	IV	OLS	IV	OLS	IV	IV	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Land Value	-0.065**	-0.138**	0.173***	0.246***	0.056***	0.005	-0.345***	0.313***	-0.002
	(0.027)	(0.065)	(0.021)	(0.060)	(0.006)	(0.010)	(0.072)	(0.092)	(0.029)
Average Land Price (City Where Firms Purchased Land)	-0.002	-0.000	0.007***	0.005***	0.001***	0.002***	-0.009***	0.036***	0.007***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.000)	(0.000)	(0.003)	(0.003)	(0.001)
Tobin's Q	0.018***	0.019***	0.001	0.000	0.000	0.000	-0.001	-0.003	0.001
	(0.004)	(0.004)	(0.001)	(0.001)	(0.000)	(0.000)	(0.003)	(0.003)	(0.001)
Cash Flows	-0.001	-0.001	0.001	0.001	-0.000	-0.000	-0.001	0.000	-0.000
	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Sale	0.015***	0.015***	0.000	-0.000	0.000	0.000*	-0.001	-0.002	0.000
	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Size	0.037***	0.035***	0.013***	0.015***	0.005***	0.003***	-0.035***	-0.013	0.005*
	(0.011)	(0.010)	(0.003)	(0.004)	(0.001)	(0.001)	(0.008)	(0.009)	(0.003)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustered at Firm Level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Paap Wald F-stat		80.014		80.199		80.199	83.076	82.260	79.774
Number of Observations	11578	11455	11122	10927	11122	10927	11589	10763	10510
Adj. R-squared	0.231	0.067	0.347	0.138	0.289	0.087	0.0418	0.162	0.085

Table 5. The shock of purchase restriction policy on different types of investments, DID Estimation

This table investigates the effect of the restricted purchasing policy on firm's investment behaviors. The sample period is 2008-2012. The dependent variables in Column (1) to (3) are firm's not-land investment, commercial land investment and industrial land investment. All variables are normalized by lagged fixed asset. The dependent variable in Column (4) to (6) are proportions of these three types of investment as of total investment. The treated groups are firms which have ever owned a land in one of the 46 cities affected by the policy. There are three control groups. The upper panel includes all other firms as control firms, while the middle panel uses only the firms with headquarters in the 46 cities as control group. The lower panel uses only all other land-owner firms as control group. Firm-specific policy shock is the interaction of treatment group firm dummy and a post event dummy variable which equals to 1 for the treated firms in the quarters after the policy was enforced in their headquarter cities and 0 otherwise. The treated group firm is a dummy variable equals to 1 for treated firms and 0 for control firms. Control variables include Tobin's Q, Cash Flows, Total Sale Revenue and the Size of the firms. All specifications use year and firm fixed effects and cluster observation at firm level. Robust Standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

	Non-Land Investment	Commercial Land Investment	Industrial Land Investment	% Non-Land Investment	% Commercial Land Investment	% Industrial Land Investment
			All			
	(1)	(4)	(7)	(10)	(13)	(16)
Firm-specific Policy Shock	0.013	-0.025*	-0.001	0.129***	-0.133***	-0.006
	(0.024)	(0.014)	(0.003)	(0.035)	(0.034)	(0.009)
Number of Observations	7897	7310	7310	8025	7434	7220
R-squared	0.500	0.259	0.207	0.504	0.548	0.588
			Limited Purchasing City (46) Sample			
	(2)	(5)	(8)	(11)	(14)	(17)
Firm-specific Policy Shock	0.013	-0.027*	-0.001	0.130***	-0.136***	-0.004
	(0.024)	(0.015)	(0.003)	(0.035)	(0.034)	(0.010)
Number of Observations	5990	5620	5620	6087	5764	5550
R-squared	0.487	0.305	0.174	0.504	0.553	0.569
			Land Owner Firm Sample			
	(3)	(6)	(9)	(12)	(15)	(18)
Firm-specific Policy Shock	0.009	-0.028*	-0.001	0.131***	-0.140***	-0.006
	(0.025)	(0.015)	(0.003)	(0.035)	(0.035)	(0.010)
Number of Observations	5237	4962	4962	5365	5155	4941
R-squared	0.440	0.286	0.209	0.505	0.529	0.505
Control Variables†	Yes	Yes	Yes	Yes	Yes	Yes
Firm- and Year- Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Specific Time Trends	Yes	Yes	Yes	Yes	Yes	Yes

Table 6. Land price and corporate investment and borrowing behaviors for non-owner firms.

This table investigates the effect of the land price increase on the non-owner firms. All specifications use only the non-owner firm sample. The upper panel (Column (1) to (4)) uses the independent variable of average price for commercial land in cities where the firms' headquarter located, while the lower panel (Column (5) to (8)) uses the average price for industrial land. Column (1), (2) and (5), (6) use corporate investment and Column (3), (4) and (7), (8) use change of debt as dependent variables, all variables are normalized by lagged fixed asset. All specifications use year and firm fixed effects and includes other control variables and cluster observation at firm level. Column (2), (4), (6) and (8) use 2-stages IV estimation with the interaction between the city-level unsuitable land measure and national interest rate as instrument. Robust standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

	Non-owner Firms			
	Corporate Investment		Change of Debt	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Average Land Price (Commercial Land)	-0.034***	-0.150***	-0.013***	-0.070***
	(0.005)	(0.056)	(0.002)	(0.014)
Tobin's Q	0.016***	0.015***	0.004**	0.004**
	(0.004)	(0.004)	(0.002)	(0.002)
Cash Flows	-0.002	-0.002	-0.001***	-0.001***
	(0.001)	(0.001)	(0.000)	(0.000)
Sale	0.017***	0.016***	0.001	0.000
	(0.002)	(0.002)	(0.000)	(0.000)
Size	0.073***	0.073***	0.093***	0.094***
	(0.015)	(0.014)	(0.008)	(0.007)
Number of Observations	10400	10053	10528	10210
Adj. R-squared	0.442	0.092	0.115	0.092
	(5)	(6)	(7)	(8)
Average Land Price (Industrial Land)	0.005	3.381	0.006	2.509
	(0.013)	(3.161)	(0.005)	(2.732)
Tobin's Q	0.018***	0.025	0.004**	0.004
	(0.004)	(0.016)	(0.002)	(0.010)
Cash Flows	-0.002	-0.008	-0.001**	-0.003
	(0.001)	(0.006)	(0.000)	(0.003)
Sale	0.019***	0.021***	0.001	0.002
	(0.003)	(0.005)	(0.001)	(0.003)
Size	0.065***	0.058	0.091***	0.075*
	(0.016)	(0.057)	(0.008)	(0.043)
Number of Observations	9548	9232	9663	9376
Adj. R-squared	0.447	0.074	0.115	0.074
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Clustered at Firm Level	Yes	Yes	Yes	Yes

Table 7. The policy shock on non-owner firms

This table investigates the effect of the limited purchasing policy on the non-landowner firms. All specifications use only the non-land-owner firm sample. The independent variable is the investment for Column (1), change of short-term debt for Column (2), and change of debt for Column (3). Treated Cities is a dummy variable which equals to 1 for firms located in the 46 treated cities and 0 other wise. Post event is a dummy variable taking value of 1 for firm-quarters post the policy announcement in the firm's headquarter city and 0 otherwise. All variables are normalized by lagged fixed asset. All specifications use year, firm fixed effects and the firm specific time trend and cluster observation at firm level. Robust standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

	DID on Non-owner Firms		
	Investment	Change of Short-term Debt	Change of Debt
	(1)	(2)	(3)
Treated Cities*Post event	0.077***	0.012***	0.009**
	(0.011)	(0.003)	(0.004)
Tobin's Q	0.012***	-0.001	0
	(0.002)	(0.001)	(0.001)
Cash Flows	-0.004***	-0.001***	-0.001***
	(0.001)	0.000	0.000
Sale	0.020***	0	0
	(0.002)	0.000	0.000
Size	0.078***	0.019***	0.030***
	(0.013)	(0.004)	(0.005)
Firm- and Year- Fixed Effects	Yes	Yes	Yes
Firm Specific Time Trend	Yes	Yes	Yes
Clustered at Firm Level	Yes	Yes	Yes
Number of Observations	14213	13566	13477
Adj. R-squared	0.445	0.087	0.082

Table 8. Simple comparison between land owners and non-owners at Different Years

This table presents simple comparison for the land owners and non-land owners. We compare both the percentage of state-owned firms, the mean of total asset, the mean of number of employee, the mean of debt to asset ratio and the TFP by LP method between the two groups. The upper panel presents the comparison results using all samples. And the second, third and lower panel presents the comparison results at year 2000, 2005 and 2010 respectively. Difference between the two groups and the corresponding standard errors are also reported. * p<0.10, ** p<0.05, *** p<0.01.

	State-owned	Total Asset (log)	Number of Employee (log)	Debt/Asset Ratio	TFP (LP)
			All Sample		
Land Owner	0.327	21.445	7.655	0.215	0.046
	-0.004	-0.011	-0.011	-0.001	0
Non-Land Owner	0.196	20.884	6.951	0.193	0.053
	-0.005	-0.012	-0.016	-0.002	0
Difference	0.131***	0.561***	0.704***	0.022***	-0.007***
	-0.006	-0.017	-0.02	-0.002	0
			At Year 2000		
Land Owner	0.493	20.989	7.528	0.198	0.051
	-0.018	-0.034	-0.043	-0.006	-0.001
Non-Land Owner	0.307	20.823	7.171	0.231	0.052
	-0.025	-0.045	-0.072	-0.009	-0.001
Difference	0.187***	0.166**	0.357***	-0.033***	0.001
	-0.032	-0.058	-0.082	-0.01	-0.001
			At Year 2005		
Land Owner	0.513	21.381	7.571	0.25	0.044
	-0.018	-0.038	-0.044	-0.006	0
Non-Land Owner	0.341	20.929	6.982	0.249	0.048
	-0.025	-0.05	-0.069	0.011	-0.001
Difference	0.171***	0.452***	0.589***	0.002	-0.004***
	-0.031	-0.065	-0.083	-0.011	-0.001
			At Year 2010		
Land Owner	0.407	21.835	7.693	0.191	0.046
	-0.014	-0.041	-0.039	-0.005	0
Non-Land Owner	0.243	20.965	6.822	0.135	0.058
	-0.016	-0.044	-0.049	-0.006	-0.001
Difference	0.164***	0.870***	0.871***	0.057***	-0.012***
	-0.022	-0.064	-0.065	-0.008	-0.001

Table 9 Land value and investment efficiency

This table shows the effect of land value change on firm's investment efficiency. The key independent variable of Column (1) and (2) is the interaction between land value and Tobin's Q. and the key independent variable of Column (3) and (4) is the interaction between negative policy shock and Tobin's Q. All specifications use year and firm fixed effects and cluster observation at firm level. Column (2) reports the 2-stage IV estimation with the supply elasticity*interest rate as instrument for land value. Robust standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

	Corporal Investment		
	OLS	IV	DID
	(1)	(2)	(3)
Land Value	0.170***	0.550***	
	(0.041)	(0.137)	
Average Land Price (City Where Firms Purchased Land)	0.000	-0.011***	
	(0.002)	(0.003)	
Land Value*Tobin's Q	-0.018**	-0.030*	
	(0.009)	(0.017)	
Firm-specific Policy Shock			-0.086***
			(0.022)
Firm-specific Policy Shock*Tobin's Q			0.015*
			(0.008)
Tobin's Q	0.023***	0.024***	0.018***
	(0.003)	(0.003)	(0.003)
Cash Flows	-0.000	-0.001	-0.002*
	(0.001)	(0.001)	(0.001)
Sale	0.018***	0.016***	0.021***
	(0.001)	(0.001)	(0.001)
Size	0.067***	0.076***	0.130***
	(0.007)	(0.008)	(0.013)
Firm- and Year- Fixed Effects	Yes	Yes	Yes
Kleibergen-Paap Wald F-statistic		112.120	
Number of Observations	18147	17908	18151
Adj. R-squared	0.357	0.098	0.446

Table 10 Land value and firms' TFP

This table reports the effect of land value increases on firm's productivity. The dependent variable for the upper panel is the TFP estimated using Olley-Pakes method, and the lower panel uses the TFP using Levinsohn-Petrin Estimation as dependent variable. Column (2), (4) and (7), (9) use the land-owner sample. And the other specifications use the whole sample. All specifications use year and firm fixed effects and cluster observation at firm level. Column (3), (4) and (8), (9) use 2-stages IV estimation with the interaction between the unsuitable land measure and national interest rate as instrument. Column (5), (10) use the diffs-in-diffs method with the firm specific policy shock as independent variable. Robust Standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.01; Constant terms are not reported.

	TFP (Olley-Pakes Estimation)				
	OLS		IV		DID
	(1)	(2)	(3)	(4)	(5)
Land Value	-0.033***	-0.036***	-0.094***	-0.114***	
	(0.012)	(0.012)	(0.026)	(0.024)	
Firm-specific Policy Shock					0.015*
					(0.008)
Average Land Price (City Where Firms	0.000	-0.001	0.002*	0.001	
Purchased Land)	(0.001)	(0.001)	(0.001)	(0.001)	
Tobin's Q	0.006**	0.008***	0.005***	0.007***	0.007***
	(0.002)	(0.003)	(0.001)	(0.001)	(0.003)
Cash Flows	0.002***	0.002***	0.002***	0.002***	0.001**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Sale	0.004***	0.004***	0.005***	0.004***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Size	0.008*	-0.007	0.006**	-0.010***	0.030***
	(0.005)	(0.005)	(0.003)	(0.003)	(0.009)
Kleibergen-Paap Wald F-statistic			162.570	162.269	
Number of Observations	16855	11780	16831	11756	16859
Adj. R-squared	0.034	0.038	0.035	0.040	0.185
	TFP (Levinsohn-Petrin Estimation)				
	OLS		2SLS		DID
	(6)	(7)	(8)	(9)	(10)
Land Value	-0.013***	-0.013***	-0.049***	-0.050***	
	(0.001)	(0.001)	(0.002)	(0.002)	
Firm-specific Policy Shock					0.002***
					(0.001)
Average Land Price (City Where Firms	-0.000**	-0.000***	0.001***	0.001***	
Purchased Land)	(0.000)	(0.000)	(0.000)	(0.000)	
Tobin's Q	0.000***	0.001***	0.000***	0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash Flows	0.000***	0.000***	0.000***	0.000***	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sale	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	-0.004***	-0.004***	-0.005***	-0.005***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Kleibergen-Paap Wald F-statistic			162.570	162.269	
Number of Observations	16855	11780	16831	11756	16859
Adj. R-squared	0.263	0.285	0.295	0.330	0.705

Firm- and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm-Specific Time Trends	No	No	No	No	Yes

Figure 1. Geographic distribution of the location of land holding

The segments around the circle represent the 31 provinces in China. And color-coded arcs linking two segments represent the size of land firm hold. For example, the segment color-coded red represents all the land buyer public firms from Beijing. And each of the 31 red arcs represents the size of land these "Beijing" firms bought in each of the 31 provinces. The upper panel of the figure quantifies the size of land transaction by total amount of payment (in term of *yuan*).

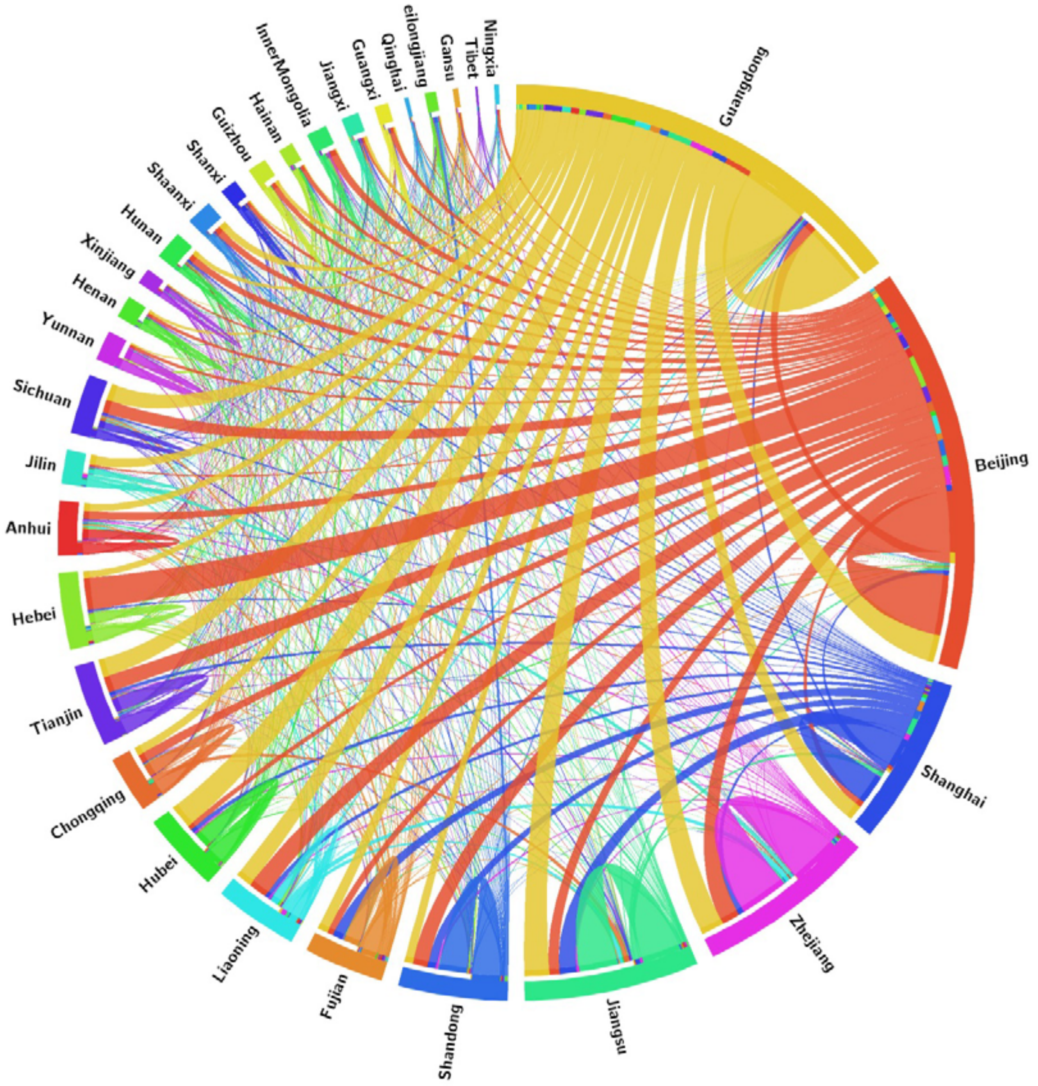
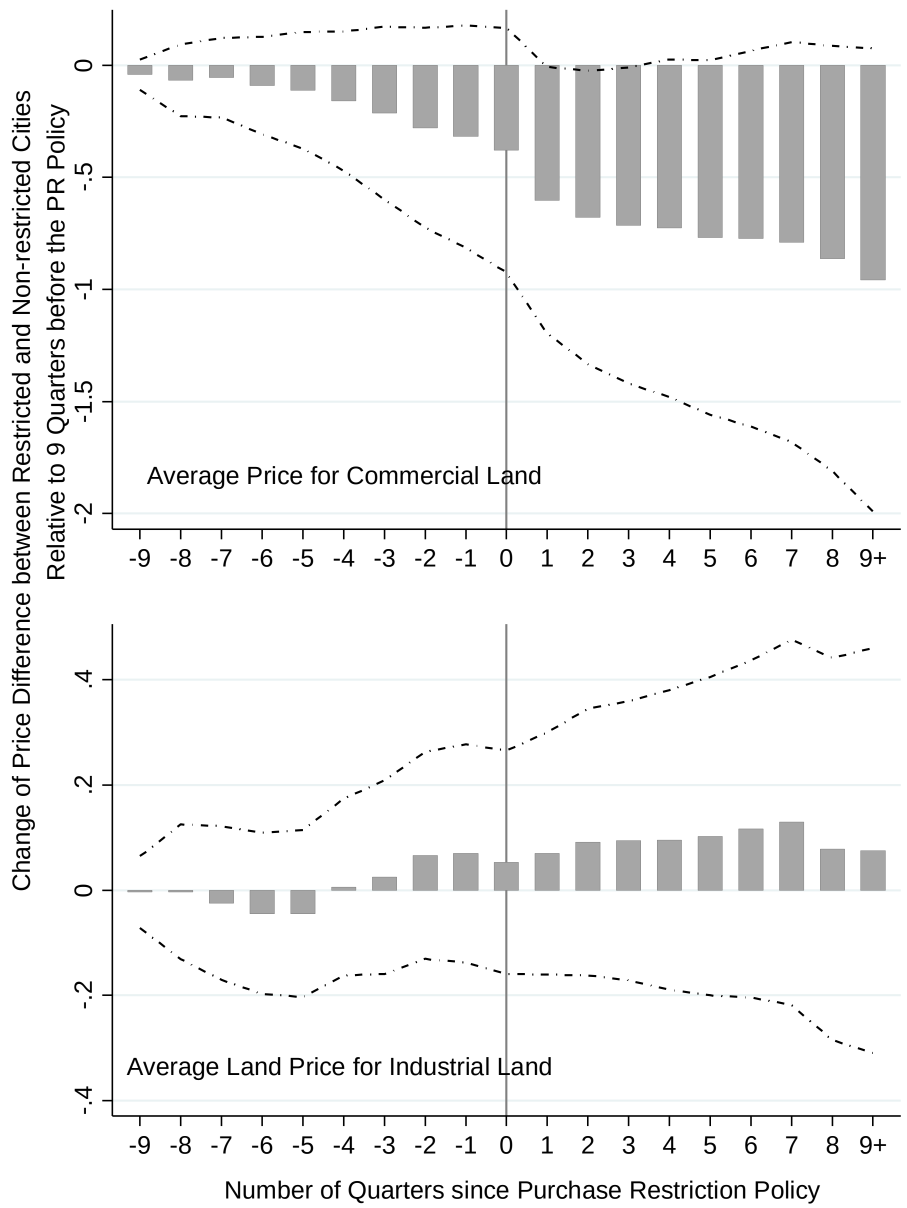


Figure 2. DID estimation on the effect of purchase restriction policy on land prices

This figure plots the Diffs-in-diffs estimators by the pre- and post-policy treatment quarters. The upper panel uses the city average commercial land price as dependent variable (y-axis) and the lower panel uses the average industrial land price as dependent variable (y-axis). The x-axis is the number of quarters since housing restriction policy. The bars represents the estimation from the following regression:

$$Land\ Price_{j,t} = \alpha + \sum_{et} \beta_{et} \times Treated_j \times EventTime_{j,t,et} + \sum \lambda_j \times t \times City_j + \varepsilon_t + \gamma_j$$

where $Treated_j$ is a dummy variable taking value of 1 if city j is one of the 46 cities affected by the policy. EventTimej,t,et, takes value 1 if calendar quarter t is event quarter et, and 0 otherwise. et represents event quarter, which takes value -9 till 9, with 0 represents the quarter when the policy is announce.



Appendix A. 46 cites which enforce "Housing Purchase Restriction" policy and the policy announcement date

City		Code	Year	Month	Day
北京市	Beijing	110000	2010	4	30
天津市	Tianjin	120000	2010	10	13
石家庄市	Shijiazhuang	130100	2011	2	20
太原市	Taiyuan	140100	2011	1	14
呼和浩特市	Huhehaote	150100	2011	4	14
沈阳市	Shenyang	210100	2011	3	1
大连市	Dalian	210200	2011	3	2
长春市	Changchun	220100	2011	5	20
哈尔滨市	Haerbin	230100	2011	2	28
上海市	Shanghai	310000	2010	10	7
南京市	Nanjing	320100	2010	10	13
无锡市	Wuxi	320200	2011	2	24
徐州市	Xuzhou	320300	2011	5	1
苏州市	Suzhou	320500	2011	3	3
杭州市	Hangzhou	330100	2010	10	11
宁波市	Ningbo	330200	2010	10	9
温州市	Wenzhou	330300	2010	10	14
绍兴市	Shaoxing	330600	2011	8	25
金华市	Jinhua	330700	2011	3	23
衢州市	Quzhou	330800	2011	9	9
舟山市	Zhoushan	330900	2011	8	2
台州市	Taizhou	331000	2011	8	25
合肥市	HeOLSi	340100	2011	1	25
福州市	Fuzhou	350100	2010	10	11
厦门市	Xiamen	350200	2010	10	1
南昌市	Nanchang	360100	2011	2	20
济南市	Jinan	370100	2011	1	21
青岛市	Qinghai	370200	2011	1	30
郑州市	Zhengzhou	410100	2011	1	6
武汉市	Wuhan	420100	2011	1	15
长沙市	Changsha	430100	2011	3	4
广州市	Guangzhou	440100	2010	10	15
深圳市	Shenzhen	440300	2010	9	30
珠海市	Zhuhai	440400	2011	11	1
佛山市	Foshan	440600	2011	3	18
南宁市	Nanning	450100	2011	3	1
海口市	Haikou	460100	2010	10	15
三亚市	Sanya	460200	2010	10	12
成都市	Chengdu	510100	2011	2	16
贵阳市	Guiyang	520100	2011	2	18
昆明市	Kunming	530100	2011	1	19

西安市	Xi'an	610100	2011	3	1
兰州市	Lanzhou	620100	2011	3	7
西宁市	Xining	630100	2011	8	1
银川市	Yinchuan	640100	2011	2	24
乌鲁木齐市	Wulumuqi	650100	2011	3	9

Appendix B. Variable definitions

Variable Name	Definition
Land Owner Firm	A dummy variable indicates a firm has holding land in our sample period from 1998 to 2012.
Corporate Investment	Corporate investment is measured as capital expenditures divided by the lagged book value of PPE and capital expenditures are calculated as the sum of cash paid for the acquisition of fixed assets, intangible assets and other long-term assets in the quarterly statement of cash flows.
Land Value	Land value is the market value of land assets holding by company normalized by lagged PPE.
Average Land Price (City Where Firms Purchased Land)	The average land price for the cities where firms purchased land measured the annual average land price for the cities where firms owned land parcels which equals to 0 if a firm does not own any land according to transaction records.
Tobin's Q	Tobin's Q is measured as the market value plus total debt normalized by the book value of the firm.
Cash Flow	Cash flow is computed as the net operating cash flow divided by lagged PPE. Sales revenue is measured as cash received from sales of goods and services divided by lagged PPE.
Sale	Sale is defined as the natural logarithm of annual sale revenue.
Size	Size is expressed as the natural logarithm of current total assets.
New Bank Loan	New bank loan is defined as the new loans a firm got within a given year from banks, which is normalized by lagged book value of PPE.
Change in Total Debt	Change in total debt measure the change of book value of (long term debt + short term debt) at year t, which is normalized also by lagged PPE.
Land $Value_{09}$	Land value is the market value of land assets holding by company measured at 2009's land price normalized by lagged PPE.
Firm-specific Policy Shock	Firm-specific policy shock is the diffs-in-diff dummy estimator indicates a firm holds lands in the cities with "housing purchase restriction" policies at year after the policy is in Effect.
Treatment Group Firm	Treatment group firm is a dummy variable indicates that a firm holds lands in the cities with "housing purchase restriction" policies.
TFP (Olley-Pakes Estimation)	Total Factor Productivity estimated using the Olley-Pakes estimation.
TFP (Levinsohn-Petrin Estimation)	Total Factor Productivity estimated using the Levinsohn-Petrin estimation.