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Heterogeneous Impact of Real Estate Prices on Firm Investment

HAZAMA Makoto
Hitotsubashi University

UESUGI Iichiro
RIETI

Research Institute of Economy, Trade & Industry, IAA
The Research Institute of Economy, Trade and Industry
http://www.rieti.go.jp/en/

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Heterogeneous Impact of Real Estate Prices on Firm Investment*

HAZAMA Makoto (Hitotsubashi University) UESGUI Iichiro (RIETI and Hitotsubashi University)

Abstract

Focusing on real estate and other fixed tangible assets, we study how the heterogeneous effects of real estate prices influence real estate investment behavior. Theoretically, expectations of declining real estate prices reduce not only overall fixed tangible investment through a collateral channel but also real estate investment through intertemporal substitution of demand. By employing a unique dataset on firms' land transactions and overall investment in Japan during the period 1997-2006, we examine these predictions and find the following. First, the entire fixed tangible asset investment is positively associated with the growth rate of land prices, which is the evidence for the collateral channel. In contrast, land investment has no statistically significant relationships with land price growth. Second, a decomposition of land investment into land purchases and sales shows that land sales actually decrease when the growth rate of land prices falls. Third, large firms and firms that acquired land during and shortly after the bubble period tend to reduce land sales. This is consistent with Geltner's (2014) argument that potential sellers of land set their reservation prices at their purchase prices and are reluctant to sell land in the face of a persistent drop in its price.

Keywords: Real estate, Land, Fixed tangible investment, Collateral channel

JEL Classification: G21, G32

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1. Introduction

Real estate is one of the most important asset types for the economy since massive fluctuations in real estate prices have frequently created booms and triggered many financial crises. These include the U.S. subprime mortgage crisis and subsequent global financial crisis that started in 2007 and the Japanese banking crisis in the 1990s. The linkage between downturns of real estate prices and financial crises is observed not only in developed countries but also in developing economies. Analyzing the banking crises that occurred in emerging markets, Reinhart and Rogoff (2009, pp. 280) find that the most important predictor of a crisis is the change in housing prices.

Real estate prices are likely to affect the real economy through the availability and cost of credit. On the one hand, Bernanke and Gertler (1989) and Kiyotaki and Moore (1997), among others, formalize such a financial linkage in their general equilibrium models by focusing on a borrower's net worth (Bernanke and Gertler) or the value of collateral that a borrower pledges to obtain credit (Kiyotaki and Moore). These two studies show that shocks to net worth or collateral value affect capital investment, which amplifies the initial shocks. On the other hand, there has been a large body of literature that empirically examines the role of real estate prices in the collateral and bank-lending channels. Gan (2007) evidences the collateral channel by documenting reduced lending and firm investment after the collapse of the Japanese real estate market in the early 1990s. Chaney, Sraer, and Thesmar (2012) find, examining the credit market in the US, that increased real estate values for companies are related to increases in firm borrowing and investment. They argue that their results are coming through the collateral channel, given that the firms' pledgable real estate assets have higher values.

In recent years, there appears a new strand of literature on collateral and bank-lending channels that focuses on heterogeneous impacts of real estate prices on different types of loans. Chakraborty, Goldstein, and MacKinlay (2014) found, studying the US loan market during the period 1988 through 2006, that banks facing a real estate price boom increased mortgage loans, while they decreased commercial and industry loans. Cunat, Cvijanovic, and Yuan (2014) examine the bank-lending channel in the US during the 2005–2010 period to find that a negative real estate shock, through its impact on bank capital, reduced not only real estate loans but also other types of loans, such as individual and agricultural credit, lease financing, and loans against receivables. Hazama, Hosono, and Uesugi (2014) show, focusing on Japanese banks during the period 2007 through 2013, that land price growth increases real estate loans but not non–real estate loans, to any significant extent.

However, there are several aspects that the previous literature on the heterogeneous impacts of real estate prices has not thoroughly investigated. First, previous literature, including Chakraborty et al. (2014), Cunat et al. (2014), and Hosono et al. (2014), focuses solely on banks' lending decisions on allocation of funds and their managerial resources, but does not explicitly consider firms' decisions on investments of different types. There are many types of tangible assets, including land, buildings, equipment, and machineries, from which firms choose for investment. Hence, we need to consider how firms determine the amount of investment of different types in response to shocks in real estate prices. Second, firms determine the level of net investment by purchasing and selling tangible assets at the same time, so that the amount of reallocation of assets (sales + purchase) is often substantially larger than the amount of net investment. Non-depreciable tangible assets such as land, in particular, are frequently purchased and sold in the market. Therefore, examining the determinants of both the purchase and sales of these assets rather than their net change is important to understand firms' investment behavior.

Against this background, we contribute to the literature on the heterogeneous impact of real estate prices on investment of different types by focusing on the distinction between investments in real estate and other fixed tangible assets. Our contributions are twofold. First, we theoretically examine the relationship between real estate prices and firms' investment of different types by a standard dynamic model of a firm's finance and investment a la Hubbard and Kashyap (1992), Whited (1992), and Ogura (2015). The model incorporates several paths through which real estate prices affect investment of different asset types. In a collateral channel, the value of collateral pledged by borrower firms determines the firms' credit availability and their investment opportunity. In case firms anticipate a decline in future real estate prices, collateral constraints are more likely to restrain firms, leading to a reduction in their demand for investment of any type. There is also a channel in which real estate prices affect investment through intertemporal allocation of demand. In case firms expect a decline in real estate prices, they reduce, rather than increase, their current demand for real estate investment. On balance, during the downturn in the real estate market, we expect an investment decline for firms in both real estate and other tangible assets. We also expect a more sizable decline in real estate investment, relative to other tangible assets, among firms relatively more likely to face a binding constraint. Second, we empirically test the above theoretical predictions of the relationship between real estate prices and investment in Japan by employing a unique dataset. We specifically examine the contrast between investments in fixed tangible assets overall and land. We focus on land not only because the value of land comprises a major portion of the real estate value but also because the volatility of land prices explains most of the fluctuations in real estate values. We first compare the response of fixed tangible asset investment and that of land investment and then decompose the land investment into land purchase and sales to study the determinants of these land purchase and sales.

Our empirical findings are as follows. First, the entire fixed tangible asset investment is positively associated with the growth rate of land prices. In contrast, contrary to the prediction, land investment has no statistically significant relationships with land price growth. These statistical regularities are qualitatively the same for a number of robustness checks, including alternative specifications for land price expectations, subsample analyses, introduction of additional variables, and different estimation methods. Second, land sales are positively associated with the growth rate of land prices but the statistical association between land purchase and prices is tenuous at best. Additional analyses show that firms with multiple establishments and firms that acquired land during the bubble period and the period shortly after the bubble tend to reduce land sales. These are consistent with the explanation of Geltner (2014) that potential seller firms are property owners and set their reservation prices at their purchase price and that an exogenous reduction of property prices significantly reduces the supply by these potential sellers.

The paper proceeds as follows. Section 2 presents a benchmark model of finance and investment that includes real estate and other tangible assets as input and posits hypotheses on the relationship between real estate prices and demand for investment. Sections 3 through 5 describe the empirical approach, data sources, and regression models that we employ for analysis. Section 6 presents the results. Finally, concluding remarks and directions for further research are presented in Section 7.

2. Benchmark model of firms' investment decisions

As a benchmark for the empirical examination of the relationship between real estate prices and investment of different types, we posit a theoretical model on firms' finance and investment decisions. We follow Ogura (2015), which is an extension of Hubbard and Kashyap (1992) and Whited (1992), up to the derivation of two Euler equations for real estate investment and other fixed tangible asset investment, but deviate from it to examine comparative statics on the impact of real estate prices on the two types of investment. Firms maximize the present discounted value of their return at time *t*

$$\max_{\{k_u, l_u, N_u, B_u\}_{u=t}^{\infty}} V_t = E_t\left[\sum_{u=t}^{\infty}\left\{\prod_{j=0}^{u-t}\beta_{t+j}\right\}d_u\right], \tag{1}$$

subject to the following conditions for any time $u \geq t$

$$K_u = k_u + (1-\delta)K_{u-1}, \tag{2}$$

$$L_u = l_u + L_{u-1}, \tag{3}$$

$$E_t[d_u] \geq 0, \tag{4}$$

$$B_u \leq E_t[q_{u+1}]L_u + E_t[s_{u+1}]K_u, \tag{5}$$

$$\lim_{T\to\infty}\left\{\prod_{j=0}^{T-u}\beta_{u+j}\right\}B_T = 0, \tag{6}$$

where, K_t is the stock of fixed tangible asset, k_t is the investment expenditure on fixed tangible asset, L_t is the stock of real estate assets, l_t is the investment expenditure on real estate assets, B_t is the borrowing outstanding, d_t is the dividend, q_t is the real estate price, s_t is the price of fixed tangible assets, β_t is the discount factor at time t, and δ is the depreciation rate.

Firm's dividends are defined as

$$\begin{aligned} d_u = \quad & p_u F(L_{u-1}, K_{u-1}, N_u) - w_u N_u - \phi(k_u, l_u, K_{u-1}, L_{u-1}) \\ & -(1+i_{u-1})B_{u-1} + B_u - q_u l_u - s_u k_u \end{aligned}, \tag{7}$$

where p_t is the output price of the firm, N_t is the labor input, w_t is the real wage, and i_t is the interest rate at time t.

Here, we assume that adjustment costs of investment are additively separable between different fixed tangible assets and that land is always fully utilized for production.[1] We combine the three first-order conditions with respect to *k*, *l*, and *B* to obtain

$$\begin{aligned} & -(1+i_t)\left\{\frac{\partial\phi(k_t, l_t, K_{t-1}, L_{t-1})}{\partial k_t} + s_t\right\} + E_t\left[\frac{\partial d_{t+1}}{\partial K_t}\right] \\ & + \Lambda_t\left\{E_t[s_{t+1}] - s_t - \frac{\partial\phi(k_t, l_t, K_{t-1}, L_{t-1})}{\partial k_t}\right\} = 0 \end{aligned}, \tag{8}$$

$$\begin{aligned} & -(1+i_t)\left\{\frac{\partial\phi(k_t, l_t, K_{t-1}, L_{t-1})}{\partial l_t} + s_t\right\} + E_t\left[\frac{\partial d_{t+1}}{\partial L_t}\right] \\ & + \Lambda_t\left\{E_t[q_{t+1}] - q_t - \frac{\partial\phi(k_t, l_t, K_{t-1}, L_{t-1})}{\partial l_t}\right\} = 0 \end{aligned}, \tag{9}$$

By total differentiation, we have the formula including *dK* and *dL*

[1] Firms may own real estate properties for capital gains without using them for production, but the current model does not consider firms' idle-land-holding behavior. Note, however, that the number of firms that hold land as inventory is only one-tenth of those that hold land as an asset for their own use in the Survey of Firms' Land Transactions and that the ratio of open-space land to land owned by firms for their own use is only 7% in the 2008 Basic Survey of Land Owned by Corporations by MLIT. These indicate that firms in recent years employ land mostly for production rather than for capital gains and that our current model is overall consistent with the reality.

$$M\begin{bmatrix} dK_t \\ dL_t \end{bmatrix} = v\,, \tag{10}$$

where each element of *M* is

$$M_{11} = -(i_t + 1 + \Lambda_t)\frac{\partial^2 \phi_t}{\partial K_t \partial k_t} + (1-\delta)\frac{\partial^2 \phi_{t+1}}{\partial K_t \partial k_{t+1}} - \frac{\partial^2 \phi_{t+1}}{\partial K_t{}^2} + E_t[p_{t+1}]\frac{\partial^2 F_{t+1}}{\partial K_t{}^2}\,, \tag{11}$$

$$M_{12} = E_t[p_{t+1}]\frac{\partial^2 F_{t+1}}{\partial L_t \partial K_t}\,, \tag{12}$$

$$M_{21} = E_t[p_{t+1}]\frac{\partial^2 F_{t+1}}{\partial K_t \partial L_t}\,, \tag{13}$$

$$M_{22} = -(i_t + 1 + \Lambda_t)\frac{\partial^2 \phi_t}{\partial L_t \partial l_t} + (1-\delta)\frac{\partial^2 \phi_{t+1}}{\partial L_t \partial l_{t+1}} - \frac{\partial^2 \phi_{t+1}}{\partial L_t{}^2} + E_t[p_{t+1}]\frac{\partial^2 F_{t+1}}{\partial L_t{}^2}\,, \tag{14}$$

and each element of *V* is

$$v_1 = -[(\Lambda_t + 1 - \delta)dE_t[s_{t+1}] - (i_t + 1 + \Lambda_t)ds_t] - \frac{\partial F_{t+1}}{\partial K_t} dE_t[p_{t+1}], \tag{15}$$

$$v_2 = -[(\Lambda_t + 1)dE_t[q_{t+1}] - (i_t + 1 + \Lambda_t)dq_t] - \frac{\partial F_{t+1}}{\partial L_t} dE_t[p_{t+1}], \tag{16}$$

Note that we obtain (12) and (13) applying the assumption of additive separability of adjustment costs of investment to M_{12} and M_{21}. Further, we suppose that $dE_t[s_{t+1}] = 0, ds_t = 0,$ $dE_t[p_{t+1}] = 0, dp_t = 0$, and $|M| \neq 0$ to solve for *dK* and *dL*.

$$\begin{bmatrix} dK_t \\ dL_t \end{bmatrix} = M^{-1} v\,, \tag{17}$$

From (17), we derive the following relationships between real estate prices and demand for real estate properties and other fixed tangible assets. Note that *dK* and *dL* can be replaced with *dk* and *dl*.

$$\frac{dK_t}{dg_t} = \frac{dk_t}{dg_t} = \frac{M_{12}(1+\Lambda_t)q_t}{M_{11}M_{22} - M_{12}M_{21}}\,, \tag{18}$$

$$\frac{dL_t}{dg_t} = \frac{dl_t}{dg_t} = \frac{-M_{11}(1+\Lambda_t)q_t}{M_{11}M_{22} - M_{12}M_{21}}\,, \tag{19}$$

From the assumptions on the signs of derivatives of adjustment cost of investment, M_{11} and M_{22} are negative, while M_{12} and M_{21} are positive. Further, we assume

$$\frac{\partial^2 F_{t+1}}{\partial K_t^{\,2}} \frac{\partial^2 F_{t+1}}{\partial L_t^{\,2}} \geq \left(\frac{\partial^2 F_{t+1}}{\partial L_t \partial K_t} \right)^2 , \tag{20}$$

which is a sufficient condition for $M_{11}M_{22} \_ \; M_{12}M_{21}$.[2] Therefore, we verify that

$$\frac{dK_t}{dg_t} = \frac{dk_t}{dg_t} > 0 \;,\; \frac{dL_t}{dg_t} = \frac{dl_t}{dg_t} > 0 \,. \tag{21}$$

These indicate that the expected growth rate of real estate prices is positively associated with real estate investment as well as with other fixed tangible property investment.

Intuitively, real estate prices positively affect real estate and other fixed tangible asset investment through several paths. First, the value of collateral pledged by borrower firms determines firms' credit availability and investment opportunity through a collateral channel. In case firms anticipate an increase (decrease) in future real estate prices, collateral constraints are less (more) likely to bind, leading to an increase (decrease) in firms' demand for investment of any type. Second, in another channel, real estate prices affect investment through intertemporal allocation of demand. In case firms expect an increase (decrease) in real estate prices, their current demand for real estate investment increases (decreases) rather than decreases (increases). On balance, during the (upturn) downturn of the real estate market, we expect an increase (decline) both in firms' real estate investment and other tangible asset investment.[3]

3. Empirical approach

In Section 2, we obtained the theoretical prediction on the relationships between the growth rate of real estate prices and two different types of investment: real estate and other fixed tangible asset investment. We employ Tobin's Q-type investment equations augmented with variables on firms' financial constraints and real estate prices in order to empirically examine the prediction. In case of multiple assets for firms' investment, Wildasin (1984), Hayashi and Inoue (1991), and Chirinko (1993) assume an additively separable adjustment cost function and demonstrate a one-to-one correspondence between Q and the weighted sum of investment for multiple assets. Chirinko (1993), in particular, uses the above correspondence and estimates the investment equation for each type of asset.

[2] Note that this inequality holds for CES (constant elasticity of substitution) production functions.

[3] By dividing (19) by (18), we further show a sizable change in real estate investment, compared to other tangible assets, among firms that are relatively more likely to face a binding constraint. In other words, real estate investment is more sensitive than other fixed tangible investment when firms are more likely to be credit-constrained.

However, we need to pay attention to a few caveats before proceeding to the details of an empirical model. First, only a loose connection exists between the theoretical model in the previous section and the empirical model explained below. The model that generates one-to-one correspondence between Q and the investment amount differs from ours in that it lacks the constraints on non-negative dividends and collateral. Hence, adding variables on firms' financing constraints and real estate prices to the model directly derived from the Q theory of investment is rather arbitrary. Second, the empirical model compares investments in land and fixed tangible assets overall, while the theoretical model distinguishes between real estate and non–real estate assets. We also focus on the development of land prices in the empirical model rather than on the development of real estate prices. The focus on land prices rather than real estate prices can be justified since most of the fluctuations in real estate prices are driven by land prices rather than by the cost of structures, as Davis and Heathcote (2007) indicate.

In Section 4, we detail data sources and construction of the dataset. Then, in Section 5, we explain the empirical models in more detail and describe the variables used for analysis.

4. Data

4.1 Data sources

Three data sources are used for our empirical analysis. First, information on firms' capital investment and financial conditions is obtained from the Basic Survey of Business Structure and Activities (BSBSA; Kigyo Katsudo Kihon Chosa in Japanese) by the Ministry of Economy, Trade and Industry. The main purpose of this survey is to quantitatively gauge the activities of Japanese enterprises, including capital investment, exports, foreign direct investment, and investment in research and development. To this end, the survey covers the universe of enterprises in Japan with more than 50 employees and with paid-up capital of over JPY 30 million. From this data source, we obtain firm-level data on fixed tangible investment, stocks of fixed tangible assets, address of the headquarter of the firm, number of employees, and other balance sheet items, including total asset, sales, and operating profits.

Second, information on firms' land transactions is obtained from the Survey of Firms' Land Transactions (SFLT; Kigyo no Tochishutoku Jokyo ni kansuru Chousa in Japanese) by the Ministry of Land, Infrastructure, Transport, and Tourism. The main purpose of this survey is to measure the current status of land ownership among Japanese firms, including the acreage of land owned by a firm, the acreage of land owned by a firm in each of the 47 prefectures in the country, the acreage of land purchased/sold and the book values of land purchased/sold within one year for each firm, and the acreage of unused land. To this end, the survey covers the universe of enterprises in Japan with capital of more than JPY 100 million. From this data source, we obtain firm-level data on the acreage of land purchase and sales for each year.

Third, data on real estate prices are needed to analyze the impact of real estate markets on bank-lending behavior. We use appraisal-based land prices, published as the Public Notice of Land Prices (PNLPs; Chika Koji in Japanese), compiled by the Land Appraisal Committee of MLIT for more than 20,000 locational points in Japan as of January 1 every year. PNLPs are different from transaction prices. Specifically, two real estate appraisers separately examine the location on site, analyze the recent trading examples and prospects for returns from the land, and evaluate and report it to the Land Appraisal Committee. Then, the committee considers the balance among locational points and regions and authorizes the PNLP of the point. The report discloses a great deal of information on the land in addition to the PNLP, such as the address, the frontal road, the nearest station and the distance from it, the square meters and the shape of the land, the intended purpose under urban planning, the building-to-land ratio, and the floor-to-area ratio.

We aggregate PNLPs and the transaction prices at the municipality level, i.e., city, ward, town, or village level. To adjust for different attributes of various lands, we follow a hedonic approach. Specifically, we regress the PNLP or the transaction price per square meter on various attributes of the lands, and average the fitted values of the lands within the municipality for each year. The explanatory variables we use are square meters, the width of the road, the distance from the nearest station, the latitude, the latitude squared, the longitude, the longitude squared, the building-to-land ratio, the floor-to-area ratio, a dummy for running water, a dummy for a sewage line, a dummy for gas, dummies for the area for the intended purpose, dummies for the class of intended purposes, and year dummies. We use aggregated PNLPs for each municipality and relate them to the location information of firms' headquarters in the sample. It should be emphasized that the locations of firms' headquarters in our dataset are geographically diverse and not necessarily concentrated in narrow areas, such as in the center of Tokyo.

4.2 Sample selection

In order to examine firms' investment behavior for land and fixed tangible assets as a whole in response to firms' expectation on future land prices, we set our observation period to the years 1997 to 2006. The sample years start from 1997 because the BSBSA has been publishing annual data since 1995 and we need one or two preceding years to construct lagged variables.[4] We also set 2006 as the end-of-period year to exclude the recent financial crisis and the serious recessions that followed, during which real estate price expectations may have been tumultuous and difficult to precisely detect from outside. We benefit from the choice of sample period during the downturn of

[4] Note that SFLT and PNLP started in 1987 and 1975, respectively.

real estate prices because the expected real estate prices we use for analysis are robust to a variety of expectation specifications when prices actually decline for a long period.

We combine the BSBSA and SFLT datasets to construct a panel dataset of firms. Each year's sample comprises about 3,000 to 4,000 firms, except for the years 1999–2001, which we dropped from the sample because we found a number of inconsistencies in the SFLT land transactions data for those years. Of the sample, 52% belong to the manufacturing sector, and the wholesale and retail sectors account for 23% and 11%, respectively. In contrast, only 2% of the sample firms belong to construction or real estate sectors. The underrepresentation of construction and real estate industries in the sample, relative to the total population of firms in Japan, is presumably due to the sample selection of BSBSA, which mainly focuses on manufacturing, wholesale and retail, and services industries. We should note this underrepresentation of construction and real estate firms in the sample when interpreting the results, since firms in these industries may hold land as inventory and their response to real estate price shocks may differ from that of other industries.

Finally, to exclude outliers, for each year, we drop firm-year observations for which our dependent variable falls into either the below -1 or above 1% tail of its distribution. Our final dataset consists of 26,993 firms, which make up our sample for empirical analysis in the following sections.

5. Regression

5.1 Regression model and dependent variables

We estimate the following two equations:

$$\frac{FIXED_{it}}{K_{it-1}} = \beta_0 + \beta_1 SALES\_GROWTH_{it-1} + \beta_2 LP\_GROWTH_{it-1} + \beta_3 FIRM_{it-1} + \beta_4 Industry_i + \beta_5 Year_i + \beta_6 prefecture_i + \varepsilon_{it} \quad (22)$$

and

$$\frac{LAND_{it}}{L_{it-1}} = \alpha_0 + \alpha_1 SALES\_GROWTH_{it-1} + \alpha_2 LP\_GROWTH_{it-1} + \alpha_3 FIRM_{it-1}, + \alpha_4 Industry_i + \alpha_5 Year_i + \alpha_6 prefecture_i + \nu_{it} \quad (23)$$

These are Tobin's Q-type investment equations, augmented by the variables of the growth rate of land prices, representing firms' expectations of future land price growth as well as firms' characteristic variables that proxy for their financial constraints. The dependent variable in the first equation is the fixed tangible investment ratio, defined as the ratio of gross investment in fixed tangible assets, including structures, equipment, machineries, and land, during period t to their stock amount that are measured by their book values at the end of period $t - 1$. This ratio is widely used in empirical studies on investment based on the Q theory. The dependent variable in the second equation is the land investment ratio, defined as the ratio of net investment in land during period *t* to their stock amount that are measured by their book values at the end of period *t - 1*. Further, we decompose the net land investment (*LAND*) into land purchases (*LAND_PURC*) and land sales (*LAND_SALE*) and employ both as dependent variables for a deeper understanding of the firms' land investment decision. Land is non-depreciable, and its sales are as important as land purchases.

5.2 Explanatory variables

As regressors, we use a proxy for Tobin's Q and a variety of additional variables that may affect investment. For all time-varying variables, we use a one-year lag to eliminate possible endogeneity problems.

Growth of land prices

The variable *LP_GROWTH* proxies for the expected growth rate of land prices for each firm. Assuming perfect foresight regarding real estate prices from year *t* to *t + 1* in the municipality where the firm's headquarters are located, we suppose that the firm makes an investment decision based on one-year-ahead price forecasts. The sample period, 1997 through 2006, witnessed a persistent decline in land prices in almost all the 47 prefectures.[5] Hence, it is more likely that firms could correctly forecast future land prices during the sample period compared to the tumultuous years of financial crises. Nevertheless, assuming perfect foresight without any qualifications could lead to misleading results. Therefore, we estimate the model with a number of alternative expected growth rate specifications for land prices as a robustness check.

Proxy for Tobin's Q

Because most of our sample firms are not listed on a stock exchange, we are not able to use Tobin's Q, defined as the ratio of the market value to the replacement cost of capital, as a regressor to represent the firms' investment opportunities. We therefore use the sales growth rate (*SALES_GROWTH*) of the firms, instead, as a proxy for their investment opportunities, following studies such as Shin and Stulz (1998), Whited (2006), and Acharya et al. (2007). We expect *SALES_GROWTH* to have a positive coefficient.

Firms' financial constraints

We also include a vector of variables representing the firms' financial constraints, *FIRM*. Specifically, we use firm size, represented by the natural logarithm of total assets (*LnASSET*); their capital ratio, computed as the ratio of net worth to total assets (*CAP*); their profitability, represented

[5] We average PNLP growth rates for each prefecture to find that they are negative in almost all the prefecture-years except for a few prefectures in metropolitan areas either at the beginning or at the end of the sample period.

by the ratio of current income to total assets (*ROA*); and their liquidity, proxied for by the ratio of liquid assets to total assets (*LIQUID_ASSET*).

Recent studies such as Whited (2006) consider financial frictions to be an important factor generating variations in firm investment. Firms with higher profitability (*ROA*), more liquidity (*LIQUID_ASSET*), and larger size (*LnASSET*) are less likely to be financially constrained.[6] Thus, we expect the coefficients of these variables to be positive. In a similar vein, since firms with a higher net worth *(CAP*) are less likely to be financially constrained, we expect *CAP* to have a positive coefficient.

Year, industry, and prefecture dummies

To control for macroeconomic, industry-level, and regional shocks that affect firm investment in fixed tangible assets and land, we introduce year, industry, and prefecture dummies. We add 12 industry dummies, classifying firms into 13 industries (1: agriculture, forestry, and fishery; 2: mining; 3: construction; 4: manufacturing; 5: wholesale; 6: retail; 7: restaurants; 8: finance and insurance; 9: real estate; 10: transportation and telecommunication; 11: public utilities; 12: services; 13: others). We also add 46 prefecture dummies, employing the 47-prefecture classification. Prefecture dummies can control for possible time-invariant regional heterogeneity in the way firms respond to fluctuations in land prices.

6. Results

6.1 Summary statistics

We start summarizing the descriptive statistics for the sample we use for analysis. In Tables 1(a), (b), and (c), we show the mean, standard deviation, several percentile points, etc., for both dependent and independent variables, including year and industry dummies. The dependent variables for gross fixed tangible investment rate (FIXED), net land investment rate (LAND), land purchase rate (LAND_PURC), and land sales rate (LAND_SALE), have mean values of 13%, 0.3%, 1%, and 0.7%, respectively. The gross fixed tangible investment rate is much higher than the net land investment rate. Note, however, that the net fixed tangible investment must be much lower than FIXED and that the gross purchases and sales of land, LAND_PURC and LAND_SALE, respectively, are much larger than the net land investment.

(Table 1(a), (b), and(c))

We now consider some of the explanatory variables. The growth rate of land prices, LP_GROWTH, is mostly negative between year t and t + 1 for municipalities where the firms'

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[6] Note, however, that these firm characteristics could also be related to future profitability, as discussed by Abel and Eberly (2011) and Gomes (2001), and thus could affect firm investment even without financial constraints.

headquarters are located. This indicates that the land transaction market in Japan was mostly in downturn during the sample period. The median value of ASSET is JPY 9.2 billion, and the mean JPY 46.8 billion, indicating that the sample consists mostly of large firms, most of them unlisted (results not shown in Table 1).

6.2 Baseline results for overall fixed tangible asset investment and net land investment

The baseline estimation results for fixed tangible asset investments overall as well as net land investments are shown in Table 2. We find that LP_GROWTH takes a positive and significant coefficient with FIXED as a dependent variable, indicating that a 1 percentage point increase in the growth rate of land prices corresponds to a 0.06 percentage point increase in the fixed tangible asset investment ratio. This positive coefficient is consistent with the prediction based on the collateral channel hypothesis. As regards the other explanatory variables, we find a positive but insignificant coefficient for the Tobin's Q proxy (SALES_GROWTH). Of the other firm attribute variables, CAP, LIQUID_ASSET, and lnASSET take positive and significant coefficients. We conclude that firms with relatively larger net worth as well as liquid asset and total asset amounts tend to invest more in fixed tangible assets than other firms do. Note, however, that ROA takes a positive but insignificant coefficient.

(Table 2)

We find one conspicuous difference with LAND as a dependent variable, compared to the FIXED estimation; that is, LP_GROWTH takes an insignificant but negative coefficient. The result does not support the collateral channel hypothesis or the intertemporal substitution hypothesis. As for other explanatory variables, all the coefficients of firms' attributes take positive values, although only those of ROA and LIQUID_ASSET are statistically significant.

6.3 Robustness checks

The coefficients of LP_GROWTH show contrasting signs in the two baseline estimations in Section 6.2: they are significantly positive in the FIXED estimation but insignificantly negative in the LAND estimation. In the following additional estimations, we examine their robustness.

First, we construct another LP_GROWTH set with different definitions, employing different assumptions on the firms' expectation formation on land prices and time horizon of expectations. We extend the firms' time horizon of expectations from one year to multiple years. Table 3(a) shows the results where LP_GROWTH with longer time horizons of two, three, four, and five years are employed. For the FIXED estimation, coefficients for LP_GROWTH become smaller and gradually insignificant for longer horizons. For the LAND estimation, coefficients are insignificant and negative for all horizons. Then, we change the assumption on expectation formation from perfect foresight to lagged expectation formation. We also employ different time horizons, from two to five years, for expectation formation. Table 3(b) shows the results where LP_GROWTH is employed with land prices lagged back to t – 2, t – 3, t – 4, and t – 5. For all the different time horizons in the FIXED estimations, coefficients are positive and significant, but substantially smaller in size than in the baseline case. In contrast, the coefficients are still insignificant for all horizons in the LAND estimations.

(Table 3(a) and (b))

Second, we divide the sample by the number of establishments for a firm. The primary motivation is to control for the possible measurement error of LP_GROWTH by focusing on firms that have only one establishment and are highly unlikely to own land in other than the headquarters' location. Unlike firms with multiple establishments possibly located in different prefectures, these single-establishment firms are less susceptible to measurement errors on land prices. Table 4 shows the results for two subsamples: one for single-establishment firms and the other for multiple-establishment firms. For the single-establishment firms, the coefficient of LP_GROWTH in the FIXED estimation is positive and marginally significant, while it remains insignificant in the LAND estimation. The positive coefficient is larger than in the baseline case. Note, further, that even for the multiple-establishment firms the coefficient of LP_GROWTH in the FIXED estimation is positive and marginally significant.

(Table 4)

Third, we introduce an additional explanatory variable to represent the extent of a firm's exposure to land price volatility. This variable is the ratio of land to total assets (LAR)—the ratio of land values that a firm owns, evaluated at the current land price in the municipality where the firm's headquarters is located, to the amount of total assets.[7] Table 5 shows the results. For the FIXED estimation, we find that the coefficient of LP_GROWTH remains positive and significant and that the coefficient of LAR is significantly negative, indicating that firms with a large exposure to land assets have reduced investment in fixed tangible assets. We also find, for the LAND estimation, that the coefficient of LP_GROWTH is insignificant despite the inclusion of LAR as one of the explanatory variables.

(Table 5)

Fourth, we implement the same specification as in the baseline case but for a different period, which includes the financial crisis years. We expect the coefficients of LP_GROWTH to significantly change because of the wild fluctuation in land prices during the years 2007 through 2011, so that the firms' expectation formation on future land prices might completely differ from our formulation in the baseline case. Table 6 shows the results. As we expect, the coefficients of LP_GROWTH, for both FIXED and LAND estimations, significantly differ from the baseline case,

[7] Gan (2007) employs a similar variable to measure a firm's exposure to land price decline after the bubble period in Japan.

in which they are negative and insignificant (FIXED estimation) and marginally significant (LAND estimation).

(Table 6)

In sum, after a number of robustness checks, we state that the coefficients of LP_GROWTH in the FIXED estimations are significantly positive in all cases except where firms may have followed a different formulation for land price expectation or where perfect foresight by firms is assumed for more than four years. We also show that the coefficients of LP_GROWTH in the LAND estimations are insignificant in all cases except when the financial crisis years are included in the sample period.

6.4 Results for land purchases and land sales

In Sections 6.2 and 6.3, we noted that LP_GROWTH is insignificant in almost all LAND estimation cases. Note, however, that gross land purchases and sales are substantially larger than the net investment in land and that land purchase and sales behavior may well be quite distinct from each other. Hence, we decompose net investment in land into land purchases (LAND_PURC) and land sales (LAND_SALE) and use the same specification as in the baseline case for estimation. Table 7 shows the results.

(Table 7)

With LAND_PURC as a dependent variable, we still find that LP_GROWTH takes an insignificant coefficient. In contrast, the variable takes a positive and significant coefficient in the LAND_SALE estimation, indicating that a 1 percentage point increase in the growth rate of land prices corresponds to a 0.01 percentage point increase in the land sales ratio. Actually, this positive coefficient is inconsistent with the predictions based on the collateral channel hypothesis and the intertemporal demand substitution hypothesis. As for the other explanatory variables, the SALES_GROWTH, CAP, ROA, and LIQUID ASSET coefficients take opposite signs in the LAND_PURC versus LAND_SALE estimations, although some of them are insignificant. Since land purchase and land sales contribute to net land investment in the opposite directions, the signs of these estimated coefficients indicate that an increase in any one of the above variables raises net land investment through increased land purchases and decreased land sales. The only exception is the coefficient of lnASSET, which is positive and significant in both LAND_PURC and LAND_SALE estimations. The result indicates that large firms purchase and sell land at the same time more frequently than small firms do.

6.5 Additional estimations for land purchases and land sales

The results for each of the land purchase and sale estimations in Section 6.4 show that the signs of the LP_GROWTH coefficients are not consistent with the prediction based on our benchmark model in Section 2. The coefficient on LP_GROWTH in the LAND_SALE estimation, in particular, is contrary to what the collateral theory and the intertemporal demand substitution theory predict. In the following additional estimations, we investigate the source of the discrepancies between the theoretical predictions and empirical results.

First, we construct another LP_GROWTH set with different definitions, as we did in Section 6.3, employing different assumptions on the formation of firms' land price expectations as well as the time horizon of their expectations. Table 8(a) shows the results where LP_GROWTH variables with longer time horizons of two, three, four, and five years are employed. For LAND_SALE estimations, the coefficients of LP_GROWTH become smaller and gradually insignificant for longer horizons. For LAND_PURC estimations, the coefficients are insignificant and negative for all horizons as in Section 6.4. We then assume lagged expectation formation, instead, for different time horizons, from two to five years. Table 8(b) shows the results where LP_GROWTH is employed with land prices lagged back to t – 2, t – 3, t – 4, and t – 5. For all the different time horizons in the LAND_SALE estimations, the coefficients of LP_GROWTH are positive and significant, although they are substantially smaller than those in Section 6.4. On the other hand, the coefficients of LP_GROWTH become marginally significant and positive for all horizons in the LAND_PURC estimations, unlike the results in Section 6.4. Note, however, that the coefficients of the variable are still insignificant for net land investment estimations for LAND since the positive coefficients of LP_GROWTH in both purchase and sale estimations cancel out each other (results not presented).

(Table 8(a) and (b))

Second, we divide the sample by the number of establishments for a firm. The primary purpose is to control for the possible measurement error of LP_GROWTH, but we have another motivation as well—to examine the different impacts of firm size on the firms' response to land price growth. Table 9 shows the results. For single-establishment firms, the coefficients of LP_GROWTH are positive but insignificant in both LAND_PURC and LAND_SALE estimations. In contrast, for multiple-establishment firms, the coefficient on LP_GROWTH is significantly positive in the LAND_SALE estimation but insignificant in the LAND_PURC estimation. Although the possibility of measurement error needs to be further examined, these results indicate that not only does the amount of land sales and purchases increase for relatively larger firms but they are also more procyclical with respect to land prices in their tendency to sell their land than are smaller firms. Therefore, the greater the decline in land prices, the lower the amount of their land sales.

(Table 9)

Third, we introduce an additional explanatory variable that represents the extent of a firm's exposure to land price volatility. We employ the variable LAR to represent firms' exposure to land price fluctuations. We introduce LAR as one of the explanatory variables and the interaction term with LP_GROWTH to detect the impact of firms' exposure to land on the LP_GROWTH coefficient. Table 10 shows the results. For the LAND_SALE estimations, we find that the LP_GROWTH coefficient remains positive and significant and that the LAR coefficient is insignificant. We also find that the coefficient of the interaction term LAR*LP_GROWTH is positive and significant, indicating that land sales of firms with large exposure to land assets are less sensitive to prices. We also find, for the LAND_PURC estimation, that the coefficients of LP_GROWTH, LAR, and their interaction term are all insignificant.

(Table 10)

Fourth, we add another explanatory variable that measures the extent of a firm's exposure to land price volatility in a different manner. We do this by summarizing the share of land purchased during the bubble and the period shortly after its burst to the total land holdings at the start of the sample period, in 1997 (B_PURCHASE_R). Table 11 shows the results. Note that the number of observations is substantially smaller than in the previous tables since many observations include no information on land acquisition during and after the bubble period. For the LAND_SALE estimation, we find that the coefficient of B_PURCHASE_R is negative and significant. This indicates that land sales reduce in the face of decreasing land price for firms that acquired land when its price was very high.

(Table 11)

7. Conclusion

In this paper, we studied the relationships between real estate prices and firms' investment behavior, focusing on real estate and other fixed tangible assets. After presenting benchmark theoretical predictions on the impact of real estate prices and firms' investment of different types, we find the following empirical regularities. First, the total fixed tangible asset investment is positively associated with the growth rate of land prices. In contrast, contrary to the prediction, land investment has no statistically significant relationship with land price growth. These statistical regularities are qualitatively the same in a number of robustness checks, including alternative specifications for land price expectations, subsample analyses, and introduction of additional variables. Second, land sales are positively associated with the growth rate of land prices but the statistical association between land purchase and price is tenuous at best. Additional analyses show that for firms with multiple establishments and firms that acquired land during the bubble and the period shortly after the bubble, the amount of land sales tend to reduce.

Although we need to further investigate the reasons for the positive association between land price growth and land sales among firms, one possible interpretation is provided by Geltner (2014). He assumes that potential sellers among property owners sell their land only when the current price exceeds their reservation price. Hence, property owners could be reluctant to sell land in the face of a stagnating real estate market, probably causing a “lock-in” of real estate properties among firms. The simple statistics presented in Figure 1 based on the Basic Surveys of Corporate Land Ownership by MLIT indicate that the ratio of unused land among firms has increased over the 10 years between 1998 and 2008. This is consistent with the conjecture that lands that are locked in after the bubble burst are less likely to be used for production, and more likely to remain unused.

(Figure 1)

Several issues remain to be further examined. First, we need to focus not only on the amount of investment but also on the loan amount in order to scrutinize the function of the collateral channel of real estate prices. Since BSBSA contains data on firms’ debt or loan amount, we could include it as another dependent variable in the estimation. Second, the sample period may be extended to include the late 1980s and early 1990s, when the Japanese real estate market experienced a massive price increase, if we could access different data sources. By analyzing the periods of real estate price increase as well as decrease, we could comprehensively understand the interaction between real estate prices and firm behavior. Third, the assumption of exogenous real estate prices in the empirical model should be modified by introducing instruments. Possible candidates for these instruments include changes in land-use regulations and variations in the ratio of developable land across regions as employed in Saiz (2010). Finally, since the current theoretical model failed to explain the positive association between real estate prices and firms’ land sales behavior, we need to improve it to be more consistent with the empirical regularities we have found in the analysis. A related issue is to consider introducing the supply side in the model and examine the characteristics of general equilibrium. For example, it may be worth introducing farmers in the model as potential suppliers of land to firms.[8] We will deal with these issues in the near future in order to improve the quality of the paper and derive more meaningful policy implications.

[8] Note, however, that farmers play a quantitatively minor role in supplying land to firms in Japan. The surveys by the Ministry of Agriculture, Forestry, and Fisheries (Survey on Land Ownership Transfer and Rent and Survey on Land Management Analysis) show that the amount of farmland converted for industrial use was only 43 square kilometers at its highest level (in 1995) and has declined ever since.

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Table 1 (a) Summary statistics for variables employed in the estimation

Variable	N	Mean	Sd	Min	P25	P50	P75	Max
All								
LAND	26,993	0.003	0.057	-0.461	0.000	0.000	0.000	0.554
FIXED	26,993	0.129	0.178	0.000	0.024	0.071	0.160	1.750
LAND_PURC	26,993	0.010	0.048	0.000	0.000	0.000	0.000	0.627
LAND_SALE	26,993	0.007	0.033	0.000	0.000	0.000	0.000	0.461
LP_GROWTH	26,993	-0.031	0.062	-0.203	-0.067	-0.041	-0.014	0.277
SALES_GROWTH	26,993	0.021	0.336	-0.903	-0.051	0.005	0.067	41.943
CAP	26,993	0.160	0.209	-4.261	0.036	0.091	0.220	10.690
ROA	26,993	0.032	0.070	-8.020	0.009	0.026	0.052	0.691
LIQUID_ASSET	26,993	0.554	0.194	-0.005	0.426	0.565	0.694	0.995
lnASSET	26,993	9.291	1.341	5.389	8.377	9.124	9.987	16.467
ASSET	26,993	46779	280262	219	4340	9171	21755	14200000
lnEST	26,993	1.883	1.232	0.000	1.099	1.946	2.639	7.750
EST	26,993	16.102	48.957	1.000	3.000	7.000	14.000	2321.000
LAR	26,840	4.061	10.798	0.000	0.351	0.871	2.572	147.791

Table 1 (b) Number of observations by year

Year	Freq.	Percent
1997	4,152	15.38
1998	3,729	13.81
1999	679	2.52
2000	353	1.31
2001	1,755	6.5
2002	3,349	12.41
2003	2,902	10.75
2004	3,176	11.77
2005	3,431	12.71
2006	3,467	12.84
Total	26,993	100

Table 1 (c) Number of observations by industry

	Freq.	Percent
Agriculture, Forestry and Fisheries	11	0.04
Mining	54	0.2
Construction	459	1.7
Manufacturing	14,091	52.25
Wholesale	6,306	23.34
Retailing	2,994	11.08
Eating and Drinking	187	0.69
Finance and insurance	84	0.31
Real estate	55	0.2
Transporting and communication	121	0.45
Electricity, gas, and water	243	0.9
Service	1,358	5.03
Others	1,030	3.81
Total	26,993	100

Table 2 Baseline estimation for LAND and FIXED

OLS						
Dependent variable	LAND			FIXED		
	Coef.		se.	Coef.		se.
LP_GROWTH	-0.0077		0.0087	0.0615	**	0.0252
SALES_GROWTH	0.0029		0.0018	0.024		0.0167
CAP	0.0032		0.0022	0.0288	***	0.0106
ROA	0.0432	**	0.0212	0.2095		0.1466
LIQUID_ASSET	0.0067	***	0.0022	0.1158	***	0.0092
lnASSET	0.0002		0.0003	0.0108	***	0.0009
1997	0		.	0		.
1998	-0.0001		0.0013	-0.001		0.0046
1999	-0.0009		0.0025	-0.0265	***	0.0075
2000	-0.0025		0.0036	-0.0089		0.0109
2001	-0.0021		0.002	-0.0226	***	0.0054
2002	-0.0046	***	0.0014	-0.0274	***	0.0055
2003	-0.0023	*	0.0013	-0.0431	***	0.0046
2004	-0.0046	***	0.0013	-0.04	***	0.005
2005	-0.0042	***	0.0014	-0.0275	***	0.0054
2006	-0.0035	**	0.0017	-0.024	***	0.0063
Cons	0.0584	**	0.0264	0.0024		0.0392
Industry dummy	Yes			Yes		
Prefecture dummy	Yes			Yes		
R-squared	0.009			0.053		
F	3.059			20.629		
Prob > F	0			0		
N	26,993			26,993		

Table 3(a) Estimations for LAND and FIXED with different horizons for predicted land price growth (forward)

OLS																
LP_GROWTH	2 years forward				3 years forward				4 years forward				5 years forward			
Dependent variable	LAND		FIXED		LAND		FIXED		LAND		FIXED		LAND		FIXED	
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0051	0.0033	0.0182 *	0.0094	-0.0032	0.0022	0.012 *	0.0067	-0.0024	0.0018	0.009	0.0056	-0.0018	0.0018	0.0051	0.0052
SALES_GROWTH	0.003	0.0019	0.024	0.0167	0.003	0.0019	0.0241	0.0167	0.003	0.0019	0.0241	0.0167	0.003	0.0019	0.024	0.0167
CAP	0.0035	0.0022	0.0296 ***	0.0106	0.0035	0.0022	0.0296 ***	0.0106	0.0036	0.0022	0.0296 ***	0.0107	0.0036	0.0022	0.0294 ***	0.0107
ROA	0.0435 **	0.0213	0.2108	0.1469	0.0435 **	0.0213	0.2107	0.1469	0.0436 **	0.0213	0.2106	0.1469	0.0436 **	0.0213	0.2106	0.1469
LIQUID_ASSET	0.0067 ***	0.0022	0.1182 ***	0.0092	0.0067 ***	0.0022	0.1182 ***	0.0092	0.0067 ***	0.0022	0.1182 ***	0.0092	0.0067 ***	0.0022	0.1183 ***	0.0092
lnASSET	0.0003	0.0003	0.0106 ***	0.0009	0.0003	0.0003	0.0106 ***	0.0009	0.0003	0.0003	0.0107 ***	0.0009	0.0002	0.0003	0.0107 ***	0.0009
1997	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.
1998	0.0003	0.0013	-0.0021	0.0046	0.0003	0.0013	-0.0023	0.0046	0.0004	0.0013	-0.0026	0.0046	0.0004	0.0013	-0.0024	0.0046
1999	-0.001	0.0026	-0.0265 ***	0.0074	-0.0009	0.0026	-0.0269 ***	0.0074	-0.0008	0.0026	-0.0269 ***	0.0074	-0.0009	0.0026	-0.0267 ***	0.0074
2000	-0.0053 *	0.003	-0.0093	0.0111	-0.0053 *	0.003	-0.0094	0.0111	-0.0053 *	0.003	-0.0094	0.0111	-0.0054 *	0.003	-0.0092	0.0111
2001	-0.0015	0.002	-0.0243 ***	0.0053	-0.0015	0.002	-0.0244 ***	0.0053	-0.0015	0.002	-0.0244 ***	0.0053	-0.0015	0.002	-0.0243 ***	0.0054
2002	-0.0041 ***	0.0014	-0.0285 ***	0.0055	-0.004 ***	0.0014	-0.0289 ***	0.0055	-0.0039 ***	0.0014	-0.0293 ***	0.0055	-0.0037 ***	0.0014	-0.0294 ***	0.0055
2003	-0.0018	0.0013	-0.044 ***	0.0046	-0.0016	0.0014	-0.0446 ***	0.0047	-0.0013	0.0014	-0.0456 ***	0.0048	-0.0012	0.0015	-0.0453 ***	0.005
2004	-0.0038 ***	0.0014	-0.0414 ***	0.0051	-0.0035 **	0.0015	-0.0428 ***	0.0053	-0.0033 **	0.0016	-0.0435 ***	0.0055	-0.0036 **	0.0015	-0.0417 ***	0.0053
2005	-0.0035 **	0.0016	-0.0288 ***	0.0057	-0.0033 *	0.0017	-0.0296 ***	0.006	-0.0036 **	0.0016	-0.0284 ***	0.0057	-0.004 ***	0.0015	-0.0264 ***	0.0055
2006	-0.0025	0.0018	-0.0234 ***	0.0066	-0.0031 *	0.0017	-0.0217 ***	0.0063	-0.0034 **	0.0016	-0.0204 ***	0.0061	-0.0036 **	0.0016	-0.0193 ***	0.006
Cons	0.0578 **	0.0263	0.0005	0.0393	0.0578 **	0.0263	0.0008	0.0393	0.0577 **	0.0264	0.001	0.0393	0.0578 **	0.0264	-0.0001	0.0392
Industry dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.009		0.054		0.009		0.054		0.009		0.054		0.009		0.053	
F	3.13		20.74		3.13		20.74		3.13		20.73		3.11		20.70	
Prob > F	0		0		0		0		0		0		0		0	
N	27019		27019		27019		27019		27019		27019		27019		27019	

Table 3(b) Estimations for LAND and FIXED with different horizons for predicted land price growth (lagged)

OLS																
LP_GROWTH	2 years backward				3 years backward				4 years backward				5 years backward			
Dependent variable	LAND		FIXED		LAND		FIXED		LAND		FIXED		LAND		FIXED	
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	0.0009	0.0037	0.0319 ***	0.0119	0.0004	0.0025	0.028 ***	0.0085	0.0006	0.0021	0.025 ***	0.0071	0.0001	0.002	0.022 ***	0.0063
SALES_GROWTH	0.003	0.0019	0.0241	0.0166	0.003	0.0019	0.0241	0.0166	0.003	0.0019	0.0242	0.0166	0.003	0.0019	0.0241	0.0166
CAP	0.0037 *	0.0022	0.0298 ***	0.0107	0.0037 *	0.0022	0.0299 ***	0.0107	0.0037 *	0.0022	0.0298 ***	0.0107	0.0037 *	0.0022	0.0299 ***	0.0107
ROA	0.0435 **	0.0213	0.2104	0.1468	0.0435 **	0.0213	0.2103	0.1468	0.0435 **	0.0213	0.2104	0.1468	0.0435 **	0.0213	0.2105	0.1469
LIQUID_ASSET	0.0066 ***	0.0022	0.1183 ***	0.0092	0.0066 ***	0.0022	0.1183 ***	0.0092	0.0066 ***	0.0022	0.1184 ***	0.0092	0.0066 ***	0.0022	0.1184 ***	0.0092
lnASSET	0.0002	0.0003	0.0107 ***	0.0009	0.0002	0.0003	0.0108 ***	0.0009	0.0002	0.0003	0.0108 ***	0.0009	0.0002	0.0003	0.0108 ***	0.0009
1997	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.
1998	0.0003	0.0013	-0.0047	0.0046	0.0003	0.0013	-0.0043	0.0046	0.0003	0.0013	-0.0044	0.0046	0.0004	0.0013	-0.0036	0.0046
1999	-0.001	0.0026	-0.0295 ***	0.0075	-0.001	0.0026	-0.0301 ***	0.0075	-0.001	0.0026	-0.0302 ***	0.0075	-0.0009	0.0026	-0.0297 ***	0.0075
2000	-0.0055 *	0.003	-0.011	0.0111	-0.0055 *	0.0031	-0.0125	0.0112	-0.0055 *	0.0031	-0.0131	0.0112	-0.0055 *	0.0031	-0.0123	0.0112
2001	-0.0017	0.002	-0.026 ***	0.0054	-0.0017	0.002	-0.027 ***	0.0054	-0.0018	0.002	-0.0282 ***	0.0055	-0.0017	0.002	-0.028 ***	0.0055
2002	-0.0042 ***	0.0014	-0.0315 ***	0.0056	-0.0042 ***	0.0014	-0.0321 ***	0.0056	-0.0043 ***	0.0014	-0.033 ***	0.0057	-0.0042 ***	0.0015	-0.0331 ***	0.0057
2003	-0.002	0.0014	-0.0468 ***	0.0048	-0.002	0.0014	-0.0477 ***	0.0048	-0.0021	0.0014	-0.0483 ***	0.0049	-0.002	0.0014	-0.0481 ***	0.0048
2004	-0.0044 ***	0.0014	-0.0427 ***	0.0051	-0.0044 ***	0.0014	-0.0443 ***	0.0052	-0.0044 ***	0.0014	-0.0452 ***	0.0053	-0.0043 ***	0.0014	-0.0448 ***	0.0052
2005	-0.0047 ***	0.0015	-0.0284 ***	0.0055	-0.0047 ***	0.0015	-0.0294 ***	0.0056	-0.0047 ***	0.0015	-0.0309 ***	0.0057	-0.0046 ***	0.0015	-0.0306 ***	0.0056
2006	-0.0042 ***	0.0016	-0.0231 ***	0.0062	-0.0042 ***	0.0016	-0.0239 ***	0.0062	-0.0043 ***	0.0016	-0.0247 ***	0.0063	-0.0041 **	0.0017	-0.0249 ***	0.0063
Cons	0.0588 **	0.0264	0.004	0.0391	0.0587 **	0.0264	0.0059	0.0392	0.0589 **	0.0264	0.007	0.0393	0.0587 **	0.0264	0.0068	0.0393
Industry dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.009		0.054		0.009		0.054		0.009		0.054		0.009		0.054	
F	3.11		20.81		3.11		20.90		3.11		20.96		3.11		21.00	
Prob > F	0		0		0		0		0		0		0		0	
N	27019		27019		27019		27019		27019		27019		27019		27019	

Table 4 Estimation for LAND and FIXED by the number of establishments

OLS												
	All				# Establishment==1				# Establishment>=2			
Dependent variable	LAND		FIXED		LAND		FIXED		LAND		FIXED	
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0077	0.0087	0.0615 **	0.0252	0.0187	0.0334	0.1805 *	0.0986	-0.0088	0.0094	0.0513 *	0.0268
SALES_GROWTH	0.0029	0.0018	0.024	0.0167	-0.0019	0.0024	0.0282 **	0.0132	0.0036	0.0025	0.0235	0.0186
CAP	0.0032	0.0022	0.0288 ***	0.0106	0.0054	0.0034	-0.0085	0.0182	0.0022	0.0025	0.0395 ***	0.012
ROA	0.0432 **	0.0212	0.2095	0.1466	0.0327 ***	0.0114	0.3658 ***	0.0758	0.0441 *	0.0236	0.1887	0.1504
LIQUID_ASSET	0.0067 ***	0.0022	0.1158 ***	0.0092	0.0063	0.004	0.1313 ***	0.0204	0.0057 **	0.0026	0.1142 ***	0.0095
lnASSET	0.0002	0.0003	0.0108 ***	0.0009	0.0005	0.0006	0.0188 ***	0.0031	0.0001	0.0003	0.0105 ***	0.0009
1997	0	.	0	.	0	.	0	.	0	.	0	.
1998	-0.0001	0.0013	-0.001	0.0046	-0.0002	0.0031	-0.0105	0.012	-0.0001	0.0014	0.0006	0.005
1999	-0.0009	0.0025	-0.0265 ***	0.0075	0.0037	0.0058	-0.0474 ***	0.0171	-0.0019	0.0028	-0.0241 ***	0.0081
2000	-0.0025	0.0036	-0.0089	0.0109	-0.0055	0.0096	0.022	0.0352	-0.0022	0.0039	-0.0125	0.0114
2001	-0.0021	0.002	-0.0226 ***	0.0054	-0.0013	0.0034	-0.0054	0.0174	-0.0023	0.0022	-0.0246 ***	0.0056
2002	-0.0046 ***	0.0014	-0.0274 ***	0.0055	0.0021	0.0034	-0.0427 ***	0.012	-0.0059 ***	0.0015	-0.0228 ***	0.006
2003	-0.0023 *	0.0013	-0.0431 ***	0.0046	0.0006	0.003	-0.0415 ***	0.012	-0.0029 *	0.0015	-0.0411 ***	0.005
2004	-0.0046 ***	0.0013	-0.04 ***	0.005	-0.0022	0.0026	-0.0374 ***	0.0131	-0.0052 ***	0.0015	-0.0385 ***	0.0053
2005	-0.0042 ***	0.0014	-0.0275 ***	0.0054	0.0001	0.0028	-0.0289 **	0.0126	-0.0053 ***	0.0016	-0.0257 ***	0.0057
2006	-0.0035 **	0.0017	-0.024 ***	0.0063	-0.0028	0.0037	-0.0429 ***	0.0126	-0.0041 **	0.0019	-0.0193 ***	0.0068
Cons	0.0584 **	0.0264	0.0024	0.0392	-0.0057	0.0087	-0.0401	0.0486	0.0589 **	0.0264	0.007	0.0387
Industry dummy	Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.009		0.053		0.01		0.1		0.009		0.05	
F	3.059		20.629		0.948		8.807		2.967		16.761	
Prob > F	0		0		0.6023		0		0		0	
N	26,993		26,993		3,786		3,786		23,207		23,207	

Table 5 Estimation for LAND and FIXED including the variable on firms' exposure to land assets

OLS								
Dependent variable	LAND				FIXED			
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0077	0.0087	-0.0103	0.0087	0.0615 **	0.0252	0.0663 ***	0.0253
LAR			0.0000	0.0000			-0.0004 ***	0.0001
SALES_GROWTH	0.0029	0.0018	0.0031	0.002	0.024	0.0167	0.024	0.0167
CAP	0.0032	0.0022	0.0034	0.0022	0.0288 ***	0.0106	0.0283 ***	0.0105
ROA	0.0432 **	0.0212	0.044 **	0.0216	0.2095	0.1466	0.2058	0.1451
LIQUID_ASSET	0.0067 ***	0.0022	0.0068 ***	0.0023	0.1158 ***	0.0092	0.1118 ***	0.009
lnASSET	0.0002	0.0003	0.0003	0.0003	0.0108 ***	0.0009	0.0108 ***	0.0009
1997	0	.	0	.	0	.	0	.
1998	-0.0001	0.0013	0	0.0013	-0.001	0.0046	-0.0012	0.0046
1999	-0.0009	0.0025	-0.0004	0.0025	-0.0265 ***	0.0075	-0.0234 ***	0.0075
2000	-0.0025	0.0036	-0.0029	0.0032	-0.0089	0.0109	-0.0078	0.011
2001	-0.0021	0.002	-0.002	0.002	-0.0226 ***	0.0054	-0.023 ***	0.0054
2002	-0.0046 ***	0.0014	-0.0044 ***	0.0014	-0.0274 ***	0.0055	-0.0278 ***	0.0055
2003	-0.0023 *	0.0013	-0.002	0.0013	-0.0431 ***	0.0046	-0.0436 ***	0.0046
2004	-0.0046 ***	0.0013	-0.0044 ***	0.0013	-0.04 ***	0.005	-0.0416 ***	0.005
2005	-0.0042 ***	0.0014	-0.0039 ***	0.0014	-0.0275 ***	0.0054	-0.0286 ***	0.0054
2006	-0.0035 **	0.0017	-0.0031 *	0.0017	-0.024 ***	0.0063	-0.0252 ***	0.0063
Cons	0.0584 **	0.0264	0.0628 *	0.0326	0.0024	0.0392	0.0242	0.0513
Industry dummy	Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes	
R-squared	0.009		0.009		0.053		0.054	
F	3.06		2.93		20.63		20.66	
Prob > F	0		0		0		0	
N	26,993		26,840		26,993		26,840	

Table 6 Estimation for LAND and FIXED for different periods

OLS								
Dependent variable	LAND				FIXED			
	1997–2006		1997–2011		1997-2006		1997-2011	
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0077	0.0087	-0.0122 *	0.0064	0.0615 **	0.0252	-0.0022	0.0193
SALES_GROWTH	0.0029	0.0018	0.0036 *	0.0019	0.024	0.0167	0.0297 *	0.0169
CAP	0.0032	0.0022	0.0023	0.0019	0.0288 ***	0.0106	0.027 ***	0.008
ROA	0.0432 **	0.0212	0.0447 ***	0.0163	0.2095	0.1466	0.2592 **	0.1261
LIQUID_ASSET	0.0067 ***	0.0022	0.0066 ***	0.0017	0.1158 ***	0.0092	0.1263 ***	0.0082
lnASSET	0.0002	0.0003	0.0003	0.0002	0.0108 ***	0.0009	0.012 ***	0.0007
1997	0	.	0	.	0	.	0	.
1998	-0.0001	0.0013	0.0001	0.0013	-0.001	0.0046	-0.0023	0.0046
1999	-0.0009	0.0025	0	0.0025	-0.0265 ***	0.0075	-0.0252 ***	0.0075
2000	-0.0025	0.0036	-0.0047	0.0033	-0.0089	0.0109	-0.0069	0.011
2001	-0.0021	0.002	-0.002	0.002	-0.0226 ***	0.0054	-0.0233 ***	0.0054
2002	-0.0046 ***	0.0014	-0.0047 ***	0.0013	-0.0274 ***	0.0055	-0.0283 ***	0.0051
2003	-0.0023 *	0.0013	-0.0024 *	0.0013	-0.0431 ***	0.0046	-0.042 ***	0.0044
2004	-0.0046 ***	0.0013	-0.0047 ***	0.0013	-0.04 ***	0.005	-0.039 ***	0.0048
2005	-0.0042 ***	0.0014	-0.0041 ***	0.0014	-0.0275 ***	0.0054	-0.0248 ***	0.005
2006	-0.0035 **	0.0017	-0.0032 **	0.0016	-0.024 ***	0.0063	-0.0179 ***	0.0057
2007			-0.0045 ***	0.0016			-0.0112 *	0.006
2008			-0.002	0.0015			-0.0181 ***	0.0056
2009			-0.004 ***	0.0014			-0.0129 **	0.0058
2010			-0.0027 **	0.0012			-0.0408 ***	0.0051
2011			-0.0039 ***	0.0012			-0.0419 ***	0.0045
Cons	0.0584 **	0.0264	0.0365 *	0.0193	0.0024	0.0392	-0.0545 *	0.0305
Industry dummy	Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes	
R-squared	0.009		0.009		0.053		0.062	
F	3.06		3.67		20.63		32.16	
Prob > F	0		0		0		0	
N	26,993		41,841		26,993		41,841	

Table 7 Estimation for land purchases (LAND_PURC) and sales (LAND_SALE)

OLS						
Dependent variable	LAND		LAND_PURC		LAND_SALE	
	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0077	0.0087	0.005	0.0076	0.0126 **	0.005
SALES_GROWTH	0.0029	0.0018	0.0019	0.0013	-0.001	0.0007
CAP	0.0032	0.0022	0.0002	0.0016	-0.003 **	0.0013
ROA	0.0432 **	0.0212	0.0259 **	0.0125	-0.0174 *	0.009
LIQUID_ASSET	0.0067 ***	0.0022	0.0009	0.0017	-0.0058 ***	0.0014
lnASSET	0.0002	0.0003	0.0021 ***	0.0002	0.0019 ***	0.0002
1997	0	.	0	.	0	.
1998	-0.0001	0.0013	0.0001	0.0012	0.0002	0.0006
1999	-0.0009	0.0025	0.0009	0.0024	0.0018	0.0014
2000	-0.0025	0.0036	0.0011	0.003	0.0035	0.0022
2001	-0.0021	0.002	0.0034 *	0.0017	0.0054 ***	0.0012
2002	-0.0046 ***	0.0014	-0.004 ***	0.0011	0.0005	0.0008
2003	-0.0023 *	0.0013	-0.0025 **	0.0012	-0.0002	0.0008
2004	-0.0046 ***	0.0013	-0.0041 ***	0.0011	0.0005	0.0008
2005	-0.0042 ***	0.0014	-0.0029 **	0.0012	0.0013	0.0008
2006	-0.0035 **	0.0017	-0.0004	0.0014	0.0032 ***	0.001
Cons	0.0584 **	0.0264	0.0484 *	0.0257	-0.01 ***	0.0034
Industry dummy	Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes	
R-squared	0.009		0.013		0.015	
F	3.06		6.01		5.64	
Prob > F	0		0		0	
N	26,993		26,993		26,993	

Table 8(a) Estimations for LAND_PURC and LAND_SALE with different horizons for predicted land price growth (forward)

OLS																
LP_GROWTH	forward for 2 years				forward for 3 years				forward for 4 years				forward for 5 years			
Dependent variable	LAND_PURC		LAND_SALE		LAND_PURC		LAND_SALE		LAND_PURC		LAND_SALE		LAND_PURC		LAND_SALE	
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0002	0.0028	0.0049 **	0.002	-0.0008	0.0018	0.0024 *	0.0014	-0.0009	0.0015	0.0015	0.0011	-0.0007	0.0015	0.0011	0.001
SALES_GROWTH	0.002	0.0014	-0.001	0.0007	0.002	0.0014	-0.001	0.0006	0.002	0.0014	-0.001	0.0006	0.002	0.0014	-0.001	0.0006
CAP	0.0004	0.0016	-0.0031 **	0.0013	0.0004	0.0016	-0.0031 **	0.0013	0.0004	0.0016	-0.0032 **	0.0013	0.0004	0.0016	-0.0032 **	0.0013
ROA	0.0263 **	0.0127	-0.0172 *	0.0089	0.0263 **	0.0127	-0.0172 *	0.0089	0.0264 **	0.0127	-0.0172 *	0.0089	0.0264 **	0.0127	-0.0172 *	0.0089
LIQUID_ASSET	0.001	0.0017	-0.0057 ***	0.0014	0.001	0.0017	-0.0057 ***	0.0014	0.001	0.0017	-0.0057 ***	0.0014	0.001	0.0017	-0.0057 ***	0.0014
lnASSET	0.0021 ***	0.0002	0.0019 ***	0.0002	0.0021 ***	0.0002	0.0019 ***	0.0002	0.0021 ***	0.0002	0.0019 ***	0.0002	0.0021 ***	0.0002	0.0019 ***	0.0002
1997	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.
1998	0.0002	0.0011	0	0.0006	0.0002	0.0011	-0.0001	0.0006	0.0003	0.0011	-0.0001	0.0006	0.0003	0.0011	-0.0001	0.0006
1999	0.0017	0.0025	0.0026 *	0.0016	0.0017	0.0025	0.0025	0.0016	0.0017	0.0025	0.0025	0.0016	0.0017	0.0025	0.0026	0.0016
2000	-0.0027	0.0021	0.0026	0.0022	-0.0027	0.0021	0.0026	0.0022	-0.0027	0.0021	0.0026	0.0022	-0.0027	0.0021	0.0026	0.0022
2001	0.0035 **	0.0017	0.005 ***	0.0012	0.0035 **	0.0017	0.005 ***	0.0012	0.0036 **	0.0017	0.0051 ***	0.0012	0.0036 **	0.0017	0.005 ***	0.0012
2002	-0.0039 ***	0.0011	0.0002	0.0008	-0.0039 ***	0.0011	0.0001	0.0008	-0.0038 ***	0.0011	0.0001	0.0008	-0.0038 ***	0.0012	0	0.0008
2003	-0.0024 **	0.0011	-0.0006	0.0008	-0.0023 **	0.0012	-0.0007	0.0008	-0.0021 *	0.0012	-0.0008	0.0008	-0.0021 *	0.0013	-0.0009	0.0009
2004	-0.0039 ***	0.0011	0	0.0008	-0.0037 ***	0.0012	-0.0002	0.0009	-0.0035 ***	0.0013	-0.0002	0.0009	-0.0036 ***	0.0012	0	0.0009
2005	-0.0027 **	0.0013	0.0008	0.0009	-0.0025 *	0.0014	0.0008	0.001	-0.0024 *	0.0013	0.0012	0.0009	-0.0026 **	0.0012	0.0015 *	0.0009
2006	0.0003	0.0015	0.0028 ***	0.0011	0.0005	0.0014	0.0036 ***	0.001	0.0005	0.0013	0.0039 ***	0.001	0.0004	0.0013	0.004 ***	0.001
Cons	0.048 *	0.0257	-0.0098 ***	0.0034	0.0478 *	0.0257	-0.0099 ***	0.0034	0.0477 *	0.0257	-0.01 ***	0.0034	0.0477 *	0.0257	-0.0101 ***	0.0034
Industry dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.013		0.014		0.013		0.014		0.013		0.014		0.013		0.014	
F	6.03		5.49		6.03		5.48		6.04		5.47		6.03		5.48	
Prob > F	0		0		0		0		0		0		0		0	
N	27,019		27,019		27,019		27,019		27,019		27,019		27,019		27,019	

Table 8(b) Estimations for LAND_PURC and LAND_SALE with different horizons for predicted land price growth (lagged)

OLS																
LP_GROWTH	2 years backward				3 years backward				4 years backward				5 years backward			
Dependent variable	LAND_PURC		LAND_SALE		LAND_PURC		LAND_SALE		LAND_PURC		LAND_SALE		LAND_PURC		LAND_SALE	
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	0.0056 *	0.0032	0.0047 **	0.0021	0.004 *	0.0022	0.0036 **	0.0014	0.0032 *	0.0018	0.0026 **	0.0012	0.0028 *	0.0017	0.0027 **	0.0012
SALES_GROWTH	0.002	0.0014	-0.001	0.0007	0.0021	0.0014	-0.001	0.0007	0.0021	0.0014	-0.001	0.0007	0.002	0.0014	-0.001	0.0007
CAP	0.0005	0.0016	-0.0031 **	0.0013	0.0005	0.0016	-0.0031 **	0.0013	0.0005	0.0016	-0.0032 **	0.0013	0.0005	0.0016	-0.0031 **	0.0013
ROA	0.0262 **	0.0127	-0.0172 *	0.0089	0.0262 **	0.0127	-0.0172 *	0.0089	0.0262 **	0.0127	-0.0172 *	0.0089	0.0263 **	0.0127	-0.0172 *	0.0089
LIQUID_ASSET	0.001	0.0017	-0.0057 ***	0.0014	0.001	0.0017	-0.0056 ***	0.0014	0.001	0.0017	-0.0056 ***	0.0014	0.001	0.0017	-0.0056 ***	0.0014
lnASSET	0.0021 ***	0.0002	0.0019 ***	0.0002	0.0021 ***	0.0002	0.0019 ***	0.0002	0.0021 ***	0.0002	0.0019 ***	0.0002	0.0021 ***	0.0002	0.0019 ***	0.0002
1997	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.
1998	-0.0001	0.0012	-0.0004	0.0007	0	0.0012	-0.0003	0.0006	0	0.0012	-0.0003	0.0007	0.0001	0.0011	-0.0002	0.0006
1999	0.0011	0.0025	0.0022	0.0016	0.0012	0.0025	0.0021	0.0016	0.0012	0.0025	0.0022	0.0016	0.0013	0.0025	0.0022	0.0016
2000	-0.0031	0.0022	0.0024	0.0022	-0.0032	0.0022	0.0023	0.0022	-0.0033	0.0022	0.0023	0.0022	-0.0032	0.0022	0.0023	0.0022
2001	0.0031 *	0.0017	0.0048 ***	0.0012	0.003 *	0.0017	0.0048 ***	0.0012	0.0029 *	0.0018	0.0047 ***	0.0012	0.003 *	0.0018	0.0047 ***	0.0012
2002	-0.0045 ***	0.0012	-0.0003	0.0008	-0.0045 ***	0.0012	-0.0003	0.0008	-0.0045 ***	0.0012	-0.0003	0.0008	-0.0045 ***	0.0012	-0.0004	0.0008
2003	-0.003 **	0.0012	-0.001	0.0008	-0.003 **	0.0012	-0.001	0.0008	-0.003 **	0.0012	-0.001	0.0008	-0.003 **	0.0012	-0.001	0.0008
2004	-0.0044 ***	0.0011	0	0.0008	-0.0045 ***	0.0012	-0.0002	0.0008	-0.0046 ***	0.0012	-0.0001	0.0008	-0.0045 ***	0.0012	-0.0002	0.0008
2005	-0.0034 ***	0.0012	0.0013	0.0009	-0.0034 ***	0.0012	0.0012	0.0009	-0.0036 ***	0.0012	0.0012	0.0009	-0.0035 ***	0.0012	0.0011	0.0009
2006	-0.0007	0.0013	0.0036 ***	0.001	-0.0006	0.0013	0.0036 ***	0.0009	-0.0006	0.0013	0.0036 ***	0.001	-0.0006	0.0014	0.0035 ***	0.001
Cons	0.0491 *	0.0257	-0.0097 ***	0.0034	0.0492 *	0.0257	-0.0095 ***	0.0034	0.0492 *	0.0257	-0.0096 ***	0.0034	0.0492 *	0.0257	-0.0095 ***	0.0034
Industry dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.013		0.014		0.013		0.014		0.013		0.014		0.013		0.014	
F	6.02		5.48		6.02		5.48		6.02		5.48		6.02		5.48	
Prob > F	0		0		0		0		0		0		0		0	
N	27,019		27,019		27,019		27,019		27,019		27,019		27,019		27,019	

Table 9 Estimation for LAND_PURC and LAND_SALE by the number of establishments

OLS																		
	All						# Establishment=1						# Establishment>=2					
Dependent variable	LAND		LAND_PURC		LAND_SALE		LAND		LAND_PURC		LAND_SALE		LAND		LAND_PURC		LAND_SALE	
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0077	0.0087	0.005	0.0076	0.0126 **	0.005	0.0187	0.0334	0.02	0.0235	0.0013	0.0254	-0.0088	0.0094	0.005	0.0083	0.0138 ***	0.0052
SALES_GROWTH	0.0029	0.0018	0.0019	0.0013	-0.001	0.0007	-0.0019	0.0024	-0.0015	0.0016	0.0004	0.0023	0.0036	0.0025	0.0024	0.0018	-0.0012	0.0008
CAP	0.0032	0.0022	0.0002	0.0016	-0.003 **	0.0013	0.0054	0.0034	0	0.0019	-0.0054 *	0.003	0.0022	0.0025	-0.0002	0.002	-0.0024 *	0.0013
ROA	0.0432 **	0.0212	0.0259 **	0.0125	-0.0174 *	0.009	0.0327 ***	0.0114	0.016 *	0.0082	-0.0167 **	0.0079	0.0441 *	0.0236	0.0269 *	0.0142	-0.0171 *	0.0097
LIQUID_ASSET	0.0067 ***	0.0022	0.0009	0.0017	-0.0058 ***	0.0014	0.0063	0.004	0.0028	0.003	-0.0035	0.0029	0.0057 **	0.0026	-0.0007	0.002	-0.0064 ***	0.0016
lnASSET	0.0002	0.0003	0.0021 ***	0.0002	0.0019 ***	0.0002	0.0005	0.0006	0.0013 ***	0.0004	0.0009 *	0.0005	0.0001	0.0003	0.0021 ***	0.0003	0.002 ***	0.0002
1997	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.
1998	-0.0001	0.0013	0.0001	0.0012	0.0002	0.0006	-0.0002	0.0031	0.0004	0.0024	0.0007	0.002	-0.0001	0.0014	0	0.0013	0.0001	0.0006
1999	-0.0009	0.0025	0.0009	0.0024	0.0018	0.0014	0.0037	0.0058	0.0008	0.0055	-0.0028	0.0019	-0.0019	0.0028	0.0005	0.0027	0.0024	0.0016
2000	-0.0025	0.0036	0.0011	0.003	0.0035	0.0022	-0.0055	0.0096	-0.0007	0.0038	0.0048	0.0088	-0.0022	0.0039	0.0011	0.0033	0.0033	0.0023
2001	-0.0021	0.002	0.0034 *	0.0017	0.0054 ***	0.0012	-0.0013	0.0034	-0.0027	0.0028	-0.0014	0.0019	-0.0023	0.0022	0.0041 **	0.0019	0.0063 ***	0.0013
2002	-0.0046 ***	0.0014	-0.004 ***	0.0011	0.0005	0.0008	0.0021	0.0034	0.0004	0.0027	-0.0017	0.0021	-0.0059 ***	0.0015	-0.0049 ***	0.0013	0.0009	0.0008
2003	-0.0023 *	0.0013	-0.0025 **	0.0012	-0.0002	0.0008	0.0006	0.003	-0.0018	0.0022	-0.0024	0.0021	-0.0029 *	0.0015	-0.0027 **	0.0013	0.0002	0.0008
2004	-0.0046 ***	0.0013	-0.0041 ***	0.0011	0.0005	0.0008	-0.0022	0.0026	-0.0038 **	0.0018	-0.0016	0.0019	-0.0052 ***	0.0015	-0.0044 ***	0.0013	0.0009	0.0008
2005	-0.0042 ***	0.0014	-0.0029 **	0.0012	0.0013	0.0008	0.0001	0.0028	-0.0017	0.0023	-0.0018	0.0016	-0.0053 ***	0.0016	-0.0035 **	0.0014	0.0018 **	0.0009
2006	-0.0035 **	0.0017	-0.0004	0.0014	0.0032 ***	0.001	-0.0028	0.0037	0.0006	0.0029	0.0034	0.0026	-0.0041 **	0.0019	-0.001	0.0016	0.0031 ***	0.0011
Cons	0.0584 **	0.0264	0.0484 *	0.0257	-0.01 ***	0.0034	-0.0057	0.0087	-0.0089	0.0064	-0.0032	0.0056	0.0589 **	0.0264	0.0494 *	0.0257	-0.0094 ***	0.0036
Industry dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.009		0.013		0.015		0.01		0.012		0.011		0.009		0.013		0.014	
F	3.06		6.01		5.64		0.95		1.13		1.09		2.97		5.01		4.76	
Prob > F	0		0		0		0.60		0.21		0.28		0		0		0	
N	26,993		26,993		26,993		3,786		3,786		3,786		23,207		23,207		23,207	

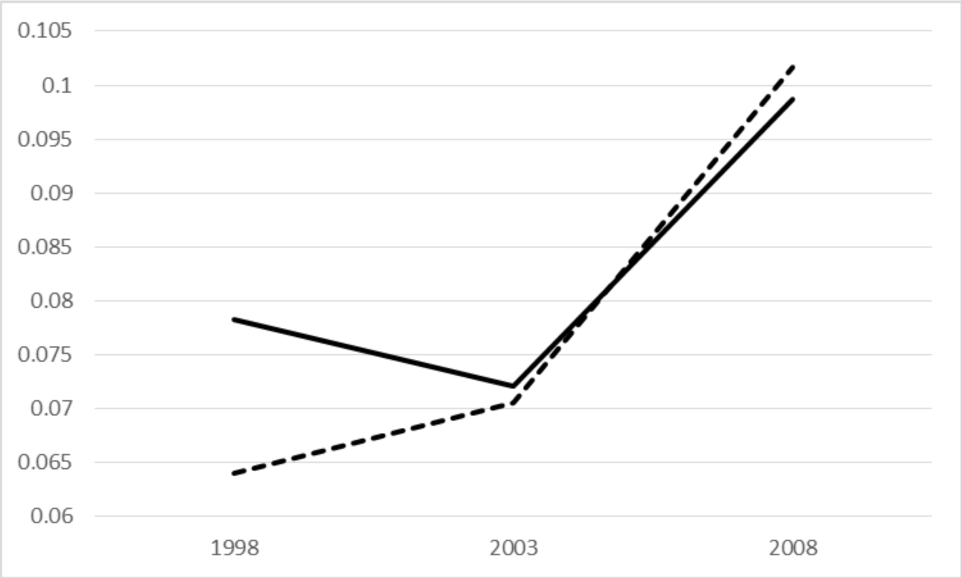
Table 10 Estimation for LAND_PURC and LAND_SALE including the variable on the firms' exposure to land assets

OLS																		
Dependent variable	LAND						LAND_PURC						LAND_SALE					
	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.	Coef.	se.
LP_GROWTH	-0.0077	0.0087	-0.0103	0.0087	-0.0138	0.0095	0.005	0.0076	0.0041	0.0076	0.0037	0.0083	0.0126 **	0.005	0.0144 ***	0.005	0.0175 ***	0.0055
LAR			4.0E-05	3.8E-05	4.4E-05	3.8E-05			1.9E-05	3.6E-05	-2.1E-05	2.2E-05			-2.4E-05	2.2E-05	-2.7E-05	2.2E-05
LAR*LP_GROWTH					0.0005	0.0005					0.0001	0.0004					-0.0004 *	0.0002
SALES_GROWTH	0.0029	0.0018	0.0031	0.002	0.0031	0.002	0.0019	0.0013	0.0021	0.0014	0.0021	0.0014	-0.001	0.0007	-0.001	0.0007	-0.001	0.0007
CAP	0.0032	0.0022	0.0034	0.0022	0.0034	0.0022	0.0002	0.0016	0.0002	0.0016	0.0002	0.0016	-0.003 **	0.0013	-0.0031 **	0.0013	-0.0031 **	0.0013
ROA	0.0432 **	0.0212	0.044 **	0.0216	0.0439 **	0.0216	0.0259 **	0.0125	0.0266 **	0.0129	0.0266 **	0.0129	-0.0174 *	0.009	-0.0174 *	0.009	-0.0174 *	0.009
LIQUID_ASSET	0.0067 ***	0.0022	0.0068 ***	0.0023	0.0068 ***	0.0022	0.0009	0.0017	0.0007	0.0018	0.0007	0.0018	-0.0058 ***	0.0014	-0.0061 ***	0.0014	-0.0061 ***	0.0014
lnASSET	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0021 ***	0.0002	0.0022 ***	0.0002	0.0022 ***	0.0002	0.0019 ***	0.0002	0.0019 ***	0.0002	0.0019 ***	0.0002
1997	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.	0	.
1998	-0.0001	0.0013	0	0.0013	0	0.0013	0.0001	0.0012	0.0003	0.0012	0.0003	0.0012	0.0002	0.0006	0.0002	0.0006	0.0003	0.0006
1999	-0.0009	0.0025	-0.0004	0.0025	-0.0004	0.0025	0.0009	0.0024	0.0012	0.0025	0.0012	0.0025	0.0018	0.0014	0.0015	0.0014	0.0016	0.0014
2000	-0.0025	0.0036	-0.0029	0.0032	-0.003	0.0032	0.0011	0.003	-0.0006	0.0027	-0.0006	0.0027	0.0035	0.0022	0.0023	0.002	0.0024	0.002
2001	-0.0021	0.002	-0.002	0.002	-0.0021	0.002	0.0034 *	0.0017	0.0032 *	0.0017	0.0032 *	0.0017	0.0054 ***	0.0012	0.0052 ***	0.0012	0.0053 ***	0.0012
2002	-0.0046 ***	0.0014	-0.0044 ***	0.0014	-0.0044 ***	0.0014	-0.004 ***	0.0011	-0.0039 ***	0.0011	-0.0039 ***	0.0011	0.0005	0.0008	0.0005	0.0008	0.0006	0.0008
2003	-0.0023 *	0.0013	-0.002	0.0013	-0.002	0.0014	-0.0025 **	0.0012	-0.0023 *	0.0012	-0.0023 *	0.0012	-0.0002	0.0008	-0.0003	0.0008	-0.0002	0.0008
2004	-0.0046 ***	0.0013	-0.0044 ***	0.0013	-0.0045 ***	0.0013	-0.0041 ***	0.0011	-0.0039 ***	0.0011	-0.0039 ***	0.0011	0.0005	0.0008	0.0005	0.0008	0.0005	0.0008
2005	-0.0042 ***	0.0014	-0.0039 ***	0.0014	-0.0039 ***	0.0014	-0.0029 **	0.0012	-0.0027 **	0.0012	-0.0027 **	0.0012	0.0013	0.0008	0.0012	0.0008	0.0012	0.0008
2006	-0.0035 **	0.0017	-0.0031 *	0.0017	-0.0031 *	0.0017	-0.0004	0.0014	-0.0002	0.0014	-0.0002	0.0014	0.0032 ***	0.001	0.0029 ***	0.001	0.0029 ***	0.001
Cons	0.0584 **	0.0264	0.0628 *	0.0326	0.063 *	0.0327	0.0484 *	0.0257	0.052	0.0323	0.052	0.0323	-0.01 ***	0.0034	-0.0108 ***	0.0027	-0.011 ***	0.0027
Industry dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummy	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
R-squared	0.009		0.009		0.009		0.013		0.013		0.013		0.015		0.015		0.015	
F	3.06		2.93		2.92		6.01		5.91		5.85		5.64		6.16		6.35	
Prob > F	0		0		0		0		0		0		0		0		0	
N	26,993		26,840		26,840		26,993		26,840		26,840		26,993		26,840		26,840	

Table 11 Estimation for LAND_PURC and LAND_SALE including the variable on the share of land purchased during and shortly after the bubble

OLS									
Dependent variable	LAND			LAND_PURC			LAND_SALE		
	Coef.		se.	Coef.		se.	Coef.		se.
LP_GROWTH	-0.002		0.0122	0.0194	*	0.0106	0.0214	***	0.0074
B_PURCHASE_R	0.0000		0.0000	0.0000		0.0000	-0.000006	***	0.0000
B_PURCHASE_R*LP_GROWTH									
SALES_GROWTH	0.002		0.0017	0.0014		0.0013	-0.0007		0.0005
CAP	-0.0036	*	0.0022	-0.0037	*	0.002	-0.0001		0.0011
ROA	0.1199	***	0.0125	0.0699	***	0.0105	-0.05	***	0.0071
LIQUID_ASSET	0.0069	**	0.0029	0.0005		0.0023	-0.0064	***	0.0019
lnASSET	-0.0001		0.0003	0.0016	***	0.0003	0.0018	***	0.0002
1997	0		.	0		.	0		.
1998	-0.0001		0.0016	0.0003		0.0014	0.0004		0.0008
1999	-0.0007		0.0034	0.0023		0.0034	0.003		0.002
2000	-0.0007		0.0041	-0.0027		0.0038	-0.002		0.0017
2001	-0.0024		0.0027	0.0044	**	0.0022	0.0068	***	0.0017
2002	-0.0072	***	0.0016	-0.0062	***	0.0014	0.001		0.0009
2003	-0.0042	**	0.0017	-0.0033	**	0.0015	0.0009		0.001
2004	-0.0074	***	0.0017	-0.0059	***	0.0014	0.0015		0.001
2005	-0.0096	***	0.0018	-0.0073	***	0.0014	0.0023	**	0.0012
2006	-0.0073	***	0.002	-0.0034	**	0.0016	0.0039	***	0.0013
Industry dummies	Yes			Yes			Yes		
Prefecture dummies	Yes			Yes			Yes		
R-squared	0.014			0.018			0.018		
F	3.487556			4.55364			5.360767		
Prob > F	0			0			0		
N	15526			15526			15526		

Figure 1 Ratio of unused land to total land owned by firms



Note: Bold line is for all the sample firms and dotted line is for firms with 300+ regular workers.

Source: Basic Survey of Corporate Land Ownership by the Ministry of Land, Infrastructure, Transportation, and Tourism.