Should We Fear an Adverse Collateral Effect on Investment in China?

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Yongheng Deng
Institute of Real Estate Studies
NUS Business School and School of Design and Environment
National University of Singapore
ydeng@nus.edu.sg

Joseph Gyourko
The Wharton School, University of Pennsylvania and NBER
gyourko@wharton.upenn.edu

Jing Wu
Department of Construction Management, Tsinghua University
and Institute of Real Estate Studies, National University of Singapore
ireswujing@tsinghua.edu.cn

Abstract

Working with unique data on land values in 35 major Chinese markets and a panel of firms outside the real estate industry, we estimate standard investment equations that yield no evidence of a collateral channel effect. This is markedly different from previous work on the United States and Japan which finds economically large impacts. One reason for this appears to be that some of the most dominant firms in China are state-owned enterprises (SOEs) which are unconstrained in the sense that they do not need to rely on rising underlying property collateral values to obtain all the financing necessary to carry out their desired investment programs. However, we also find no collateral channel effect for non-SOEs when we perform our analysis on disaggregated sets of firms. Norms and regulation in the Chinese capital markets and banking sector can account for why there is no collateral channel effect operating among these firms. We caution that our results do not mean that there will be no negative fallout from a potential real estate bust on the Chinese economy. There are good reasons to believe there would be, just not through a collateral channel effect.

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I. Introduction

In a world without complete contracting, economists long have known that pledging collateral such as owned real estate can allow firms to borrow more, and thus, to invest more (Barro, 1976; Stiglitz and Weiss, 1981; Hart and Moore, 1994). Macroeconomists quickly recognized the implication this insight had for amplifying the business cycle via a so-called "collateral channel" effect (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997). Essentially, falling asset values reduce the debt capacity of credit constrained firms, which depresses their investment on the downside of the cycle. An analogous positive impact occurs on the upside of the cycle when collateral values are increasing for these firms. Bernanke (1983) concludes that this effect helps account for the extraordinarily large variation in output during America's Great Depression. Gan (2007a, b) argues that Japan's cycle also was amplified by a collateral channel effect due to its great property market boom and bust a couple of decades ago.

More recent research finds important collateral channel effects among U.S. firms. Using data from 1993-2007 on a large panel of firms, Chaney, et. al. (2011) report that a $1 increase in real estate collateral value raises investment by 6 cents. This is large economically, as it implies that a one standard deviation increase in underlying collateral value is associated with over one-quarter of a standard deviation increase in corporate investment. Cvijanovic (2011), who also works with recent U.S. firm data, reports large collateral channel effects. Increases in collateral value are associated with materially higher firm leverage, lower debt costs, and greater investment and equity payouts.

Given China's growing importance in the world economy and the fact that it has experienced a huge property market boom in recent years, this body of work naturally raises the question of whether there are similar impacts in that country. Data limitations are a key reason

this issue has not yet been addressed. It requires high quality information on both firms and property market values. One of the contributions of this paper is to amass two unique data sets with which to analyze the issue.

The first is a panel of 444 firms from outside the real estate industry that were continuously listed on the Shanghai and Shenzhen exchanges between 2003-2011. Standard accounting variables typically used in corporate finance research were collected from Wind Info, which provides the equivalent of Compustat data on Chinese publicly listed firms. We then manually collected and merged information on firms' real estate assets from their annual financial reports. Market values of their property holdings were recovered via procedures described more fully below. This provides us a unique data set on listed firms' real estate asset holdings in China.

The second component of our data is a panel on constant quality land prices across 35 major Chinese cities from 2003-2011. This series is constructed from sales of vacant land by local governments to residential property developers and builds on previous work we have done (Deng, Gyourko and Wu, 2012). This is the first such series available for such a wide cross section of Chinese markets. As is discussed below, we believe this series is far superior to the other available sources on property values—namely, house price data reported by the Chinese government. Land is the residual claimant on property value and it, not structure value, is what changes over time. Hence, it is preferable to measure land values directly. In addition, we are able to control for quality changes over time, while the official sources are not.

We combine these data sources to provide the first estimate of the impact of changing real estate collateral values on the investment and spending behavior of Chinese firms. In stark contrast to the recent findings referenced above on American corporations, we find no evidence

of a collateral channel effect in China. The typical concern when running investment equations of the type done by us and others in this literature is that the estimates are biased upward because of endogeneity concerns that are discussed more fully below. Hence, it is highly unlikely that our results are being driven by standard econometric concerns about this type of work. Noisy data can explain statistically insignificant results, but our estimate is a fairly precise 'zero', so it does not appear that defects in our new data series are responsible for our key conclusion either.

We argue that the nature of some Chinese firms, as well as financial market norms and regulation, largely account for there being no collateral channel effect. Theory tells us that there should be no collateral channel effect unless firms are financially constrained. State-owned enterprises, which tend to be the largest firms in China, are widely alleged to have special relationships with the government-controlled banks (e.g., see Lin and Tan, 1999; Allen, Qian and Qian, 2005; Poncet, Steingress and Vandenbussche, 2010), so these firms should be unconstrained financially. Essentially, they do not need to rely on rising collateral values to get all the funds they need. When we disaggregate by type of firm, the behavior of state-owned enterprises never is affected by the value of their real estate. However, we typically do not find an economically or statistically meaningful collateral effect for non-state owned enterprises either. Here, we suspect that norms and conditions in the Chinese lending markets help explain this outcome. Purely private Chinese firms generally find it very difficult to renegotiate loan terms or get new loans under broader bank quotas even if the underlying collateral value changes. This cuts off the initial impetus for a collateral channel effect.

In sum, we conclude that China is different from the U.S. and Japan, and that there is no material collateral channel effect generated by the changing fortunes of its property market. That said, we emphasize that this does not mean that a significant real estate downturn would not

harm the Chinese economy. It almost certainly would, just not through the collateral channel. The real estate industry constitutes a very large share in China's national GDP growth, up to 12% according to some estimates.[1] Thus, the sector is a large employer in its own right and a major demander of raw and processed materials from other sectors of the economy. There also could be a meaningful wealth effect on consumption, especially since many purchases of housing units in China have been speculative in nature in the sense the buyer does not occupy the unit.[2] Hence, the direct and indirect impacts could be large, even without a collateral channel effect amplifying the cycle via firm investment behavior.

The plan of the paper is as follows. The next section describes the unique real estate and firm data we bring to bear in our estimation of the collateral channel effect. Section III then discusses our estimation strategy and reports results. There is a brief conclusion.

II. Data

We bring two new data sources to bear on the question of whether there is a collateral channel effect on Chinese firm investment. Both are unique to the study of the Chinese economy. The first is a panel on land prices across 35 Chinese cities, and the second is a panel on firms not directly involved in the real estate industry. The remainder of this section describes each in detail.

II.A. Land Value Data

Our land price series is based on sales of raw land by local governments, and is described more fully in Deng, Gyourko and Wu (2012). While raw land sales are only very rarely

[1] According to the estimates by Deng, et. al. (2011), the contribution of real estate-related industries to China's GDP growth hovered between 6-10% over the past decade, and peaked at 12.6% in 2009.
[2] See Gan (2010) for a recent analysis finding large wealth effects on consumption among Hong Kong households. We know of no similar studies for China.

observed in most countries, this is not the case in China. The Chinese government owns all the urban land in the country and allows private parties to purchase use rights, for up to 70 years for residential purposes (i.e., technically, this is a leasehold estate).[3] We treat the upfront lump sum payment as the transactions price for land because there are no further rental payments required. A 2002 ruling by the Ministry of Land and Resources required local governments to sell land via some type of public auction process and to publicly report the winning bidder along with the transactions price.[4] Because of this new process, these prices can reasonably be treated as free market values. We also typically observe the land parcel's precise address, designated usage, land conditions upon delivery, and certain planning indicators such as the floor-to-area ratio.

Building upon prior research on the city of Beijing in Wu, Gyourko and Deng (2012), we worked with a leading residential real estate data vendor in China (Soufun) to collect data on all residential usage land sales to private parties in 35 major markets from 2003-2011. Figure 1 maps the cities covered. The geographic breadth of cities in our sample is noteworthy. We are not limited to a few coastal-region markets that allegedly had the biggest booms. Table 1 reports summary statistics on the sample. We have complete data dating back to 2003 for 15 markets, with the rest entering the sample in subsequent years. The number of transactions per market ranges from 25-50 depending upon the year.

[3] Firms can still use a leasehold estate as collateral when borrowing. That is, the leasehold of the collateral properties can and will be transferred to the lender if the borrower defaults. For example, 15 of the 16 commercial banks listed in Shanghai or Shenzhen regularly release the value and breakdown of repossessed assets they seized from defaulted loans. At the end of 2010, the total book value of their repossessed assets was 14.85 billion yuan RMB, of which properties accounted for 11.89 billion, or 80.10%, with the rest from equipment and plants, securities, etc.

[4] Prior to this ruling called the 11th Provision, most transactions of urban land parcels were done by negotiation between a developer and a local government. This process was criticized for being opaque and open to corruption. For our purposes, the prices that resulted seem likely to be below free market levels, with the degree unknown and possibly changing over time depending upon local circumstances. Currently, all transactions must be done via public auctions, including regular English auctions (*pai mai)*, two-stage auctions (*gua pai)*, and sealed bids (*zhao biao*). See Cai, Henderson and Zhang (2009) for a comparison of these three types of auctions.

Figure 2 plots the percentage change in land prices for our 35 markets in constant 2009 yuan. These reflect changes in constant quality prices arising from a city-level hedonic equation of the following form that was estimated via ordinary least squares.[5] The log of real transactions price is the dependent variable. Quality controls on the right-hand side include: (a) the parcel's distance to the center of the corresponding city, which is measured after mapping the precise location of each site with GIS software; (b) the distance to the nearest subway station; this variable is relevant in 10 of the 35 cities with operating subway systems during our sample period; (c) district dummies which control for local/neighborhood-level fixed effects not captured by the two previous location controls; (d) a set of physical attributes including the size of the parcel (in land area), the density permitted on the site when built, and whether the parcel is leveled on delivery; (e) in some cases, a small portion of a residential land parcel is designated for affiliated commercial properties, public establishments, or public housing units; we control for such conditions via a set of dummies; (f) the parcel's transaction form as reflected in whether it was purchased via sealed bidding, regular English auction, or two-stage auction; and (g) year dummies, whose coefficients are used to create the constant quality price index.[6]

There clearly is substantial volatility in land price appreciation across and within cities over time. Many cities, not just the big east coast region markets of Beijing, Shanghai and Shenzhen, have experienced considerable booms and busts in land values over time. Table 2, which is taken from Deng, Gyourko and Wu (2012), reports summary statistics on average

[5] We also conducted a two-stage Heckman estimation to control for potential bias arising from the fact that there were a total of 614 parcels listed that failed to result in transactions (either because there were no bidders if there was an auction or the bid prices were lower than the local governments' reserve prices, which is relevant for cases involving sealed bids). If these failures are disproportionately concentrated in certain periods such as the financial crisis, selection bias would result in an overestimation of the price index for that period. That said, we could not find any statistically significant impact for the inverse Mills ratio estimated from our first-stage probit model.

[6] Our land price hedonic works well in each of the 35 cities. The city-level coefficients are almost always consistent with expectations, and the null that there is no explanatory power for our right-hand side variables always is easily rejected. See Deng, Gyourko and Wu (2012) for more on the hedonic model. All underlying results are available upon request.

annual land price growth over time. Table 3, also from Deng, Gyourko and Wu (2012), highlights that land values are much more volatile than house prices (and other factors of production in housing) as theory predicts for the residual claimant on property value. Standard deviations in land prices typically are in the 20%-40% range, which is about four times that of any other variable reported in Table 3.

It is the cross sectional and time series variation in these constant quality land price series which we use to impute the change in firms' collateral value.[7] While there clearly is substantial volatility in land values over time across markets, it also is the case that there has been strong trend growth in values. Deng, Gyourko and Wu (2012) report that compound real annual price appreciation has been over 20% for 11 of our 35 markets, with 16 of the remaining 24 cities having average compound annual growth rates between 10% and 20%. Hence, if Chinese firms are financially constrained and collateral value is important in obtaining the desired amount of debt, there has been a huge increase in those values over time on average, with substantial variation across markets.

We believe these data are far superior to any alternative, the most prominent of which are two government-provided series. One is called the Average Selling Price of Newly-Built Residential Index. This reports the simple average of transactions prices as measured by total sales values divided by the total amount of housing square footage permitted on the land. The other series, officially termed "Price Indices in 70 Large and Medium-Sized Cities", is a measure of the change in average prices on unit sales within individual housing complexes over time.

[7] We use residential land prices because it is not yet feasible to create an analogous index for commercial properties. Theory suggests these two series should be highly correlated, since land is substitutable between these two uses on the margin. As a robustness check, we calculated the correlation coefficient between the average transaction prices of newly-built residential buildings and commercial properties as reported by the National Bureau of Statistics of China in our 35 city sample. It was a strongly positive 0.64. Chaney, et. al. (2011) report similar findings in their robustness checks.

More specifically, this index is calculated by first computing the average sales price of new units each month in each distinct housing complex. The series reported by the government then is the transactions-volume weighted average of each complex's average price changes over time.

The first series makes no hedonic adjustments, so there is no attempt to control for quality differences across markets or drift over time. As our results and those of Wu, Deng and Liu (2011) show, not effectively controlling for quality leads to substantial biases.[8] As long as structure is in anything approaching elastic supply, it is land value that one wants to measure anyway. Deng, Gyourko and Wu (2012) and Wu, Deng and Liu (2011) also show that the second series results in downwardly biased estimates of price growth, with much lower volatility than exists in reality. Both sets of authors recommend a hedonic approach to control for quality changes over time, which is the procedure used here.[9]

II.A. Firm Data

We collected data on publicly-traded firms listed on the Shanghai or Shenzhen stock exchanges. There are 1,291 firms listed on or before 2003 on these two exchanges. We get to our final sample size of 444 firms as follows. First, we exclude firms delisted during or before 2011. We also drop those with measured negative equity and those involved in a major takeover operation during the sample period, as we suspect either data error or some other aspect of firm strategy is likely to complicate any potential relationship between real estate collateral value and investment and other spending behavior. Next, firms operating in the industries of "finance", "real estate", and "construction" are dropped because it seems likely that the relationship

[8] Average annual appreciation in our hedonic index is about five percentage points higher than in the unadjusted price series, which suggests that parcel quality has been falling over time on average. The declining quality of location with more sites being located in outlying areas as China has rapidly urbanized is an important factor, but this does vary by time and market to some extent. See Deng, Gyourko and Wu (2012) for more on this.

[9] More sophisticated repeat sales procedures such as those pioneered by Baily, Muth and Nourse (1963) and Case and Shiller (1987, 1989) are not feasible in China. The vast majority of its housing is new, so there are very few cases in which a unit has sold more than once. Hence, the older, but still reliable hedonic approach must be used for quality control purposes.

between firm investment behavior and real estate price fluctuations may be determined by a mechanism other than the collateral channel effect in these business sectors. Firms in the industries of "agriculture", "mining", "production and supply of electricity, gas and water" and "transportation and storage" also are excluded because they tend to own properties outside of urban areas, and we cannot impute property value price changes outside of the 35 major markets listed above. Thus, our final sample is restricted to firms in the industries of "manufacturing", "information technology", "wholesale and retail", "social service", and "media and culture".[10] We also restrict our focus to firms with headquarters in 35 major cities for which we have a reliable land price series that is used to impute the value of real estate collateral over time. This leaves us with a balanced panel of 444 firms with 3,996 firm-year observations during 2003-2011.

Determining the market value of these firms' real estate asset holdings obviously is a critical task for our estimation. The nature of Chinese accounting and reporting practices is such that three major categories of assets on the balance sheet are involved in constructing our measure. One is "Buildings" (a sub-entry of "Fixed Assets", the equivalent of "Property, Plant and Equipment" in China's accounting codes); a second is "Land Ownership" (a sub-entry of "Intangible Assets"); and the third is "Investment Properties". Table 4 provides more detail on related accounting codes, including a minor adjustment in 2007. Unfortunately, none of the available listed firm electronic databases in China presently provides full information on all three categories of property assets. Consequently, we manually collect this information from the original version of the firms' annual financial reports.

[10] According to the official industry codes issued by the China Security Regulatory Commission, there are also a few firms defined as in "Multiple Industries". These companies are grouped based on their largest sales sector.

While we believe this is the first systematic collection of non-real estate firms' property holdings, this is only the starting point for our analysis. As with the Compustat data on U.S. corporations, Chinese company financial reports include values based on historic cost, not current market values. We follow the procedures adopted by Chaney, et. al. (2011) to translate these book values into market values. From the financial reports, we know both the original book value and the current book value after depreciation. Then, following certain rules on depreciation, the average age of properties can be computed.[11] Finally, the book value is updated to the market value using the city-level residential land price index described above after 2003, a newly-built house price index between 2000 and 2002[12], and the city-level CPI index before 2000. Because we do not know the exact address of each property in a firm's portfolio, we follow Chaney, et. al. (2011) and Cvijanovic (2011) in presuming that a firm's properties are concentrated in the city of its headquarters.[13]

We next develop an estimate of annual change in value of firm real estate asset holdings. Our preferred measure is one that reflects changes in the market value over time of real estate assets owned by the firm in the reference year of 2002 at the very beginning of our sample period. Chaney, et. al. (2011) and Cvijanovic (2011) both do something similar to guard against bias arising from the potentially endogenous decisions of firms to alter real estate holdings in

[11] We use the following strategy to guide us in these calculations. If a firm explicitly describes its depreciation method in the appendix of its financial reports, we adopt that specific rule for that firm. Otherwise, we follow conventional rules on depreciation for China, which reflect an average of the different rules published by the listed firms in our sample: for the items of "Building" and "Investment Properties", it is assumed that the properties are straight-line depreciated with 25 years of depreciable life and 5% remains; for "Land Ownership", the corresponding assumption is straight-line depreciation method, 40 years of depreciable life, and 0 remains. Western readers may be surprised by the depreciation of land, but it does make sense because this technically is a leasehold estate position.

[12] This house price index is provided by Institute of Real Estate Studies at Tsinghua University.

[13] Both Chaney, et. al. (2011) and Cvijanovic (2011) investigate the robustness of this assumption using added information from firm 10-K filings. Unfortunately, similar documents and data are not available in China. We addressed the robustness of this assumption as follows. First, we pared down the sample to firms headquartered in the 32 cities outside of the three national financial centers of Beijing, Shanghai and Shenzhen on the presumption that firms located in the other 32 cities are less likely to be geographically dispersed in their business and, hence, real estate asset holdings. All our key results reported below still hold in this "geographically concentrated" group.

response to (or in conjunction with) market price changes. Thus, our collateral value measure is defined as:

$$RATIO\_REV1_{i,t} = [REV_{i,2002} \times \prod_{j=2003}^{t-1} (1 + LPG_{c,j}) \times LPG_{c,t}]/ASSET_{i,t-1}$$

where, $REV_{i,2002}$ is the market value of real estate assets owned by firm *i* at the end of 2002 computed based on the procedures described above, $LPG_{c,j}$ is the annual growth rate in the local land price index for firm *i*'s headquarters city *c* in year *j*, and $ASSET_{i,t-1}$ is the total assets of firm *i* at the beginning of year *t* (i.e., at the end of the previous year).

As part of our robustness checks described more fully below, we also used a second proxy, which measures the market value change in real estate assets held by the firm at the beginning of each year:

$$RATIO\_REV2_{i,t} = [REV_{i,t-1} \times LPG_{c,t}]/ASSET_{i,t-1}$$

where $REV_{i,t-1}$ is the market value of real estate assets owned by firm *i* at the beginning of year *t* (i.e., at the end of the previous year). We experiment with both measures because it is not obvious *a priori* what the optimal balance is between potential endogeneity bias and measurement error.

In addition to our measures of changes in underlying real estate collateral, we also use a number of variables describing other firm characteristics. As noted above, these are from Wind Info, which is a supplier of 'Compustat-type' data on Chinese companies.[14] These include the ratio of net investment on fixed assets (property, plant and equipment) to firm asset value (*RATIO_INV*), where the numerator is defined as expenditures on fixed assets less cash inflows from disposing of existing fixed assets over the year and the denominator reflects total assets at

[14] See their website at www.wind.com.cn for more detail.

the beginning of the relevant year (*ASSET*), *RATIO_LOAN* which is defined as the net change in loan balances scaled by firm assets, *RATIO_EBITDA*, which reflects earnings before interest tax, depreciation and amortization (again scaled by firm assets), *RATIO_CASH* which reflects the net change in cash holdings divided by assets, *RATIO_SALARY* which is defined as total salary payments divided by firm size, *RATIO_DIVIDEND*, which is total dividend payments scaled by firm assets, *RATIO_FAINV* which is the ratio of net investment on financial assets such as stocks and bonds to firm asset value, and *EMP*, which is the number of employee per million yuan of firm assets. Other variables include the market-to-book ratio (*MBR*) and leverage level at the beginning of the year (*LEVERAGE,* defined as total debt on the balance sheet divided by asset value), and the change in share of long-term loans (i.e., loans with the period of more than 1 year) in total loan balance during the year (*LONGLOAN*).

We also collected information on the total amount of government subsidies received by a firm during each year. This includes both explicit monetary subsidies and implicit subsidies from discounted tax rates. As with the other variables, this also is normalized by the total assets of the firm (*RATIO_SUBSIDY*). It serves as a proxy of government support in some of the robustness checks discussed below.

Table 5 reports the summary statistics on the variables, with each having been winsorized at the 5th percentile to eliminate extreme outliers in the data series. One noteworthy feature is the large magnitude of the annual market value change of the listed firms' real estate assets. On average, it is equivalent to about 6% of a firm's total assets if we only take properties owned in the reference year into account, and to about 7.5% if all real estate assets are included.[15]

[15] The fact that the average value of *RATIO_REV2* is larger than *RATIO_REV1* implies that the listed firms generally are expanding their real estate holdings over our sample period.

Table 6 then reports the number of firms in our sample broken down by whether or not they are state-owned enterprises (SOEs). This firm characteristic also comes from the Wind Info data source.[16] SOEs account for about three quarters of these 444 firms, although that proportion declines over time due to ongoing reforms within China. Table 7 then compares the values of these variables across the two types of firms. SOEs and non-SOEs differ in several aspects. SOEs tend to be much larger than non-SOEs. They also pay out more in salaries to their employees, but they are less profitable, pay fewer dividends, and have lower market-to-book ratios. However, both these groups experience almost the same degree of change in the market values of their real estate assets during the sample period. And, the difference in their fixed assets investment or borrowing characteristics also is statistically insignificant.

III. Empirical Implementation and Results

Chaney, et. al. (2012) provide an excellent derivation and description of a standard model of investment when a firm suffers from a binding financing constraint.[17] That model leads those authors (and others, including us, working in this literature) to reduced form investment equations of the following type:

(1) $RATIO\_INV_{i,c,t} = \alpha + \beta * RATIO\_REV_{i,t} + \gamma * LP_{c,t} + \delta_t + \eta_i + \varphi * OtherControls_{i,t} + \epsilon_{i,t}$,

where i indexes the firms, c denotes the city of their headquarters, and t reflects the year of the observation. *RATIO_INV* and *RATIO_REV* are as defined just above, *LP* is the land price index in the city where the firm is located, δ and η capture year and firm fixed effects, respectively, and *OtherControls* includes standard firm measures of leverage (total debt/asset value), market-to-

[16] More detailed information is available, as we can tell whether a SOE is directly controlled by the central government or by some type of sub-national government. See Deng, et. al. (2011) for more details on the distinction between these two groups. Because all our key conclusions are robust to this breakdown, we only report results for all SOEs versus non-SOEs.

[17] See their on-line appendix at www.princeton.edu/dsraer/theoryRE.pdf for this material.

book value and cash flow (EBITDA more specifically) used in these types of regressions. The investment and collateral value measures naturally are scaled to control for firm size differences.[18] Time and firm fixed effects are included so that identification effectively comes from variation over time within firm. One of the two real estate variables is the log of the land price index (*LP*) in the city where the firm is headquartered. This variable is intended to control for broader real estate market changes that could influence investment behavior independent of the value of an individual firm's collateral.

The coefficient of interest in this regression is β which captures how changes in the value of a firm's real estate collateral (*RATIO_REV*) affect investment (*RATIO_INV*). The underlying theory indicates that there is no reason to believe that β must be positive. For example, if firms were unconstrained financially in the sense that they were cash rich, or could always borrow as much as they needed to fund their desired investment programs, then changes in the value of their owned assets would not influence investment behavior. Naturally, the prediction is different for financially constrained firms that borrow some fraction of the collateral value of the assets they can pledge to lenders. For these firms, $\beta>0$. Overall, the estimate of β using a panel of firms reflects the combination of how many of them are financially constrained, how binding those constraints are, and how easy it is to pledge the underlying collateral to increase debt capacity (Chaney, et. al., 2011).

While it is fairly straightforward to generate a specification such as equation (1) from a simple model of investment with financial constraints, the challenge is obtaining unbiased

[18] Note that we use asset value in the denominator rather than the more typical measure in the literature of overall property, plant and equipment (which are called "fixed assets" in China) on the firm's balance sheet. This is due to the nature of the available Chinese balance sheet data. As depicted earlier in Table 4, part of a firm's real estate holdings are not included in the item "Fixed Asset" on its balance sheet. In particular, the 2007 adjustment of accounting codes separated the leased-out properties from "Fixed Asset", and put it as part of a new, independent item called "Investment Properties" on the balance sheet. This makes the fixed assets series inconsistent over our sample period. Hence, we scale by assets. The 2007 adjustment did not apply to the cash flow figures, so it does not affect our measure of *RATIO_INV*.

estimates of β. The typical worry is that OLS yields upwardly biased results on the collateral channel effect. Perhaps the most obvious reason is due to reverse causality. If a firm is large enough in its market, its own investment program might affect factor prices, including local land values. Similar effects could occur in markets in which multiple firms from the same industry co-locate. In this latter case, common shifts in investment patterns unrelated to collateral value well could be captured in the estimate of β from equation (1) if the firms' investment behavior bids up local land values. Upwardly biased estimates of β also would result if large land-holding firms are especially sensitive to local demand shocks (for whatever reason) and our real estate variables proxy for local demand to any significant extent.

The recent literature on collateral channel effects on U.S. corporate investment exploits differences in local market supply elasticity to deal with this bias (Chaney, et. al., 2011; Cvijanovic, 2011). The basic strategy is to instrument for real estate values using the interaction of a demand shifter (e.g., mortgage rates) with the local supply elasticity, along with firm and time fixed effects. The underlying logic is as follows. Demand shifters should show up in higher prices the more inelastic is local supply. If supply were perfectly elastic, prices should not change at all. The measure of supply elasticity (typically from Saiz (2010)) is based on fixed geographic factors such as the amount of water and the slopes of land plots in the market area, so it provides plausibly exogenous variation in real estate values due to changes in demand. As noted in the Introduction, that type of instrumental variables estimator yields economically large collateral channel effects on investment among U.S. corporations.

Unfortunately, there are no similarly high quality measures of local supply elasticity for our Chinese markets, so we cannot implement a similar strategy here. Hence, we begin by estimating a version of (1) that does not instrument for real estate value, keeping in mind that the

reported estimate of β is likely to be biased upward. That said, if we do not find a statistically and economically large collateral channel effect, we can be reasonably sure that it does not exist, as the biases from such a specification work in the direction of finding one.

Table 8 reports our baseline findings. The precise specification estimated is very similar to equation (1), except that it includes interaction terms of the initial firm controls with local land prices.[19] The first column reports estimates using the full sample of firms, regardless of type. The estimate of β on our measure of the real estate collateral variable, *RATIO_REV1*, is a very small and statistically insignificant 0.0045. Thus, there is no evidence of a collateral channel effect in the Chinese data, as firm investment behavior is uncorrelated with changes in the value of the real estate they own.

This average could be masking important heterogeneity across types of firms, as state-owned enterprises, which constitute the bulk of our firm sample well could be unconstrained. If so, they would not be expected to exhibit any collateral channel effect on their investment behavior. Hence, columns 2 and 3 of Table 8 report estimates of the same specification on subsamples of SOEs and non-SOEs. The results are not meaningfully different, and we cannot reliably discriminate between the coefficients across the two types of firms.

This conclusion about the absence of a collateral channel effect is robust to many alternative specifications investigated. For example, it could be that our desire to minimize upward bias due to endogeneity by measuring real estate exposure with the quantity of firm holdings at the end of 2002 ends up generating attenuation bias in our estimate of β because of

[19] This helps control for potential upward bias as discussed in Chaney, et. al. (2012). More specifically, upward bias in β might result from potential endogeneity arising from the decision to own real estate in the first place. If firms that are more likely to own real estate also are especially sensitive to local demand shocks, equation (1) will overestimate the collateral channel effect. Our inclusion of the firm traits and their interaction with local land prices helps control for any fixed firm-level correlation between investment and real estate values. We have no good instrument to deal with variation that may not be fixed, but this is not costly for us, as we do not find a meaningful collateral channel effect in any event.

measurement error. That this is not the case is evident from the fact that we obtain very similar results if we use *RATIO_REV2* instead of *RATIO_REV1* as our measure of real estate collateral, as illustrated in the top panel of Table 9. The estimates of β are now slightly negative, but they remain small in absolute value are not statistically different from the baseline estimates in Table 8.

We also investigated whether there were differences in the relationship between firm investment behavior and real estate collateral value depending upon whether the property market was improving or declining. The second panel of Table 9 reports results from adding an interaction term of *RATIO_REV1* with a dummy variable that takes a value of one if the relevant underlying land market was declining in value (i.e., *DECREASE*=1 if so, and =0 otherwise). There is no evidence of any important asymmetry in impacts on investment behavior, as the interaction term is never statistically significant at anything close to conventional confidence levels. While not reported here for space reasons, including this added term does not affect the coefficients on the other right-hand side regressors in any material way.

Another robustness check that was performed arose out of a concern that unobserved firm-level default risk could be biasing down our estimate of β. This could occur if the firms with the largest changes in real estate collateral value were also perceived by lenders as being very risky so that could not borrow to finance additional investment even in the face of rising property values. To investigate this, we began by estimating a corporate default risk instrument at the company level. We then included the inverse Mill's ratio from that corporate default model as proxy to control for unobserved heterogeneity in default risk in our investment equation. The appendix goes into the details behind the creation of this variable. The bottom panel of Table 9 reports estimates of our collateral channel effect when corporate default risk factor is

added to our baseline model. Note that there is virtually no change in the estimated impact for non-SOEs. That for SOEs does increase a bit, but it still remains immaterial in economic and statistical terms. Including added controls for potentially asymmetric collateral effects (as in the middle panel) does not the results. In sum, the absence of a collateral channel effect in China does not appear due to some type of specification bias arising from an omitted firm trait such as default risk.[20]

Our conclusion about there being no meaningful collateral channel effect are heightened by the fact that the standard errors about our estimates of β are small enough so that even the implied economic impact from a coefficient two standard deviations above the reported point estimate still is small. Returning to our baseline results in Table 8, if we consider the estimates for non-SOEs, the group of firms for which a sizeable collateral channel effect is most plausible, a coefficient of 0.0243, which is two standard deviations above the -0.0003 value reported in column 3 of Table 8, implies only six percent of a standard deviation increase in investment per dollar of assets among those firms. Given that virtually any endogeneity-driven bias arising from our simple OLS specification is to raise β above its true value, this implies a fairly tight estimate around zero for β and strongly suggests that there is no collateral channel effect operating among non-real estate firms in China.

The absence of any meaningful economic or statistical relationship between real estate collateral value and firm investment naturally raises the question of whether firms are even

[20] While our focus is on the estimate of β as a measure of the collateral channel effect, it is interesting it in own right that the estimated coefficient for corporate default risks associated with SOEs is positive and statistically significant (point estimate of 0.0426, with a standard error of 0.0131), but that for non-SOEs is not (point estimate of 0.0286, with as a standard error of 0.0202). We also estimated the analogous regression using borrowing as the dependent variable and found that riskier SOEs also borrowed more (but not riskier non-SOEs). Thus, this type of firm was allowed to borrow and invest more. It is possible that these firms are viewed as 'too big to fail', but that is the subject for another paper. More relevant for the present paper work is that there is no such effect for non-SOEs, which reinforces the point that these firms are financially constrained and that the absence of a collateral channel effect for them must be due to norms and regulation peculiar to the Chinese capital markets. Finally, including this default risk proxy did not materially change the coefficients on the other regressors.

borrowing more at all when real estate values are higher. Table 10 reports results using the annual change in total debt per dollar of asset value as the dependent variable for the full sample of firms and then the breakdowns for SOEs and non-SOEs. Here, we find that real estate collateral values are positively correlated with firm borrowing, but the impacts are small in both economic and statistical terms. On average, Chinese firms are neither borrowing nor investing more when owned property increases in value.

The results for SOEs are readily explainable in terms of their not being financially constrained. Indeed, one could interpret our findings for them as evidence in support of the claims by many that they are specially favored within the Chinese economy (e.g., see Lin and Tan (1999), Allen, Qian and Qian (2005), and Poncet, Steingress and Vandenbussche (2010)), and have no need to rely on increasing collateral value to secure financing. However, that cannot be the story for non-SOEs, who are much more likely to be financially constrained. Features of the Chinese banking system and capital markets can help account for the absence of a collateral channel effect for these firms. The aggregate volume of credit is tightly controlled in China, with the government often imposing quotas on lenders in different cities. Even if underlying collateral value owned by the firm increases, a binding quota implies that no further lending or borrowing can or will take place, as illustrated by Figure 3. Presume that the existing loan quota amount is given by L_1 in this figure. Even if a boom in the property markets leads to collateral values increasing from A to B, there can be no net increase in loans beyond L_1. Unless the loan quota is increased to L_2 as in this figure, there cannot be a collateral channel effect from rising property values.

Regulatory norms also could help explain why we do not observe a collateral channel effect among non-SOEs, even if loan quotas are not binding. Common practice in the Chinese

lending markets does not allow firms that experience positive appreciation on existing assets pledged as collateral against current loans to use that enhanced value to obtain new loans or better terms on the existing loans. This fixity in loan terms cuts off any possibility for a collateral channel effect.[21] Added properties could be used as collateral for additional debt, of course, but that is very different from being able to exploit increased value on existing assets.

The prospect of a binding loan quota constraint suggests that the best case for observing a collateral channel effect among non-SOEs would be in the recent 2009-2010 stimulus period, when those quotas were raised. In Figure 3, this would be the equivalent of raising the loan quota from L_1 to L_2. Tables 11 and 12 report regression results analogous to those in Tables 8 and 10, except that they include the interaction of our firm-level real estate collateral variable with a dummy for the stimulus period. Even in the stimulus period, Table 11's results show no evidence that non-SOEs were engaged in investment booms that are correlated with higher owned real estate values, and we know from Figure 2 that values were increasing markedly in most markets during this period. The same conclusion holds for SOEs, but that is to be expected given their likely unconstrained status.[22]

Interestingly, the results in column 3 of Table 12 do show a statistically significantly higher amount of borrowing by non-SOEs (but not SOEs, as expected) during the stimulus period that is associated with their appreciated real estate assets. The impact of higher collateral value during the stimulus period (which equals 0.0538 as the sum of -0.0243+0.0781) suggests

[21] In most cases, non-SOEs also cannot obtain better loan terms simply by prepaying their existing loans. There is no guarantee that private firms can get new (or more) loans after prepaying unless loan quota amounts have been relaxed. This is one reason the prepayment of corporate loans is rare in China, although there are no accurate statistics we could find on this issue (which is another indication of how rare this practice is).

[22] Another possibility is that non-SOEs operate in industries that the central or local governments want to discourage. In that case, it could be that they cannot expand for other regulatory reasons independent of the collateral channel effect. To investigate this, we collected data on the level of subsidy received by the firm, as described for the *RATIO_SUBSIDY* variable in the previous section. We found no evidence that non-SOE investment behavior varied by the degree of subsidy.

that a $1 increase in real estate collateral value will raise non-SOEs' loan balance by just over five cents, controlling for other factors. How large this is in economic terms can be seen via the following calculation. The standard deviations of *RATIO_REV1* and *RATIO_LOAN* for non-SOEs during the stimulus period are 0.144 and 0.079, respectively, which implies that a one standard deviation increase in collateral values is associated with about 10% of a standard deviation increase in loan balance (i.e., $0.144 \times 0.0538/0.079 \approx 0.0981$). While this is not zero, it also indicates that non-SOEs were not increasing overall leverage by huge amounts during the stimulus period because of rising underlying real estate collateral values.

If non-SOEs were borrowing a bit more, but not investing more in property, plant and equipment, what were they doing with the funds? Table 13 provides some answers. Six potential spending outcomes (other than fixed asset investments) are investigated. These include hiring more employees (*EMP*), increasing salary payments (*RATIO_SALARY*), expanding equity payouts (*RATIO_DIVIDEND*), investing in financial assets such as stocks or bonds (*RATIO_FAINV*), replacing short-term debt with long-term debt (*LONGLOAN*), or doing nothing but simply holding more cash (*RATIO_CASH*). The results show statistically significant correlations of increasing real estate collateral value during the stimulus period only with firm employment levels, with a marginally significant correlation with respect to adjusting debt structure to take on more longer-term loans. Cash holdings are also higher, but the point estimate of 0.0505 (column 1) only has a t-statistic of 1.5.

While statistically significant, the impact on employment is small in economic terms. A one standard deviation of increase in collateral value only results in about three percent of a standard deviation increase in employment ($0.144 \times 0.2275/0.987 \approx 0.0332$) for non-SOEs during the stimulus period. The case for adjusting debt structure is similar, as a one standard deviation

of increase in collateral value is associated with about seven percent of a standard deviation increase in increase of long-term debt share ($0.144 \times 0.0822/0.131 \approx 0.0726$).[23]

We cannot tell why non-SOEs did not 'splurge' more with their added debt, but it could be they understood the change was not sustainable. With the stimulus package, the Chinese government only temporarily relaxed the loan quota, but did not unfold any fundamental reform in the financial system which could be expected to systematically ease non-SOEs' access to bank loans over the long term. If the entrepreneurs running the non-SOEs expected the loan quota to decrease back to old levels after the stimulus (i.e., from L_2 to L_1 in terms of our Figure 3), it would be unwise of them to spend the added funds on 'irreversible' uses such as fixed assets or equity payouts.[24] Instead, they appear to have chosen to expand their business by hiring a few more employees and taken out a few more longer-term loans (and possibly increased cash reserves).

IV. Conclusions

Research in macroeconomics and financial economics reports substantial collateral channel effects on firm investment that amplified the business cycles of the United States and Japan. We provide the first analysis of whether something similar can be expected for China, which also has experienced an extraordinary property market boom that appears to have crested recently. Working with unique data on land values in 35 major Chinese markets and a panel of

[23] While not statistically significant even at the 10% level, the point estimates for cash reserves imply that a one standard deviation increase in real estate collateral value is associated with one-seventh of a standard deviation increase in cash holdings.

[24] This may be investing too much foresight and discipline in the non-SOE managements, but it is the case that the debt markets soon reverted back to their formerly difficult conditions for most purely private enterprises. Conditions became so constrained that the Chinese government has begun to seriously consider undertaking a major reform in China's financial system in early 2012 to provide more secure financing to these firms. See reports from the *Wall Street Journal* ("China Tests Financial Relaxation in Wenzhou", March 28, 2012; "Chinese Premier Blasts Banks", April 3, 2012) for examples of this.

firms outside the real estate industry, we estimate standard investment equations that yield no evidence of a collateral channel effect.

This is perhaps not surprising for state-owned enterprises which probably are not financially constrained in the sense required by the underlying theory for a collateral channel effect to operate. However, we also find no such effect for non-SOEs, so our average results are not masking important heterogeneity across different types of firms. Norms and regulation in the Chinese capital markets and banking sectors can explain why the collateral channel effect does not operate among these firms in China. Various robustness analyses that range from investigating whether there is an asymmetry in the effect based on whether property market prices are increasing or decreasing to whether there is specification error from omitted firm-level default risk confirm this conclusion.

While this indicates that a real estate bust in China is unlikely to cause a material decline in investment by non-real estate firms because of a decline in underlying property collateral values, this does not imply that a bust will not materially harm the economy. It could, and we strongly suspect it will. The direct impact of a major decline in property values on hiring in the construction industry and on demand for raw and processed materials is likely to be quite large, even without amplification from the collateral channel. More indirect impacts via a wealth effect on household consumption also could be important. However, we leave investigation of those potential mechanisms to future work.

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Figure 1: Land Market Dataset Coverage

Note: the cities are labeled by the starting year of the land data in the dataset.

Figure 2: Land Price Appreciation by Year, 35 Chinese Cities, 2003-2011

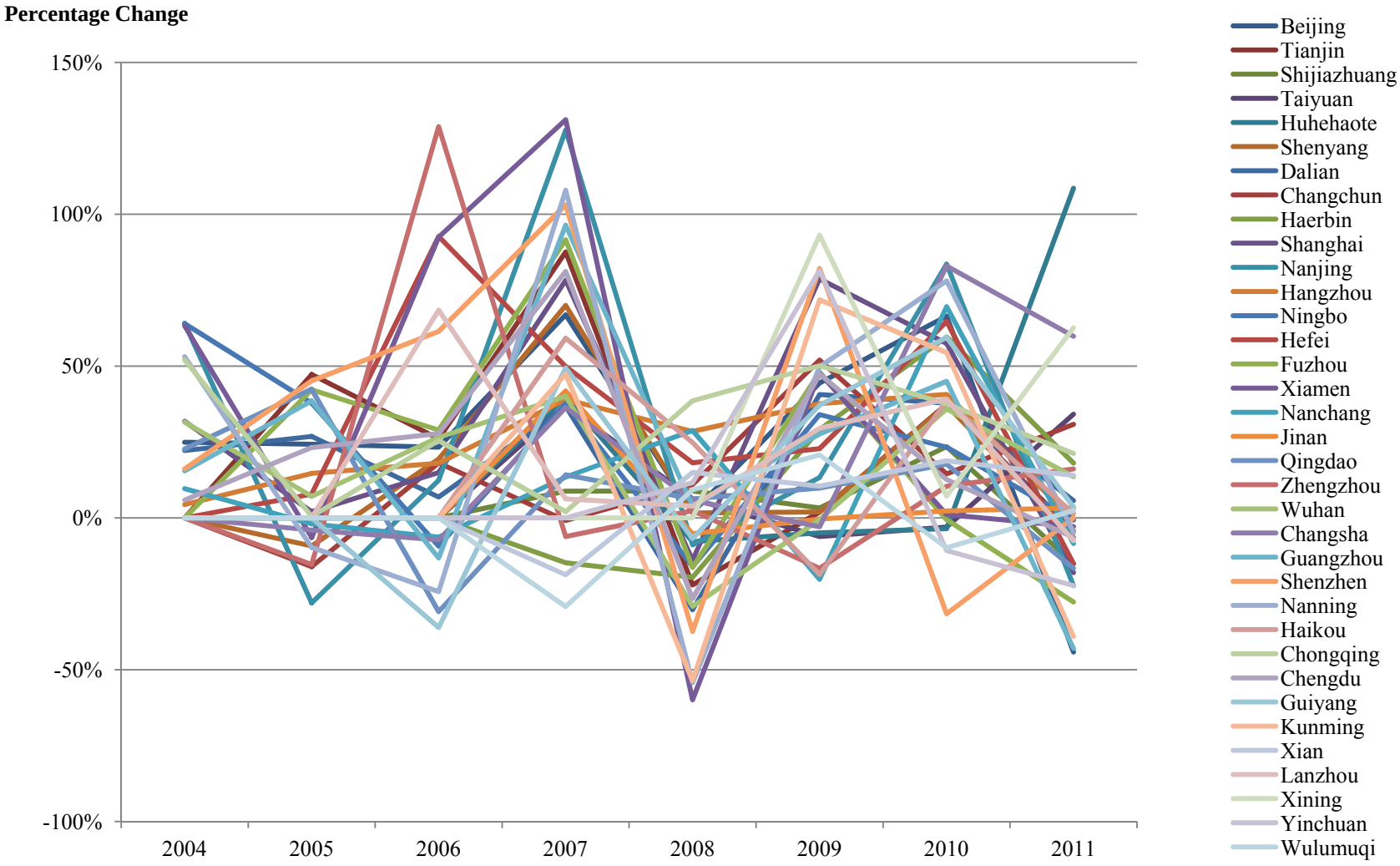

Figure 3: Loan Quotas and Collateral Channel Effects

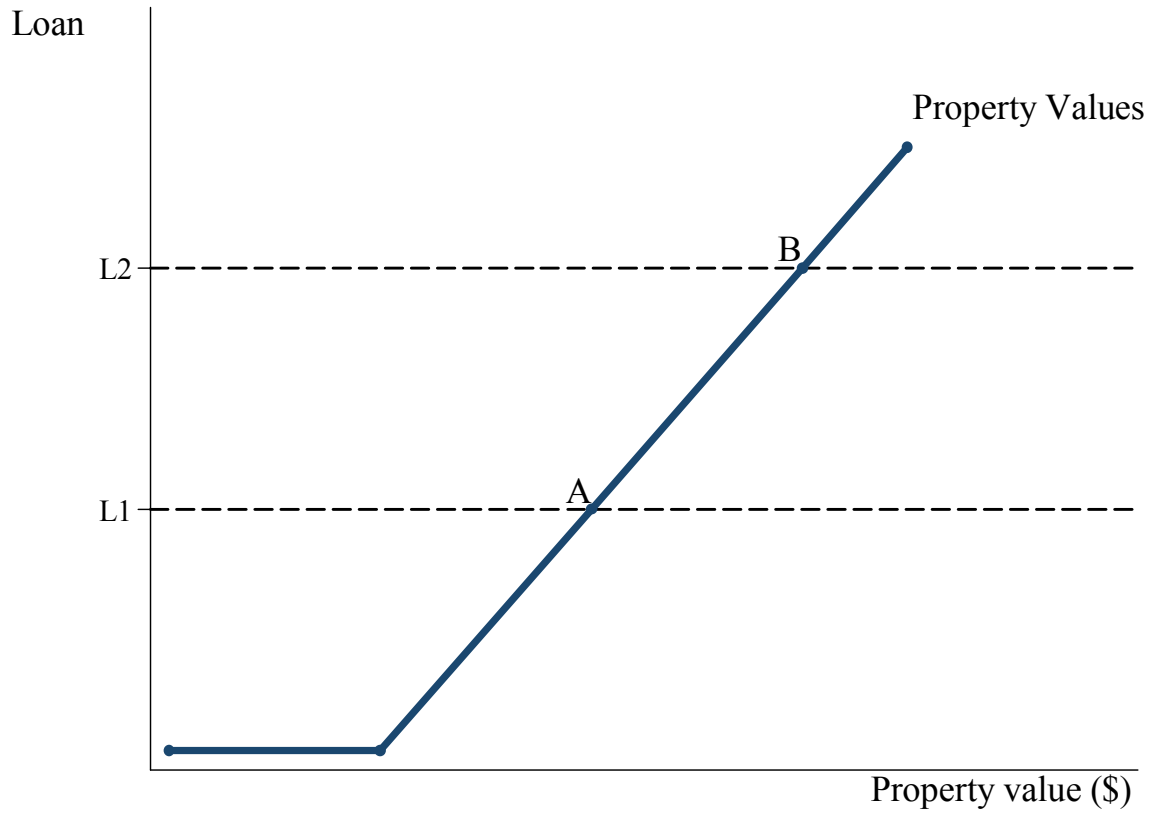

Table 1 Sample Volume of the Land Transaction Dataset

	Number of Cities Covered	Number of Land Parcels Sold
2003	15	378
2004	22	681
2005	24	773
2006	33	1133
2007	34	1413
2008	35	963
2009	35	1564
2010	35	1759
2011	35	1749
Aggregated	-	10413

Table 2: Annual Real Land Price Appreciation, Summary Statistics, 35 Major Chinese Markets

	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Mean	32.1%	12.2%	23.5%	46.4%	-5.3%	28.5%	31.4%	2.57%
Standard Deviation	21.7%	23.1%	40.5%	42.1%	24.0%	30.7%	29.4%	30.22%
Max	64.1%	47.2%	128.8%	131.2%	38.6%	93.1%	83.6%	108.58%
Min	4.4%	-28.0%	-36.1%	-29.2%	-59.9%	-20.2%	-31.6%	-44.2%
Number of Cities	15	22	24	33	34	35	35	35
Number with Positive Appreciation	15	15	17	28	18	27	29	16
Number with Negative Appreciation	0	7	7	5	16	8	6	19

Table 3: Average Annual Growth Rates and Standard Deviations, Land Prices, House Prices, Construction Costs and Wages

A. Mean of Annual Real Growth Rate

	2004	2005	2006	2007	2008	2009	2010	2011
House Price	4.14%	5.56%	6.72%	13.60%	8.18%	9.17%	23.31%	8.47%
Land Price	32.07%	12.22%	23.51%	46.39%	-5.34%	28.46%	31.36%	2.57%
Construction Cost	6.26%	0.12%	0.22%	1.26%	6.77%	-1.87%	1.76%	-
Construction Industry Wage	8.24%	12.38%	14.19%	10.73%	8.56%	14.62%	10.26%	-
Number of Cities Included	15	22	25	33	34	35	35	35

B. Standard Deviation of Annual Real Growth Rate

	2004	2005	2006	2007	2008	2009	2010	2011
House Price	4.91%	3.64%	6.13%	12.41%	8.31%	6.39%	11.60%	7.82%
Land Price	21.68%	23.06%	40.52%	42.11%	23.98%	30.72%	29.44%	30.22%
Construction Cost	2.23%	1.68%	1.39%	1.38%	2.49%	1.31%	1.29%	-
Construction Industry Wage	5.78%	4.29%	4.61%	5.07%	4.33%	9.01%	4.89%	-
Number of Cities Included	15	22	25	33	34	35	35	35

Table 4: Real Estate Asset Information in the Financial Reports

(A) Before 2006

		Self-Occupied & Lease-Out Properties
Self-Built Properties	Construction in Progress	• The lands are listed in the item of "Land Ownerships" as a subentry of "Intangible Assets". • The construction materials, affiliated plants and equipment are listed in the item of "Construction in Progress".
	Completed Properties	• The lands are listed in the item of "Land Ownerships" as a subentry of "Intangible Assets". • The structures are listed in the item of "Buildings" as a subentry of "Fixed Assets". The plants and equipment are excluded.
Purchased Properties		• Both lands and structures are listed in the item of "Buildings" as a subentry of "Fixed Assets". The plants and equipment are excluded.

(B) Since 2007

		Self-Occupied Properties	Lease-Out Properties
Self-Built Properties	Construction in Progress	• The lands are listed in the item of "Land Ownerships" as a subentry of "Intangible Assets". • The construction materials, affiliated plants and equipment are listed in the item of "Construction in Progress".	
	Completed Properties	• The lands are listed in the item of "Land Ownerships" as a subentry of "Intangible Assets". • The structures are listed in the item of "Buildings" as a subentry of "Fixed Assets". The plants and equipment are excluded.	• Both lands and buildings are listed in the item of "Investment Properties". The plants and equipment are excluded.
Purchased Properties		• Both lands and structures are listed in the item of "Buildings" as a subentry of "Fixed Assets". The plants and equipment are excluded.	

Table 5: Definition and Summary Statistics of Variables

Variable	Definition	Average	Std. Dev
ASSET	Total asset at the beginning of the year; in billion yuan RMB.	4.882	17.598
RATIO_REV1	Market value change of real estate assets held in 2002 (see the text for more details); normalized by *ASSET*.	0.060	0.151
RATIO_REV2	Market value change of real estate assets held at the beginning of the year (see the text for more details); normalized by *ASSET*.	0.075	0.170
RATIO_INV	Net change in investment on fixed assets; normalized by *ASSET*.	0.056	0.056
RATIO_LOAN	Net change in loan balance; normalized by *ASSET*.	0.019	0.074
RATIO_EBITDA	Earnings before interest, taxes, depreciation and amortization; normalized by *ASSET*.	0.089	0.059
RATIO_CASH	Net change in cash holdings; normalized by *ASSET*.	0.020	0.073
RATIO_SALARY	Total salary payments; normalized by *ASSET*.	0.065	0.034
RATIO_DIVIDEND	Total dividend payments; normalized by *ASSET*.	0.018	0.028
RATIO_FAINV	Net change in investment on financial assets; normalized by *ASSET*.	0.006	0.031
EMP	Number of employee per million of *ASSET*.	1.381	1.012
RATIO_SUBSIDY	Total amount of government subsidies received; normalized by *ASSET*.	0.003	0.005
MBR	Market-to-book ratio at the beginning of the year.	1.627	1.043
LEVERAGE	Leverage level at the beginning of the year.	0.501	0.159
LOANLOAN	Net change in share of long-term loan in total loan balance.	0.005	0.128
RISK	The ratio of the probability density function to the cumulative distribution function of corporate default model at the beginning of the year (see the text for more details).	3.069	0.105

Table 6: Distribution of Sample by Ownership Structure

Year	Number of SOEs	Number of Non-SOEs
2003	353	91
2004	347	97
2005	343	101
2006	329	115
2007	323	121
2008	325	119
2009	320	114
2010	318	126
2011	318	126

Table 7: Summary Statistics of Variables by Ownership Structure Groups

	SOEs		Non-SOEs		t stat.
	Average	Std. Dev	Average	Std. Dev	
ASSET	5.477	20.089	3.147	5.650	3.655***
RATIO_REV1	0.060	0.153	0.060	0.144	0.018
RATIO_REV2	0.076	0.173	0.075	0.163	0.062
RATIO_INV	0.057	0.055	0.055	0.057	1.052
RATIO_LOAN	0.019	0.073	0.022	0.079	1.109
RATIO_EBITDA	0.086	0.057	0.096	0.065	4.442***
RATIO_CASH	0.019	0.071	0.023	0.078	1.704*
RATIO_SALARY	0.066	0.033	0.061	0.035	4.807***
RATIO_DIVIDEND	0.017	0.026	0.023	0.034	5.464***
RATIO_FAINV	0.005	0.029	0.008	0.035	3.295**
EMP	1.377	1.020	1.390	0.987	0.331
RATIO_SUBSIDY	0.003	0.005	0.004	0.006	3.191***
MBR	1.552	0.972	1.847	1.201	7.817***
LEVERAGE	0.502	0.158	0.499	0.163	0.455
LOANLOAN	0.004	0.127	0.008	0.131	0.855
RISK	3.075	0.102	3.053	0.113	5.119***

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Do Chinese Firms Invest More When Collateral Value Increases?

Dependent Variable: *RATIO_INV*

	Full Sample	SOE's	Non-SOE's
$RATIO\_REV1_{i,t}$	0.0045	0.0062	-0.0003
	(0.0061)	(0.0072)	(0.0123)
Log(LP_{it})	-0.0148	-0.0154	0.0217
	(0.0110)	(0.0122)	(0.0245)
$MBR_{i,t}$	0.0032***	0.0030**	0.0050**
	(0.0011)	(0.0013)	(0.0023)
$RATIO\_EBITDA_{i,t}$	0.1743***	0.1761***	0.1776***
	(0.0186)	(0.0237)	(0.0375)
$LEVERAGE_{i,t}$	-0.0624***	-0.0662***	-0.0629***
	(0.0108)	(0.0123)	(0.0192)
Initial Controls * Log($LP_{i,t}$)	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Number of Observations	3974	2962	1012
R2	0.473	0.488	0.499

Note: (1) the observations are clustered by city-year.
(2) standard errors in parentheses.
(3) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Collateral Channel Effects under Alternative Specifications

Dependent Variable: *RATIO_INV*

A. Real Estate Collateral Value Measured Continuously (*RATIO_REV2* instead of *RATIO_REV1*)			
	Full Sample	SOE's	Non-SOE's
$RATIO\_REV2_{i,t}$	-0.0026	-0.0035	-0.0010
	(0.0064)	(0.0078)	(0.0109)
B. Asymmetry in Collateral Channel Effects			
	Full Sample	SOE's	Non-SOE's
$RATIO\_REV1_{i,t}$	0.0083	0.0110	0.0019
	(0.0079)	(0.0102)	(0.0170)
$RATIO\_REV1_{i,t} * DECREASE_{i,t}$ (*DECREASE*=1 if land values are declining; =0, otherwise)	-0.0148	-0.0184	-0.0095
	(0.0211)	(0.0260)	(0.0486)
C. Real Estate Collateral Effects Controlling for Corporate Default Risk			
	Full Sample	SOE's	Non-SOE's
$RATIO\_REV1_{i,t}$	0.0093	0.0111	0.0002
	(0.0083)	(0.0095)	(0.0210)

Note: (1) all models are estimated with additional control variables (see Table 8 for the full specification).
(2) the observations are clustered by city-year.
(3) standard errors in parentheses.
(4) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Do Chinese Firms Borrow More When Land Values Rise?

Dependent Variable: *RATIO_LOAN*

	Full Sample	SOE's	Non-SOE's
$RATIO\_REV1_{i,t}$	-0.0000	-0.0052	0.0189
	(0.0104)	(0.0116)	(0.0203)
Log(LP_{it})	0.0110	0.0141	0.0456
	(0.0162)	(0.0172)	(0.0460)
$MBR_{i,t}$	0.0002	-0.0011	0.0069*
	(0.0020)	(0.0025)	(0.0037)
$RATIO\_EBITDA_{i,t}$	0.0329	0.0306	0.0184
	(0.0299)	(0.0376)	(0.0571)
$LEVERAGE_{i,t}$	-0.1467***	-0.1497***	-0.1737***
	(0.0175)	(0.0196)	(0.0356)
Initial Controls * Log($LP_{i,t}$)	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Number of Observations	3974	2962	1012
R2	0.232	0.248	0.285

Note: (1) the observations are clustered by city-year.
(2) standard errors in parentheses.
(3) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: Is There Evidence of a Collateral Channel Effect During the Stimulus Period?

Dependent Variable: *RATIO_INV*

	Full Sample	SOE's	Non-SOE's
$RATIO\_REV1_{i,t}$	0.0068	0.0083	-0.0056
	(0.0089)	(0.0102)	(0.0176)
$RATIO\_REV1_{i,t}$ * 2009/10	-0.0043	-0.0042	0.0095
	(0.0110)	(0.0141)	(0.0226)
Log(LP_{it})	-0.0150	-0.0156	0.0219
	(0.0110)	(0.0121)	(0.0245)
$MBR_{i,t}$	0.0032***	0.0030**	0.0050**
	(0.0011)	(0.0013)	(0.0023)
$RATIO\_EBITDA_{i,t}$	0.1743***	0.1762***	0.1778***
	(0.0186)	(0.0237)	(0.0376)
$LEVERAGE_{i,t}$	-0.0625***	-0.0662***	-0.0629***
	(0.0108)	(0.0123)	(0.0192)
Initial Controls * Log($LP_{i,t}$)	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Number of Observations	3974	2962	1012
R2	0.473	0.488	0.499

Note: (1) the observations are clustered by city-year.
(2) standard errors in parentheses.
(3) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Did Chinese Firms Borrow More During the Stimulus Period?

Dependent Variable: *RATIO_LOAN*

	Full Sample	SOE's	Non-SOE's
$RATIO\_REV1_{i,t}$	-0.0105	-0.0093	-0.0243
	(0.0130)	(0.0165)	(0.0297)
$RATIO\_REV1_{i,t}$ * 2009/10	0.0197	0.0079	0.0781**
	(0.0199)	(0.0209)	(0.0371)
Log(LP_{it})	0.0118	0.0147	0.0465
	(0.0162)	(0.0173)	(0.0451)
$MBR_{i,t}$	0.0000	-0.0011	0.0066*
	(0.0020)	(0.0025)	(0.0036)
$RATIO\_EBITDA_{i,t}$	0.0329	0.0304	0.0201
	(0.0299)	(0.0376)	(0.0570)
$LEVERAGE_{i,t}$	-0.1466***	-0.1496***	-0.1742***
	(0.0176)	(0.0196)	(0.0356)
Initial Controls * Log($LP_{i,t}$)	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Number of Observations	3974	2962	1012
R2	0.232	0.248	0.288

Note: (1) the observations are clustered by city-year.
(2) standard errors in parentheses.
(3) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 13: How did Non-SOEs Spend the Money During the Stimulus Period?

	RATIO_CASH	*EMP*	*RATIO_SALARY*	*RATIO_FAINV*	*RATIO_DIVIDEND*	*LONGLOAN*
$RATIO\_REV1_{i,t}$	0.0248	-0.2525	0.0108*	0.0141	0.0066	-0.0368
	(0.0253)	(0.1785)	(0.0057)	(0.0134)	(0.0091)	(0.0504)
$RATIO\_REV1_{i,t}$ * 2009/10	0.0505	0.4800**	0.0004	-0.0177	-0.0106	0.1190*
	(0.0347)	(0.2241)	(0.0078)	(0.0189)	(0.0120)	(0.0647)
Log(LP_{it})	0.0010	-0.2323	-0.0067	-0.0232	-0.0128	0.0540
	(0.0461)	(0.2912)	(0.0100)	(0.0201)	(0.0168)	(0.0701)
$MBR_{i,t}$	0.0051	0.0053	0.0013*	0.0030	-0.0008	0.0053
	(0.0047)	(0.0246)	(0.0007)	(0.0019)	(0.0014)	(0.0075)
$RATIO\_EBITDA_{i,t}$	0.4168***	1.5708***	0.0780***	-0.0103	0.2028***	0.1022
	(0.0625)	(0.4122)	(0.0139)	(0.0265)	(0.0259)	(0.0984)
$LEVERAGE_{i,t}$	-0.0132	-0.0660	-0.0017	-0.0523***	-0.0152	0.0832
	(0.0358)	(0.2046)	(0.0063)	(0.0141)	(0.0103)	(0.0670)
Initial Controls * Log($LP_{i,t}$)	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1012	1011	1012	1012	1012	1012
R2	0.239	0.795	0.847	0.224	0.503	0.117

Note: (1) the observations are clustered by city-year.
(2) standard errors in parentheses.
(3) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix 1: Estimation of Firm-Level Default Risk

We adopt a popular proportional hazard modeling framework (Deng, 1997, Deng, Quigley and Van Order, 2000) to estimate the firm-level default risk. The empirical estimation is based on a large sample of 2,061 publicly-traded firms in China. We used data from 1995-2010 on these firms, which were traded on the Shenzhen or Shanghai stock exchanges. Our corporate default model specification follows the existing literature on firm bankruptcy analysis (see, for example, Duffie, et al., 2007). Key variables of the default risk model include firm-specific attributes, such as distance to default (*DTD*), which is defined as the logarithm of total assets over total liabilities, weighted by the idiosyncratic risk of firm's stock return. Hillegeist, et al. (2004), Bharath and Shumway (2008), and Duan et al. (2012) each report that distance-to-default is a highly significant measure that helps capture heterogeneous firm level credit risk. Another variable used is Net Income/Total Asset (*NI/TA*), which measures firm profitability. Bharath and Shumway (2008) and Duan et al. (2012) found it provides significant predictive power for bankruptcy, controlling for the distance to default measure. A third variable is Earnings before Interest and Taxes/ Total Asset (*EBIT/TA*), which Altman (1968) included in his classic work. We also control for firm size (*SIZE*) based on the hypothesis that large firms are more likely to have more diversified business lines and financial flexibility than smaller firms. Other variables included in our model control for the type of firm, specifically whether the entity is a state-owned enterprise. This variable is called *OWNERSHIP* in our model. We also include various market level attributes such as real GDP growth (*GDP*), stock index return (*STOCK*), and the inflation rate (*INFLATION*).

Our results, which are presented below in Appendix Table A1 generally are consistent with findings in the existing literature (Hillegeist, et al., 2004; Bharath and Shumway, 2008, and

Duan et al., 2012). The estimated inverse Mill's ratio obtained from this firm bankruptcy default model is then added to our baseline investment regression, with results on the collateral channel effect reported at the bottom of Table 9. Note that this estimate is based on a slightly smaller sample of 376 firms (versus 444 firms in the baseline regression) because of missing credit risk data for some firms.

Appendix Table A1. Firm Level Bankruptcy Default Estimation

	Whether the Corporate Defaults
DTD	-0.2559***
	(0.0873)
NET INCOME	-0.4262***
	(0.1536)
EBIT/TA	-0.3682*
	(0.1967)
SIZE	-0.1385**
	(0.0697)
OWNERSHIP	-0.0976
	(0.0718)
GDP	-0.7328***
	(0.2529)
STOCK	0.0521
	(0.0727)
INFLATION	-0.3100***
	(0.1017)
Industry Fixed Effects	Yes
Number of Observations	2,061

Note: standard errors in parentheses.