Real estate prices and firm capital structure*

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First Draft: August 30, 2010

This Draft: January 15, 2013

*I am most grateful to Christopher Polk and Jack Favilukis for invaluable advice, support and guidance. I thank Joao Cocco, Vicente Cunat, Daniel Ferreira and David Thesmar for their insightful comments and suggestions. I would also like to thank Ulf Axelson, Engelbert Dockner, Miguel Ferreira, Todd Gormley and the seminar participants at the 2012 Paris Spring Corporate Finance Conference, EFA 2012, LSE Lunchtime Workshop, Cass Finance Research Seminar, Universidade Nova de Lisboa, Swiss Finance Institute Lugano, ESMT Berlin, Queen Mary University of London, University of New South Wales Sydney, IE Busines School, HEC Paris, Bocconi University, University of Pennsylvania Wharton, Stockholm School of Economics and UNC Chapel Hill. I gratefully acknowledge the support from the FSA and Department of Finance, LSE. All errors are of course my own.

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Abstract

This paper examines the impact of real estate prices on firm capital structure decisions. I find that for a typical US listed company, a one standard deviation increase in collateral value translates into a 2.6 percent increase in total leverage. My identification strategy employs a triple interaction of MSA level land supply elasticity, aggregate real estate prices and a measure of a firm's real estate holdings as an exogenous source of variation in the value of firm collateral. I find that for every one percent increase in collateral value, a firm's annualized cost of long-term debt drops by four basis points. More financially constrained firms tilt their debt structure towards arm's length financing and less information-sensitive debt in response to collateral value appreciation. These results indicate the importance of collateral values in mitigating potential informational imperfections.

Keywords: collateral, debt capacity, capital structure, real estate prices

1 Introduction

This paper investigates how firms' capital structure and payout policy decisions respond to changes in the value of an important pledgeable asset, real estate. Given that a large fraction of US corporations owned real estate in the late 1990s price boom, this variation provides a natural laboratory for testing the effect of large asset value swings on corporate capital structure decisions.

The ideas presented in this paper constitute a part of the growing literature on collateral being the main determinant of capital structure. Rampini and Viswanathan (2010a) argue that collateral determines the capital structure. Others document a positive relationship *between asset tangibility and firm borrowing* (e.g. Rampini and Viswanathan (2010b), Almeida and Campello (2007), Bharath, Pasquariello and Wu (2009), Eisfeldt and Rampini (2007), Campello and Giambona (2010)). This result is largely explained by the fact that tangible assets can be pledged as collateral to lenders and thus allow companies to raise debt. Collateral helps to mitigate inefficient credit decisions when soft information is critical, since it makes debt less sensitive to cash flow variations.

In this paper, I depart from the existing literature in that I investigate the role of shocks to asset values that are orthogonal to firm financing decisions in determining capital structure choice, since these carry time-series and cross-sectional implications on firm financing behavior. Changes in real estate asset values directly impact the value of collateral and thus the debt capacity of firms. Surprisingly, to the best of my knowledge, there are no empirical studies that address the effect of exogenous changes in collateral valuation on corporate capital structure.

To identify the causal effect real estate prices on firms' capital structure, I need an exogenous source of variation in firms' pleadgable real estate values. Otherwise, I would be faced with two major issues. Firstly, the variation in local real estate prices may be endogenous to firm capital structure decisions through local demand or firm investment, which could be jointly determined by an omitted time-varying factor, such as the availability of credit or future growth prospects. To address this issue, I use land supply elasticity at the MSA[1] level interacted with a measure of aggregate real estate prices, which provides me with an *across-MSA type of variaton*. My study is not the first attempt at using land supply elasticity as a an exogenous source of variation in local (MSA-level) real estate prices (Mian and Sufi (2010)). However, one limitation of using this approach in this setting is that by conducting the analysis using the MSA-level variation one is introducing a potential aplification bias,

[1] MSA - Metropolitan Statistical Area.

whereby the estimated coefficinets could be inflated due to potential *within-MSA* spilloever effects. Hence, I need a source of *firm-level variation* in collateral values. To address this second issue, I further interact the land supply elasticity-aggregate real estate prices interaction with a measure of firms' real estate holdings. Consequently, my "triple-interaction" instrument for firms' collateral values is based on both *across-MSA* and *across-firm* variation and it gives me a more precise and clean measure of the collateral effect.

I document a significant effect of collateral value increases on firms' capital structure. A one standard deviation increase in predicted value of firm pledgeable collateral translates into a 2.6 percent increase in total leverage for a typical US firm.

Next, I examine this effect in more detail, by exploring the cross-sectional heterogeneity of firms' capital structure response that can be linked to firm-level measures of both financial constraints and real estate ownership. I find that more financially-constrained firms (either firms with higher values of the Kaplan and Zingales (1997) (KZ) index or low-dividend payout firms) borrow more than the typical firm against increases in their real estate collateral value. More interestingly, these firms tend to "spread" their debt structure by increasing their relative exposure to arm's length financing while substituting more expensive and more information sensitive types of debt with cheaper and more attractive alternatives. Thus, collateral values do not only seem to increase total firm leverage, but also serve to mitigate potential informational imperfections. Moreover, I find that in total, this collateral-based borrowing sensitivity is significant for real estate owners (i.e. firms with capital leases) but largely disappears for real estate renters.

To measure the effect of collateral value shocks on alleviating financing inefficiencies, I test whether the positive sensitivity of firm borrowing to collateral value appreciation is associated with a decrease in the cost of financing and the probability and the number of associated covenant terms and restrictions attached to newly issued debt contracts.

Firstly, the results of the IV estimation suggest a four basis points decline in a firm's average cost of long-term debt for a one-percent change in collateral value.

Secondly, by using a dataset containing detailed data on private credit agreements from *DealScan* and *Edgar*, I find that, unconditionally, apart from being associated with a decline in convertible leverage, increases in collateral value result in firms entering into financial contracts that are less likely to contain new capital expenditure restrictions and have fewer covenants. In particular, I find a significant drop in the probability of debt-to-capitalization, net worth, and tangible net-worth covenants. Conditional on a firm previously having a capital expenditure restriction at some point in the sample, this likelihood drops even further. This result suggests that the standard *dynamic credit multiplier effect* of Campello and

Hackbarth (2008) is amplified by the relaxation of capital expenditure restrictions via collateral appreciation, which in turn facilitates further investment. Furthermore, this evidence suggests that the ability of firms to collateralize and, in particular, positive shocks to the value of firm pledgeable assets can help reduce financial inefficiencies.

Interdependence of capital structure and equity payout policies is a predominant factor in determining how firms build, preserve and enhance financial flexibility over time. By analyzing firm payout policy with respect to the increased borrowing, I find that the majority of firms employ collateral-based borrowing together with substantial cash to service equity payouts. Out of every dollar increase in the value of their collateral, firms borrow additional 19 cents. 37 percent of the increased borrowing is the spent on share re-purchases, 5 percent on total dividend payout, 27 percent on R&D expenses and 31 percent on capital investment.

The results of this paper provide empirical support for Almeida and Campello (2007) who establish a differential interplay between asset tangibility and firm leverage for credit constrained and unconstrained firms. Further, my findings provide empirical support for Rampini and Viswanathan (2010a) and Rampini and Viswanathan (2010b), who argue that collateral determines the capital structure and develop a dynamic agency-based model of firm financing where collateral is used to secure payment obligations. Campello and Giambona (2010) report empirical findings on the relationship between asset tangibility and capital structure, identifying when and how tangibility affects leverage.

Eisfeldt and Rampini (2007) investigate the role of leasing on the debt capacity of firms. Evidence presented in this paper confirms the intuition of Inderst and Müller (2006), who develop a theoretical framework in which collateral may improve arm's length financing. Collateral helps to mitigate inefficient credit decisions when soft information is critical, since it makes debt less sensitive to cash flow variations.

Finally, my paper is also closely related to the recent empirical work which attempts to link exogenous asset shocks to variation in firm investment. Chaney, Sraer and Thesmar (2011) analyze the impact of real estate prices on corporate investment. In a related paper, Gan (2006) studies the impact of collateral on corporate investments in Japan. The shock she considers is the land market collapse in 1990s. However, these papers do not characterize the microeconomic mechanism through which *firm-level collateral value changes* affect firm capital structure, payout policy, cost of finance, and the shape of financial contracts that firms enter into. This paper fills that gap.

The rest of the study is organized as follows. Section 2 gives a set of stylized predictions about firm capital structure in the presence of collateral value shifts, based on Almeida and Campello (2007) investment-to-cash-flow-sensitivity model under financing frictions. Section

3 describes the data, and Section 4 details the empirical strategy and results. Section 5 presents the results of robustness checks, and Section 6 concludes.

2 Empirical predictions

In the Miller—Modigliani world, the value of collateral is irrelevant. The amount and value of pledgable assets can affect firm credit rating but should not create additional value. However, in the presence of financial frictions such as risk-shifting (Jensen and Meckling (1976)), under-investment (Myers (1977)) and adverse selection (asymmetric information) collateralizable assets can be pledged to lenders in order to mitigate inefficiency costs. This will in turn increase the debt capacity of firms suffering from these costs—credit constrained firms.

In the following section I present two empirical predictions that are easily derived from the investment-to-cash flow sensitivity model of Almeida and Campello (2007) to show that there is a positive relationship between leverage and collateral value, in the presence of financial frictions. Suppose that there is an exogenous change in the value of tangible assets. What is going to be the cash-flow sensitivity of leverage?

The implications of a model presented in Giambona and Schweinbacher (2007) provide an intuitive answer and yield the following empirically testable prediction[2]:

Prediction: The collateral value sensitivity of leverage is:

a) *strictly positive for financially constrained firms;*

b) *equal to zero for financially unconstrained firms.*

The prediction states that in presence of financing frictions, when firms are not able to finance their investment entirely with debt, any increase in the value of collateral the firm can pledge to secure debt financing will result in increases in the leverage ratio. Moreover, the positive sensitivity of leverage to collateral value will be increasing in the tangibility ratio. The intuition for this positive relationship is akin to the credit multiplier argument in Kiyotaki and Moore (1997). It is also closely related to work by Henessy, Levy and Whited (2007), who show that firms which anticipate collateral constraints in the future benefit from investment in tangible assets, since it relaxes future financing constraints.

[2] For details of derivation of the implications of Giambona and Schweinbacher (2007) see Appendix.

3 Data

The sampling universe consists of US listed firms that do not belong to: financial and real estate industries. I collect their accounting data from COMPUSTAT for the period 1996-2006, which gives me a total of 144,119 firm-quarter observations. I merge this dataset with data on US MSA-level land prices and data on debt structure of US listed companies. The final fully-matched sample consists of 20,405 firm-quarter observations.

3.1 Accounting data

I start with a sample of active COMPUSTAT firms in 1996. This provides me with a sample of 14,035 firms whose headquarters are located in the US across 269 MSAs. Apart from accounting variables commonly used in the corporate finance literature, I collect data on firms' real estate holdings, as measured by Property, Plant and Equipment Net Total, PPE Buildings Net Cost, PPE Land and Improvements Net Cost. In the regressions I use PPE Net Total as a proxy for firms' real estate holdings measured in Q41995, due to the lack of data observations reported by PPE Land and Improvements Net Cost. Unfortunately, COMPUSTAT does not provide data on geographic location of each real estate holding owned by a firm, but it does report data on the firm headquarters location in terms of STATE, COUNTY and ZIP CODE. Under the assumption that firms' headquarters and production facilities are located in the same MSA and that they represent a significant fraction of companies' real estate assets, I proxy for the geographical location of firms' real estate assets using their headquarter location. I relax this assumption in Section 4.1.1, where I assume that a firm's aggregate exposure to real estate shocks is measured as a weighted sum of exposures to each MSA in which it has operation activities. Finally, to ensure that my results are statistically robust, all variables defined as ratios are winsorized at the fifth percentile.

3.2 Debt structure data

One of the main goals of this paper is to examine how firms adjust their financing decisions in response to real estate shocks through a substantial variation in their debt structure. To estimate the effect of collateral value change on firm capital structure, and different types, priorities and maturities of leverage in particular, I use the Capital IQ Debt Structure dataset, which includes a detailed account of firms' debt structure for non-financial companies from COMPUSTAT. It contains detailed debt information on 14,302 firms giving in total 153,506 firm-quarter observations. Each debt issue found in Capital IQ Debt is classified into one of seven broad categories (following classification by Rauh and Sufi (2010)):

(1) Bank debt: Consists of two main categories:

(i) Revolving bank debt, which includes committed revolving credit facilities or lines of credit and

(ii) Term bank debt, which includes term loans, bank overdrafts, and borrowings on uncommitted lines of credit.

(2) Bonds: Consists of public debt issues, industrial revenue bonds, and Rule 144A private placements.

(3) Program debt: Consists of commercial paper, shelf registration debt, and medium term notes (MTNs). These programs are often exempt from SEC registration requirements, and thus constitute "program" debt.

(4) Private placements: Consists of non-Rule 144A privately placed debt issues, and ambiguous notes or debentures which we cannot match to SDC Platinum.

(5) Mortgage or equipment debt: Consists of mortgage bonds, mortgage loans, equipment trust certificates, and other equipment-based debt.

(6) Convertible debt

(7) Other debt: Includes acquisition notes, capitalized leases, and unclassified debt.

3.3 Real estate prices and measurement

To measure real estate value changes I use MSA level data on land prices available from Land and Property Values in the US, Lincoln Institute of Land Policy (Davis and Palumbo (2007)). The data is available quarterly for 46 MSAs between 1984 and 2010. The choice to use land prices instead of commercial real estate prices is motivated by the fact that land prices reflect real estate value that is less depreciable than structures (e.g. buildings). Further, availability of reliable commercial real estate data at MSA level for the period in question is limited and not freely available. Namely, most publicly available sources report state prices indices for offices, excluding other types of commercial real estate[3]. Summary statistics are presented in Table 1 (Panel C). Since COMPUSTAT does not report firm headquarter location in terms of its MSA, I employ a matching algorithm that maps firms' ZIP CODE to MSA identifiers using a mapping table available from the US Census Bureau.

3.3.1 Land supply elasticity

[3] Commercial real estate can be classified into: offices, retail, industrial and other properties.

As noted before, changes in real estate prices and corporate capital structure may be jointly determined by an omitted time-varying variable such as local demand shocks. Hence, proper identification of the effects of real estate prices on corporate capital structure calls for an exogenous source of variation in local real estate price growth. To address this issue, I use land supply elasticity at the MSA level[4] interacted with aggregate (national) real estate prices as an instrument for local real estate price growth. The motivation is straightforward: MSAs with elastic land supply should experience small real estate price appreciation in response to increases in aggreagate real estate demand, since land supply is relatively easy to expand. On the other hand, inelastic land supply MSAs should witness large real estate price appreciation in response to the same aggregate real estate demand shock (Glaeser, Gyourko, and Saiz (2010)). Two main factors restrict land supply: one, there may be topological constraints that impede real estate construction, such as steepness of terrain or presence of water bodies. Two, regulation plays an important role in restricting land development and new construction. Environmental regulation, urban planning, zoning are just a few issues that restrict the amount of land supply. Saiz (2010) estimates land supply elasticities for 269 MSAs by processing satellite-generated data on elevation and presence of water bodies. The land supply elasticity measure in Saiz (2010) varies from 0 to 4 (for the 46 MSAs in my sample) and is increasing in elasticity. I define land supply inelasticity e^m as four minus land supply elasticity as defined by Saiz (2010). My measure is four minus the Saiz (2010) measure so that it increases in housing supply inelasticity. Figure 1 plots land price growth from 2002—2006 for 46 MSAs in my sample against land supply elasticity.

4 Real estate prices and firm capital structure

In this Section I empirically analyze the effect of real estate prices on firms' leverage, their capital structure and cost of financing. The exact thought experiment that I implement using instruments for real estate prices answers the following questions: Firstly: what is the effect of the increases in value of collateralizable assets on firm's capital structure decisions, all else being equal? Secondly: is this effect different for financially constrained and financially unconstrained firms? This experiment allows me to evaluate the magnitude of these financing constraints empirically and learn whether positive shocks to collateral value can indeed help alleviate these inefficiencies. Finally, I look at the real effects of collateral channel by analyzing how firms employ their new debt stock.

[4] Available from Saiz (2010).

4.1 Identification strategy

The existing studies highlight the importance of tangible assets as a determinant of capital structure[5]. Rampini and Viswanathan (2010) argue that collateral determines the capital structure. My empirical strategy is developed to estimate the effect of collateral value on firm capital structure, whereby collateral value is jointly determined by the amount of real estate holdings that can be pledged as collateral (tangibility) and real estate value changes.

A potential concern with this experiment is that there are possibly time-varying macroeconomic factors that are driving both real estate prices and firm financing decisions, and in particular its borrowing behavior. The main reason that local real estate prices may be endogenous to firm borrowing is through local demand. Suppose there is a positive macroeconomic demand shock (e.g. local GDP shock, wage growth shock), which is accompanied by real estate price appreciation and provides a stimulus for the local economic activity. In order to meet increased product demand, a firm needs to increase product supply, which is achieved through increased investment. Increased investment is financed through increased borrowing.

To address these issues, my *first test* exploits variation in land supply elasticity across MSAs. The intuition behind this test is the following: for an equivalent aggregate real estate demand shock, as proxied by an increase in national real estate prices, the slope of the land supply curve determines the degree to which real estate prices rise in an area. This basic prediction holds under most models of real estate price growth. Glaeser, Gyourko, and Saiz (2010) present evidence that during the house price booms of the 1980s, price increases were higher in places where housing supply was more inelastic because of geographical constraints. At the same time, most elastic metro areas appear not to have experienced bubbles at all during the 1980s.

Further, my first test exploits the variation within an MSA which allows for two firms located within the same MSA at different points in time with different real estate exposures to be subject to the same real estate shock. Hence, the full effect of a real estate demand shock on firm collateral value will be equal to the product of the amount of firm's pledgable real estate holdings and predicted local real estate prices, as instrumented by interacting local land supply elasticity aggregate real estate prices. This intuition suggest the following reduced-form specification for a firm i, located in MSA m, at time t:

[5] See Rampini and Viswanathan (2010).

$$Leverage_t^{i,m} = \alpha + \beta_1 P_{m,t} + \beta_2 P_{m,t} Exp_{i,0} + \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + u_{it} \quad (1a)$$

$$P_{m,t} + P_{m,t} Exp_{i,0} = \dot{\beta}_1 P_{US,t} e_{m,0} + + \dot{\beta}_2 P_{US,t} e_{m,0} Exp_{i,0} + \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + \varepsilon_{it} \quad (1b)$$

P_{mt} represents real estate prices in metro area m at quarter t, $Leverage_t^{i,m}$ is leverage for firm i, located in MSA m in time period t. The instrument in the first-stage regression is land supply inelasticity $e_{m,0}$ interacted with aggregate US real estate prices at t, as measured by the NCREIF US Property Index[6], and $Exp_{i,0}$, a proxy for firm i's real estate holdings as of Q41995[7]. I control for the MSA-fixed effects μ_m and quarter-fixed effects δ_t, capturing macroeconomic conditions that I want to abstract from. The dependent variable in the second stage regression, $Leverage_t^{i,m}$, is defined as the ratio of total debt to market value of total assets: $Leverage_t^{i,m} = \frac{TD_t^{i,m}}{TA_t^{i,m}}$.

The choice to use firm real estate assets in the reference year (instead of $PPENT_t^i$) is motivated by the trade off between possible endogeneity and measurement error. A potential concern with using a firm's time t real estate holdings $PPENT_t^i$ is that in response to real estate price growth firms may be buying up and increasing their real estate asset base, in which case my estimates would be overestimated. Hence, I opt for the former, in order to avoid any endogeneity issues. Therefore, coefficient β_2 measures how a firm's leverage varies with each additional 1 percent increase in collateral value, and not to the general or local real estate shocks.

λ_i captures firm fixed-effects and $X_t^{i,m}$ provides a set of firm level controls, namely: $Profitability$—defined as the ratio of Earnings Before Interest and Taxes (After Depreciation) and book capital (debt plus equity), M/B and $ln(Sales)$. Standard errors $u_t^{i,m}$ are clustered at the MSA level.

In my *second test*, I exploit both the across- and within-MSA variation which allows for two firms located within the same MSA at the same point in time t with different real estate exposures to be subject to the identical real estate shock. This test suggests the following specification:

[6] The US NCREIF Property Index is a quarterly time series composite total rate of return measure of investment performance of a very large pool of individual commercial real estate properties.

[7] $PPENT_{1995}^i$ measures firm i's real estate holdings (scaled by total assets) in the reference year.

$$Leverage_t^{i,m} = \alpha + \beta_1 P_{m,t} + \beta_2 P_{m,t} Exp_{i,0} + \theta X_t^{i,m} + \lambda_i + \delta_t \times \mu_m + u_{it} \tag{2a}$$

$$P_{m,t} + P_{m,t} Exp_{i,0} = \dot{\beta}_1 P_{US,t} e_{m,0} +$$

$$+ \dot{\beta}_2 P_{US,t} e_{m,0} Exp_{i,0} + \theta X_t^{i,m} + \lambda_i + \delta_t \times \mu_m + \varepsilon_{it} \tag{2b}$$

My initial intuition is confirmed in first stage results of the effect of aggregate real estate demand shifts on pleadgable collateral values, as filtered through local land supply inelasticity, as shown in Table 2. The magnitude of the estimated coefficient suggest that a one standard deviation increase in $P_{US,t} e_{m,0} Exp_{i,0}$ translates into a 0.9 standard deviation increase in real estate collateral value. This effect is economically large and significant. High values of associated F-statistics confirm that chosen instruments are strong. I conduct additional tests of the validity and relevance of my proposed instrument. I compute partial R-squared values: partial R-squared associated with the first-stage MSA level real estate prices regression is 0.63, while partial R-squared associated with the first-stage predictive collateral value regression is 0.53. As one can see in Table 2, $P_{US,t} e_{m,0}$ is solid predictor of P_{mt}, and $P_{US,t} e_{m,0} Exp_{io}$ is a solid predictor of $P_{mt} Exp_{io}$.

Table 3 presents the results of several specifications of equations 1 and 2. Column 1 shows the results of equation 1 in its simplest form: estimated using raw MSA level real estate prices (OLS) – without the $P_{mt} Exp_{io}$ term. In column 2, we see the results of the OLS estimation using raw prices and the interaction term. This specification corresponds to equation 1, which allows two firms with different exposure to the real estate market to be subject to the same real estate shock at different points in time t. Coefficient β_2 is positive and statistically significant. Column 3 contains the results of the OLS estimation of equation 2, saturating at the $MSA \times t$ level. In this specification, I allow for two firms which operate in the same MSA at the same time t, with different real estate exposures to be subject to the same real estate shock. β_2 is again positive and statistically significant. The estimated coefficient is 0.06, which means that for a one standard deviation increase in the value of its real estate assets, firms increase their leverage by 2.6%.

Columns 4 and 5 contain the results of the IV estimation of equation 1 and 2 respectively. In both specifications, the coefficient of interest, β_2 is positive and significant suggesting that in response to increases in the value of their pleadgable real estate, firms adjust their leverage upwards. The coefficient of 0.08 suggests that for a one standard deviation increase in the value of its real estate holdings, firms, on average, increase their market leverage by 3.4%.

4.1.1 Measurement issues

As noted earlier, I assume that the majority of a firm's real estate holdings are located in the MSA where their headquarters are located. This assumption may pose an issue in case the majority of a firm's real estate holdings are actually located elsewhere. Since COMPUSTAT does not contain data on the location of each piece of firm's real state holdings, I test the validity of my assumption by using state-level data on firms' operations obtained from Garcia and Norli (2012). To measure the degree of firm geographic concentration, Garcia and Norli (2012) extract state name counts from annual reports filed with the SEC on Form 10 K. The 10 K statement gives information on the firm's real estate holdings, such as factories, warehouses, and sales offices. For example, firms may include sales at stores in different states, and/or list the manufacturing facilities they operate together with the city and state where they are located. The authors parsed of all 10 Ks filed with the SEC during the period 1994 through 2008, yielding a count of the number of times each 10 K mentions a U.S. state name.

Based on the state name counts, I construct a relative exposure of each firm to local, state level real estate market. These relative exposures (or weights) are then interacted with corresponding state-level land prices and summed at the firm-quarter level, to give a weighted firm real estate exposure to each state where it operates. This is formalized in the following specification:

$$Leverage_t^i = \alpha + \beta_1 \sum_{s=1}^{S} w_{i,s,t} P_{s,t} + \beta_2 \sum_{s=1}^{S} w_{i,s,t} P_{s,t} Exp_{i,0} + \theta X_t^{i,s} + \lambda_i + \delta_t + \sum_{s=1}^{S} \mu_s + u_{it} \quad (3)$$

where $w_{i,s,t}$ is the relative exposure of firm i in state s at time t. $P_{s,t}$ are the state-level land prices obtained from the Land and Property Values in the US, Lincoln Institute of Land Policy. λ_i captures firm fixed-effects, δ_t quarter fixed-effects and $\sum_{s=1}^{S} \mu_s$ capture pseudo state-weight fixed effects. The results of the above OLS estimation are shown in Table 4[8].

As we can see from column 3, the estimated coefficient on $\sum_{s=1}^{S} w_{i,s,t} P_{st} Exp_{io}$ is positive and highly significant (0.065) and very similar to the one in column 2 of Table 3. When the specification is saturated with the interaction of pseudo-state weight dummies and quarter dummies, as in column 4, the coefficient stays positive and statisticaly significant (0.03). These are in line with the results from Table 3. Although in this specification I potentially

[8] The above specification is estimated using OLS and not IV due to the lack of availability of land supply elasticity measure at the state level.

err on the endogeneity issue (by not employing an exogenous source of variation in local real estate prices), one can argue that my measure of firm exposure to different local markets is more refined.

Nevertheless, in the reminder of the paper I will focus on estimating various specifications of Equation 1 and 2, attempting to estimate an exogenous shock to the value of firm collateral using an IV approach, at the expense of opting for an admittedly noisier measure of firm exposure to local real estate markets. If anything, by making the assumption that the majority of a firm's real estate holdings are located in the MSA where their headquarters are located, I will be admittedly missing out on a lot of variation which will in turn only bias my coefficients downwards.

4.2 Leverage and financial constraints

Several existing theoretical studies (Giambona and Schweinbacher (2007)) have pointed out that pledgable assets are particularly useful in enhancing borrowing capacity of credit constrained firms but not of unconstrained ones. There is has been little empirical evidence that provides support for this argument. Moreover, there is little evidence on the variation of this effect across different leverage types and priorities. In this section I explore the differential effect of collateral value appreciation on firm financing for relatively more financially constrained firms.

To distinguish between relatively more and relatively less financially constrained firms in my sample, I follow the approach of Lamont, Polk and Saa-Requejo (2001) and construct the KZ index of financial constraints for each firm in my sample[9]. The KZ index is an attractive measure (although not uncontroversial), that relates a linear combination of firm accounting ratios to discrete categories of financial constraints, as defined in Kaplan and Zingales (1997). The accounting ratios are: cash flow to total capital, market to book, debt to total capital, dividends to total capital and cash holdings to total capital. The KZ index thus provides a continuous measure of financing constraints. The firms in the top 25 percent of all firms ranked on KZ index in each quarter are classified as "likely constrained" (the FC dummy takes on the value of 1) and the firms in the bottom 25 percent as "likely unconstrained" (the FC dummy takes on the value of 0).

My argument has a cross-sectional implication that allows me to implement a "differences-

[9]For additional robustness tests on my choice of measure of financial constraints, see Section 5. In Section 5 I show that my results are confirmed by using a different measure of financial constraints - the dividend payout ratio.

in-differences"-like test. As existing theoretical models suggest, I expect to see larger leverage-to-collateral value sensitivity for relatively more financially constrained than unconstrained firms. Local real estate price changes constitute an exogenous shock to the firms and I expect firms with different levels of financial constraints to be affected in different ways. This rationale is formalized in the following reduced-form specification:

$$
\begin{aligned}
Leverage_t^{i,m} &= \alpha + \beta_1 P_{mt} + \beta_2 P_{m,t} Exp_{i,0} + \beta_3 P_{m,t} Exp_{i,0} \times FC_{t-1}^i + \\
&+ \beta_4 FC_{t-1}^i + \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + u_{it} \qquad \text{(4a)} \\
P_{m,t} + P_{m,t} Exp_{i,0} + P_{m,t} Exp_{i,0} \times FC_{t-1}^i &= \dot{\beta}_1 P_{US,t} e_{m,0} + \\
&+ \dot{\beta}_2 P_{US,t} e_{m,0} Exp_{i,0} + \dot{\beta}_3 P_{US,t} e_{m,0} Exp_{i,0} \times FC_{t-1}^i + \\
&+ \beta_4 FC_{t-1}^i + \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + \varepsilon_{it} \qquad \text{(4b)}
\end{aligned}
$$

where FC_{t-1}^i represents the value of KZ dummy variable for firm i at time $t-1$.

As Equation 4 shows, the instruments in the first-stage are land supply inelasticity interacted with aggregate real estate prices and beginning-of-sample measure of firm's real estate holdings, and their interaction with the financial constrainsts dummy. The coefficient of interest is β_3, defined to capture the sensitivity of financially constrained firms's leverage to collateral value increase. I expect this sensitivity to be large and positive.

The results of this estimation are shown in Table 5. Panel A shows the estimates by debt type, as a fraction of total debt, while Panel B shows the estimates based on leverage priority and information sensitivity. In Panel A, Column 1, the estimated coefficient on the interaction term is positive and significant (0.054), indicating that financially constrained firms increase their total leverage in response to increases in their collateral values. Positive coefficients on the interaction term suggest that financially constrained firms increase their mortgage related debt, private placement debt and other types of debt (capitalized leases, trust preferred securities and other borrowings) in the overall debt structure. At the same time, their bank related and program debt is significantly decreasing as a fraction of total debt. Positive coefficient on the private placement debt suggest that, constrained firms use collateral value appreciation to ease access to arm's length financing, consistent with the theoretical model of Inderst and Muller (2006).

Further, as shown in Panel B, this increase is driven mostly by an increase in secured leverage (0.029), but also by an increase in securitized leverage.

A potential concern with the measure of financing constraints used above is that the KZ index may be capturing merely the tangibility of firms (i.e. their PPE), in which case my results would be biased. To address this issue, I define another measure of financial constraints that is orthogonal to firm tangibility by regressing KZ index values on firm PPENT and taking the KZ index innovations as a measure of financing constraints. Results of re-estimated Equation 4 are qualitatively similar to results reported in the main text.

4.3 Leverage and real estate ownership

In this Section I analyze whether the impact of the increase in collateral values on capital structure is different for firms that own their real estate than for those that rent it. However, empirical implementation of this idea is not straightforward, since based on COMPUSTAT data it is very difficult to distinguish whether a firm actually owns or rents its property. To solve this issue, I employ an idea from Tuzel (2007). Namely typically firms deploy their production assets through leasing. Accounting rules distinguish between an operating lease and a capital lease[10], the latter of which is "similar" to property ownership and it is therefore included in firm assets. Hence, to distinguish between real estate owners and renters, I construct a ratio of the rental expense from COMPUSTAT (which includes only rental payments for operating leases) to the gross PPE, and define firms that have less than 5 percent normalized rental expense as real estate owners. The choice of the 5% percent cut-off value is driven by the underlying distribution of the normalized rental expense. Using this cut-off rule 25% of the firms in my sample are classified as real estate owners.

If pledgeable assets are indeed used to increase firm borrowing capacity through securitization of new debt, we would expect to see a larger sensitivity of different types of leverage to predicted real estate prices for property owners, since renters by definition will not be able to capitalize on increases in collateral values. To test this intuition I estimate Equation 5. I expect to see larger leverage to collateral value sensitivity for firms that own their real estate than for firms that rent it.

[10]Eisfeldt and Rampini (2009) discuss the similarities between the classification of leases for accounting, tax, and legal purposes. Under commercial law there is a distinction between a "true lease" and a "lease intended as security;" and the tax law distinguishes between a "true lease" and a "conditional sales contract."

$$
\begin{aligned}
Leverage_t^{i,m} = \alpha + \beta_1 P_{m,t} + \beta_2 P_{m,t} Exp_{i,0} + \beta_3 P_{m,t} Exp_{i,0} \times OWNER_{t-1}^{i} + \\
+ \beta_4 OWNER_{t-1}^{i} + \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + u_{it}
\end{aligned}
\tag{5a}
$$

$$
\begin{aligned}
P_{m,t} + P_{m,t} Exp_{i,0} + P_{m,t} Exp_{i,0} \times OWNER_{t-1}^{i} = \dot{\beta}_1 P_{US,t} e_{m,0} + \\
+ \dot{\beta}_2 P_{US,t} e_{m,0} Exp_{i,0} + \dot{\beta}_3 P_{US,t} e_{m,0} Exp_{i,0} \times OWNER_{t-1}^{i} + \\
+ \beta_4 OWNER_{t-1}^{i} + \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + \varepsilon_{it}
\end{aligned}
\tag{5b}
$$

Dummy variable $OWNER$ indicates whether a firm owns or leases its real estate assets. The coefficient of interest is β_3—it captures the effect of collateral value appreciation for real estate owning firms. The results of this estimation are shown in Table 6. Panel A shows the estimates as a fraction of total debt, by debt type, while Panel B shows the estimates based on leverage priority and information sensitivity. In Panel A, the estimated coefficient on the interaction term is 0.135 for total leverage. The increase in total leverage is predominantely driven by an increase in percentage of the bank, bond and mortgage-related debt. The share of program debt decreases, as expected, as this group contains mainly commercial paper, shelf registration debt and other medium-term notes. As shown in Panel B, the actual priority structure of real estate owning firms changes significantly too, with an increase in secured leverage (the coefficient on the interaction term is 0.05).

Finally, I run a "triple-differences"- (or differences-in-differences-in-differences)-type of estimator which combines the Equations 4 and 5 above. The formal specification now becomes:

$$
\begin{aligned}
Leverage_t^{i,m} = \alpha + \beta_1 P_{m,t} + \beta_2 P_{m,t} Exp_{i,0} + \beta_3 P_{m,t} Exp_{i,0} \times OWNER_{t-1}^i + \\
+ \beta_4 OWNER_{t-1}^i + \beta_5 P_{m,t} Exp_{i,0} \times FC_{t-1}^i + \beta_6 FC_{t-1}^i + \\
+ \beta_7 P_{m,t} Exp_{i,0} \times FCOWNER_{t-1}^i + \beta_8 FCOWNER_{t-1}^i + \\
+ \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + u_{it}
\end{aligned}
\tag{6a}
$$

$$
\begin{aligned}
P_{m,t} + P_{m,t} Exp_{i,0} + P_{m,t} Exp_{i,0} \times FC_{t-1}^i + \\
P_{m,t} Exp_{i,0} \times OWNER_{t-1}^i + P_{m,t} Exp_{i,0} \times FCOWNER_{t-1}^i = \dot{\beta}_1 P_{US,t} e_{m,0} + \\
+ \dot{\beta}_2 P_{US,t} e_{m,0} Exp_{i,0} + \dot{\beta}_3 P_{US,t} e_{m,0} Exp_{i,0} \times OWNER_{t-1}^i + \\
+ \beta_4 OWNER_{t-1}^i + \dot{\beta}_5 P_{US,t} e_{m,0} Exp_{i,0} \times FC_{t-1}^i + \beta_6 FC_{t-1}^i \\
+ \dot{\beta}_7 P_{US,t} e_{m,0} Exp_{i,0} \times FCOWNER_{t-1}^i + \beta_8 FCOWNER_{t-1}^i + \\
+ \theta X_t^{i,m} + \lambda_i + \delta_t + \mu_m + \varepsilon_{it}
\end{aligned}
\tag{6b}
$$

where $FCOWNER_{t-1}^i = FC_{t-1}^i \times OWNER_{t-1}^i$

In this specification, the coefficient of interest is β_7, which is expected to be positive, capturing the additional effect of collateral value increases for financially constrained firms that own their real estate. I report the results for firm leverage by priority and information sensitivity in Table 8, while heterogeneity of debt structure is examined in Table 7.

By examining the control variables, one can see that they mostly enter the regression specification with the expected sign. Consistent with Myers's (1984) pecking-order theory, more profitable firms use lower leverage. The coefficient on market-to-book ratio is mostly negative and significant, providing support for Myers'(1977) and Hart's (1993) prediction that firms with good growth prospects will reduce their leverage in order to avoid the under-investment problem.

In Table 7 I investigate this argument in more detail in terms of the structure of firm debt holdings itself. In particular, coefficients on the triple-interaction term are positive for mortgage debt, bonds and private placements and negative for program and convertible debt share. These findings suggest that financially constrained real estate owners, in addition to borrowing heavily against their collateral, get access to arm's length financing: namely private placements. This finding also supports the argument that financially constrained firms spread their leverage structure in response to collateral value changes. Most importantly, we can see that they borrow not only against the collateral, but they also increase other types of debt as well.

Negative coefficients on program and convertible debt share indicate that they reduce their short-term program debt, such as commercial paper, MTN and shelf debt. The observed decrease in convertible debt issuance in response to increases in collateral value is consistent with models that predict that collateral can mitigate informational asymmetries and agency problems, which reduces the need for alternative solutions, such as convertible debt and covenant restriction (the latter will be examined in detail in Section 4.5). Reduction in convertible debt share indicates that firms opt for cheaper and less information-sensitive forms of debt as their collateral appreciates.

In Table 8, the estimated coefficient on the triple-interaction term is positive for secured and securitized leverage. This result quantifies the effect of collateral value appreciation on relaxation of financial constraints.

4.4 Collateral value and cost of debt

The evidence presented in the above sections suggests that total firm leverage increases in response to increases in collateral value, but that this change is not homogenous across different debt priorities and types and that it varies in the cross-section. Moreover, less risky, more information-sensitive types of leverage and medium-term leverage decline substantially. These findings raise another interesting question: how do firms benefit from collateral value increases? Do they simply get access to more credit at the same price—or do they renegotiate their existing obligations and issue new debt contracts at a lower price—indicating relaxing of credit constraints? If it were the latter, and firms indeed managed to obtain cheaper credit, one would expect to see a decrease in the observed cost of debt. To test these hypotheses, I run a modified version of the baseline IV specification:

$$CostofDebt_t^{i,m} = \alpha + \beta_1 P_{m,t} + \beta_2 P_{m,t} Exp_{i,0} + \theta X_t^{i,m} + \lambda_i + \delta_t \times \mu_m + u_{it} \tag{7a}$$

$$P_{m,t} + P_{m,t} Exp_{i,0} = \dot{\beta}_1 P_{US,t} e_{m,0} + \\ + \dot{\beta}_2 P_{US,t} e_{m,0} Exp_{io} + \theta X_t^{i,m} + \lambda_i + \delta_t \times \mu_m + \varepsilon_{it} \tag{7b}$$

To measure firm cost of debt I employ deal-level data from DealScan, which I match against my sample. For each deal and deal tranches, I obtain data on the loan amount, interest spread above LIBOR and deal maturity. The sample is restricted to non-financial, non-real estate firms with deals initiated between 1996 and 2006. To calculate firms' yearly average short- and long-term cost of debt, for each firm-year observation, I compute the average yearly interest rate as the mean value of quoted spread on all tranches for a specific firm with the same maturity. All deals with maturity up to a year are then denoted as short-term, while all deals with maturities are denoted as long term.

Table 9 contains the results of this estimation. Columns 1 and 2 contain the results of the baseline specification. The estimates suggest not only that firms are able to borrow more in response to collateral value appreciation, but also that the cost of their long-term borrowing drops by almost four basis points. However, in the short-term, we see no reduction in the cost of debt. The evidence presented in columns 3 and 4 is more compelling—the cost of long-term finance for financially constrained real estate owning firms drops by eight basis points more, while we see no significant effect on the short-term cost of debt. These results indicate that collateral value shocks indeed help alleviate the financing frictions that financially constrained firms face in the market. Following an increase in the value of collateral, financially constrained firms are not only able to borrow more, but they are also able to borrow more cheaply.

4.5 Collateral value and risk-shifting

In this section I study the effects of the changes in collateral value on the presence of financial covenants in the firm debt structure. If indeed collateral can be used to mitigate informational asymmetries and agency problems in securing financing, a firm's ability to collateralize would reflect the frictions it faces in raising external funds. Towards this end, one would expect to see the majority of firms facing upswings in their collateral value depart from employing the commonly used solutions to risk shifting problems, such as convertible debt issuance and the presence of debt covenants and expenditure restrictions. In previous sections I have shown that this is indeed the case for convertible debt holdings. In this section I present empirical evidence that suggests that firms exposed to increases in their collateral value in one period are less likely to face lenders imposing financial contracts with financial covenants and/or capital expenditure restrictions in the following period.

Existing theoretical models suggest that the use of capital expenditure restrictions and/or financial covenants is motivated by conflicts of interest between equity-holders and lenders. In their seminal paper, Jensen and Meckling (1976) show that equity-holders in a levered firm can take on excess risk that is not aligned with lenders' interests, by taking on risky investments that increase the value of their convex payoff structure. There are a couple of solutions to this wealth-transfer problem. One is the design of convertible debt contracts and the other the use of financial covenants that prevent the borrower from taking on risky investments.

"Financial covenants are accounting-based risk and performance hurdles that the borrower must meet to be in compliance with the loan agreement."[11] The breach of a financial covenant means that the borrower has defaulted on the loan, and that the lender has the right to demand immediate repayment of the entire loan. Banks typically utilize this right to initiate a renegotiation of the credit agreement which can lead to significant changes in interest spreads and loan amounts (Beneish and Press (1993), Beneish and Press (1995), Chen and Wei (1993), Smith (1993), Sweeney (1994), Dichev and Skinner (2002), Sufi (2007)).

4.5.1 Data description

My analysis focuses on a set of public firms' private credit contracts of public firms collected from the *SEC Edgar* filing system.[12] This dataset is matched with firm financial data from COMPUSTAT and deal-level data from *DealScan*. As before, I match this data with data on real estate prices and land supply elasticities. The *DealScan* loan sample includes deals made to non-financial firms, and I require that each deal has information on the loan amount, the interest spread of all tranches in the deal and whether the deal has a capital expenditure restriction or a financial covenant associated with it. The sample is restricted to deals initiated during the years 1996 through 2006 to ensure I cover the same time period as in the rest of my analysis.

Financial covenant data from *DealScan* are somewhat scarce. To obtain a more comprehensive measure of restrictions, Nini et al. (2009) use text-search algorithms to scan every 10-Q, 10-K, and 8-K filing in Edgar for loan contracts. More specifically, they match every firm in COMPUSTAT to its respective set of SEC filings based on the firm's tax identification number and then scan these filings. This process allows them to extract most original credit agreements and many of the major amendments and restatements of credit agreements that are contained in Edgar. Finally, DealScan and Edgar datasets are merged based on the date of the loan agreement and the name of the company.

Financial covenants are then grouped into six mutually exclusive groups: coverage ratio covenants (including interest coverage, fixed charge coverage, and debt service coverage covenants), debt to cash flow ratio covenants, net worth covenants, debt to balance sheet

[11] Nini et al (2009).

[12] Obtained from Nini et al (2009).

covenants (including debt to total capitalization and debt to net worth covenants), liquidity covenants (including current ratio, quick ratio, and working capital covenants), and minimum cash flow covenants. Furthermore, the dataset contains information on the capital expenditure restrictions contained in each agreement. Capital expenditure restrictions refer primarily to "cash" capital expenditures, and hence directly refer to investment. Capital expenditure restrictions typically cover cash capital expenditures as in a firm's cash flow statement plus capitalized value of new leases. Financial covenant data are missing for 3 percent of my sample (117 observations). Summary statistics for the loan deal characteristics for my sample are shown in Table 9.

4.5.2 Empirical strategy

In this section I analyze the average partial effect of appreciation of a borrower's collateral in one period on the likelihood of a financial covenant presence in the same borrower's loan agreement in the next period. My outcome of interest is the likelihood of a financial covenant presence, which is a discrete binary variable. I want to estimate coefficients from the general specification:

$$\Pr(covenant_{it} = 1 \mid X_{it}\beta, c_i) = G(X_{it}\beta, c_i)$$

Obtaining consistent estimates of the parameter vector β in a panel setting is the subject of a large body of econometric research (Arellano and Honore (2009); Chamberlain (1984), Fernandez-Val (2005), Bester and Hansen (2006). Following Nini et al. (2009) I estimate a probit model in which the function G takes the following form:

$$G(z) \equiv \Phi(z) \equiv \int_{-\infty}^{z} \phi(\nu) d\nu,$$

where ϕ is the standard normal density. The probit model has several desirable properties. However, it has the undesirable property that firm unobserved effects cannot be explicitly estimated given the incidental parameters problem. In other words, we cannot allow for arbitrary correlation between the unobserved effect and the covariates. To obtain average partial effects, I use an IV probit estimation which takes on the following form:

$$\Pr(covenant_{it} = 1 \mid X_{it}\beta) = \Phi(X_{it}\beta).$$

I estimate two different specifications of the above model: Panel A of Table 10 reports the results of the unconditional probit IV specification, while the results shown in Panel B refer to a probit IV specification conditional on the firm's having a capital expenditure restriction at some point during the sample period. As it can be seen in Panel A, there is a significant decrease in the likelihood of new capital expenditure restrictions, debt-to-capitalisation, net worth, shareholders' equity and tangible net worth covenants. Furthermore, there is a significant decrease in the number of covenants per deal for firms experiencing increases in collateral values. Moreover, as can be seen in Panel B, conditional on a firm's having a capital expenditure restriction at some point in the sample, that is conditional on a firm being "investment constrained", there is an even larger decrease in the likelihood that lenders impose new capital expenditure restrictions, or any of the above-mentioned covenants.

The results on the relationship between collateral value changes and capital expenditure restrictions are very interesting, particularly in the light of the dynamic credit multiplier effect. Restriction on firm investment are not assigned randomly: lenders impose restrictions into financing agreements when borrowers' credit quality deteriorates. Similarly, the evidence presented here suggests that lenders relax capital restrictions following increases in the market value of borrowers' pledgeable assets. This implies that there is a side effect on firm investment that comes not only through the *credit multiplier effect*. The standard credit multiplier effect states that the propagation of an increase in collateral value increases firm investment, which then helps relax firm financing constraints, which in turn increases firm investment, easing financing further, and so on. The results presented in Table 10 suggest that this multiplier effect is further amplified by lenders relaxing capital expenditure restrictions, thus facilitating further investment.

These results show that the firms' ability collateralize their assets is a good predictor of the future investment and credit constraints. Moreover, these results imply that collateral can be used as a tool for solving conflicts of interest between equity-holders and lenders. The evidence that firms substitute convertible debt for other cheaper forms of debt in response to collateral value shocks and that they are faced with a smaller number of covenants and investment restrictions indicates that collateral values indeed alleviate asymmetric information and agency problems. This points further to say that asset market spill-overs during economic booms not only have a positive effect on the real economy through increased investment, but also provide a possible solution to some of the imminent capital structure problems.

4.6 Real estate equity extraction—what do firms do with increased borrowing?

What do firms do with the increased borrowing against their real estate? The answer to this question will help us assess: firstly, if there is an economically significant corporate *collateral channel* (as suggested by Bernanke and Gertler (1990), Kiyotaki and Moore (1997) and others) and what its macroeconomic implications are. Secondly, it will help us establish the effect of collateral value shocks on firm payout policy decisions and, most importantly, it will help us disentangle the underlying motive for the observed increase in leverage in the cross-section. To answer these questions, I analyze firm payout policy for both financially constrained and unconstrained firms.

Using the KZ index as a measure of financial constraints, estimates in Table 12 indicate that financially constrained real estate owners use their borrowing proceeds to finance R&D expenditures and for common dividend payouts and share repurchases. Furthermore, their cash holdings, as a percentage of total assets, drop. If one treats cash as negative debt, then this indicates an increase in firm net leverage. One possible interpretation of this result is that in order to reduce agency costs by limiting cash balances, firms make substantial payouts to existing shareholders.

Existing studies (Campello and Hackbarth (2008), Chaney et al. (2010)) predict that financially constrained firms will increase their investment spending in response to boosts in asset tangibility or positive shocks to collateral value. In the presence of financing imperfections there is going to be an endogenous relationship between firms' real and financing decisions. Campello and Hackbarth (2008) argue for the presence of firm-level dynamic credit multiplier effect, where investment fosters a feedback effect by increasing firm's capital base, in which investment (in tangible assets) helps relax financing constraints, which in turn fosters new investment, easing financing further etc. This mechanism is amplified by firm asset tangibility, which is not only tied to firm's investment process but also to firm's ability to raise external funds. Results presented in Table 12 provide evidence to support this credit multiplier argument.

Financially constrained real estate owning firms tend to increase their capital investment following collateral value increases—the results shown in Figure 2 indicate that around 27% of the real estate equity is used for financing new investment (either capital or R&D). However, the other 73% of the real estate equity is used for common dividend payout and equity re-purchase. In the absence of profitable investment opportunities, financially constrained firms choose to maintain their borrowing capacity by not choosing to stockpile the borrowing proceeds (and thus keep their internal funds limited) and make significant equity payouts.

What are the implications in economic terms? Figure 2 shows the economic implications of this effect for financially constrained real estate owning firms. A one dollar increase in the value of collateral translates into 19 cent increase in total debt on average, out which, financially constrained firms use 7 cents (37 percent) for share re-purchases, 6 cents (31 percent) for financing new investment, 5 cents (27 percent) for R&D expense and 1 cent (5 percent) is paid out as dividends. It seems that financially constrained firms borrow heavily against their collateral not only to finance new investment opportunities, but in the absence of good investment opportunities, to adjust their capital structure so as to reach their leverage optimum and to transfer the benefits of collateral value increases to existing shareholders.

5 Robustness tests

There is a major potential concern with my empirical strategy employed above. It relates to the choice of measure of the level of firm financial constraints.

5.1 Financially constrained vs. financially unconstrained firms revisited

The results presented in the previous section indicate that financially constrained firms do not only increase their total leverage, but also increase the variation in the structure of their debt holdings in response to collateral value increases. This collateral-induced debt heterogeneity is, however, absent for financially unconstrained firms. To ensure that my findings are not driven by the choice of financial constraint classification scheme (KZ measure of financing constraints), I also employ a standard *ex-ante* constraint classification scheme of Almeida (2004), based on firm dividend payout ratio: in every year of my sample period, I rank firms based on their dividend payout ratio. I assign to the *high dividend payout* group all firms that are ranked in the top three deciles of the annual payout distribution. Dividend payout ratio is computed as the ratio of total distributions (common dividends plus stock repurchases) to operating income. Following Fazzari et al. (1988), financially constrained firms have significantly lower payout ratios than unconstrained firms.

I split my sample into two—one for high-dividend payout ratio firms and one for low-dividend payout ratio firms—and I estimate the IV regression as in Equation 1 on both sub-samples. The results of the estimation for leverage by priority structure are shown in Table 13. As can be seen from Table 13, the coefficient on the interaction term $P_{m,t}Exp_{i,0}$

is positive and significant for total leverage for low-dividend payout firms, accompanied by a significant increase in unsecured type of leverage. On the other hand, we see an increase in total leverage, with no variation in debt priority structure for low-dividend payout firms. The coefficient of interest is 0.16 for low-dividend payout firms, and 0.08 for high-dividend payout firms. Hence, based on the dividiend-payout classification scheme more financially constrained firms (low-dividend payout group) increases its leverage twice as much as less financially constrained firms (high-dividend payout group). This finding is consistent with the one presented earlier in Table 5, providing further evidence of the robustness of my results to choice of financial constraint classification scheme. It is important to note that the estimate coefficient for more financially constrained firms (low-dividend payout) is 0.169, while when using the KZ index it is 0.0541 (column 1, Table 5). These results suggest that, if anything, employing the KZ index in the estimation creates an attenuating bias.

5.2 Industry effects

In this section I examine the heterogenous effect of collateral value appreciation across industries. Based on the four-digit SIC code, I classify each firm in my sample into one of the 12 industry groups based on Kenneth R. French's division criteria. The summary statistic are shown in Table 14. As noted before, financial companies are excluded from the sample.

Next, I estimate the IV specification as in Equation 1 for each of the industry categories. The results are shown in Table 15. The β_2 is positive and significnt for Consumer Durables, Consumer Non-Durables, Energy, Chemicals and Business Equipment. Economically, as expected, the coefficient is highest for Durables, most likely due to high tangibility levels characteristic for this industry. For industries which are typically characterized by leasing their fixed assets and equipment, such as Utilities and Telecomms, the estimated effect is negative. These results confirm the intuition that the majority of the collateral value effect comes through the tangibilty of the firms' assets and its ability to collateralize them (effectively use them to secure their borrowing).

6 Conclusion

This paper contributes to the capital structure literature in that it gives simple evidence of an exogenous source of variation in firm capital structure decisions. It shows that firms significantly increase their leverage in response to collateral value appreciation. Consequently, their cost of financing becomes lower and they issue debt at more favorable and attractive terms. This effect is more pronounced for firms that are likely to be financially constrained, which also experience a significant change in the composition of their debt mix. They get improved access to arm's length financing and they tilt their debt structure towards longer-term maturities.

By employing a triple interaction of MSA level land supply elasticity, aggregate real estate price changes and a measure of a firm's real estate holdings as an exogenous source of variation in the value of firm collateral, I find a significant effect of collateral value changes on firm capital structure: a typical US public company extracts 19 cents of real estate equity for every dollar increase in value of its collateral.

I explore the cross-sectional implications of the collateral-based capital structure effect in terms of the level of firm financial constraints and real estate ownership. By employing different classification schemes for the level of financial constraints, namely the KZ index and dividend payout ratio, I find evidence for the first-order importance of collateral value as a determinant of the capital structure. I find that financially constrained firms not only increase their total (net) leverage in response to collateral value appreciation, but they also tend to spread out their debt structure by improving access to arm's length financing and substituting more expensive and information-sensitive types of debt with more attractive alternatives. Concurrently, I find evidence that creditors will have less need to monitor and are less likely to impose new expenditure restrictions or financial covenants. The evidence of the less likely incidence of capital expenditure restrictions amplifies the dynamic credit multiplier effect through firms taking up investment projects that would have been foregone should have the capital restrictions have been in place. Evidence of an increased bond, mortgage-related and private placement debt share, and at the same time decreased convertible and program debt share, suggests that collateral indeed helps alleviate financing imperfections for the firms that are off their optimal leverage levels.

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8 Tables and figures

Table 1: **Summary Statistics**

Panel A presents summary statistics on debt structure for a sample of 20,405 firm-quarter observations for which I obtain accounting, detailed debt structure and real estate data. The sample covers firms for which I have data for at least three consecutive years between 1996 and 2006. Debt structure data has been obtained from Capital IQ Debt dataset.

Panel A	Mean share of total capital (D+E)
Bank	0.0574
Program	0.0153
Bonds	0.0022
Private placements	0.0421
Convertible	0.0223
Mortgage related	0.0011
Other (by type)	0.0109
Senior	0.1223
Junior	0.0002
Subordinated	0.0058
Other (by seniority)	0.0000
Preferred	0.0001
Secured	0.0713
Unsecured	0.0138
Securitized	0.0000

Panel B	Assets (MM)	Debt/Assets	M/B	OIADP/Assets	PPENT/Assets	Cash/Assets	CAPEX/Assets
Mean	6,097.39	0.15	39.02	-2.68	0.28	0.07	0.07
Median	382.01	0.00	1.69	0.03	0.20	0.04	0.03
St. Dev.	22,826.37	0.72	2,228.26	172.96	0.25	0.14	0.87
N	20,405	20,405	20,405	20,405	20,405	20,405	20,405

Table 2: **First stage results**

This table shows results of the first stage regression of the baseline IV specification. The instrument in the first-stage is land supply inelasticity interacted with changes in aggregate real estate prices and a firm's real estate holdings. Column 2 contains results of the first-stage regression. All regressions control for firm characteristics: profitability (defined as ratio of earnings before income and taxes (after depreciation) and book capital, M/B and size-define as ln(Sales). Specifications include firm-, MSA- and quarter-fixed effects and standard errors cluster along the MSA dimension.

P_t^m		$P_t^m \times$ PPENT$_{1995}^i$	
Profitability	-0.001	Profitability	0.000
	(-1.7)		(0.65)
ln(sales)	0.000	ln(sales)	-0.004
	(-0.01)		(-2.07)
M/B	0.000	M/B	0.000
	(-1.08)		(-0.77)
$P_t^{US} e_{m,0} Exp_{i,0}$	-0.001	$P_t^{US} e_{m,0} Exp_{i,0}$	0.004
	(-7.53)		(58.66)
$P_t^{US} e_{m,0}$	0.008	$P_t^{US} e_{m,0}$	0.001
	(56.93)		(22.04)
Quarter-Fixed Effect	Yes		Yes
MSA-Fixed Effect	Yes		Yes
Firm-Fixed effect	Yes		Yes
R2	0.63	R2	0.53
F	302.79	F	203.52
Prob	0	Prob	0

Table 3: **Real estate prices and firm leverage**

This table shows results of the baseline specifications as shown in Equation 1 and 2. Column 1 shows the results of the basic OLS regression using MSA level real estate prices. Column 2 shows the results of the OLS regression which includes the interaction of MSA level real estate prices and firm real estate exposure. Column 3 is similar to Column 2, with the addition of Quarter*MSA Fixed Effect. Columns 4 and 5 report the results of the IV specification. The instrument in the first-stage is land supply inelasticity interacted with changes in aggregate real estate prices and a firm^'s real estate holdings. The dependent variable is leverage, defined as total debt scaled by market value of total assets. All regressions control for firm characteristics: profitability (defined as ratio of earnings before income and taxes (after depreciation) and book capital, M/B and size-define as ln(Sales). Specifications include firm-, MSA- and quarter-fixed effects and standard errors cluster along the MSA dimension.

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	IV	IV
$P_t^m \times$ PPENT$^i_{1995}$		0.0641**	0.0591*	0.0764**	0.0587**
		(2.224)	(1.854)	(2.127)	(2.433)
P_t^m	0.0459*	-0.0109	0.0313	-0.0021	-0.0238
	(1.723)	(-1.283)	(1.274)	(-0.122)	(-0.412)
Profitability	-0.0006	-0.0016	-0.0017	-0.0017**	-0.0017**
	(-0.982)	(-1.372)	(-1.488)	(-2.260)	(-2.350)
ln(Sales)	-0.0031	-0.0054	-0.0051	-0.0053	-0.0055
	(-0.449)	(-0.751)	(-0.741)	(-1.219)	(-1.224)
M/B	-0.000**	-0.0003**	-0.0003**	-0.0003***	-0.0003***
	(-2.150)	(-2.131)	(-2.080)	(-3.097)	(-3.216)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes
Quarter*MSA Fixed Effect			Yes		Yes
Obs.	20,405	20,405	20,405	20,405	20,405
R-squared	0.676	0.673	0.685	0.572	0.635

Table 4: **Leverage and real estate prices: geographical dispersion**

This table presents the results of the baseline specification when the assumption that the majority of a firm's real estate holdings are located in the same MSA as its headquarters is relaxed. Using a relative exposure of each firm to local, state real estate market (as obtained from Garcia and Norli(2012)) and state level real estate prices from the Lincoln Institute of Land Policy, I estimate my baseline specification taking into account the location of each firm's operating assets. The dependent variable is leverage, defined as total debt scaled by market value of total assets. All regressions control for firm characteristics: profitability (defined as ratio of earnings before income and taxes (after depreciation) and book capital, M/B and size- defined as ln(Sales). Specifications include firm-, $\mathcal{W}_s$- and quarter fixed effects and standard errors cluster along the MSA dimension. $\mathcal{W}_s$-Fixed Effect is defined as the relative state-level exposure fixed effect.

	Spec 1	Spec 2	Spec 3	Spec 4
P_t^s	0.0180***	0.0081*	0.0047	0.0021
	(5.959)	(1.745)	(1.114)	(0.326)
$P_t^s \times$ PPENT$_{1995}^i$			0.0606***	0.0268*
			(5.484)	(1.867)
Profitability	-0.283***	-0.192***	-0.281***	-0.191***
	(-11.87)	(-6.144)	(-11.81)	(-6.083)
ln(Sales)	-0.0065	-0.0286***	-0.0101	-0.0348***
	(-0.812)	(-3.053)	(-1.227)	(-3.588)
M/B	0.0059***	0.0008	0.0064***	0.0013
	(2.684)	(0.310)	(2.916)	(0.510)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes
$\mathcal{W}_s$-Fixed Effect	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes
Quarter-$\mathcal{W}_s$-Fixed Effect		Yes		Yes
Observations	18,262	18,262	18,262	18,262
R-squared	0.862	0.912	0.864	0.913

Table 5: **Leverage and real estate prices: financially constrained vs unconstrained firms**

This table presents results of the differences-in-differences specification for more financially constrained firms. Dummy variable FC is used to indicate if the firm is liekly to be financially constrained. Dummy variable FC = 1 if the firm is ranked in the top 25% each quarter based on the value of its KZ index. In panel A, the dependent variable is total leverage (defined as total debt scaled by market value of total assets). I explore the structure of the firm debt mix—the dependent variable is debt type scaled by total debt. In Panel B, I look at leverage by priority (secured, unsecured, securitized). t-stats are reported in brackets. Standard errors cluster along the MSA dimension.

Panel A	Total	Bank	Program	Bonds	PP	Convertible	Mortgage	Other
FC$\times P_t^m \times$ PPENT$^i_{1995}$	0.0541***	-0.103*	-0.0916*	0.0118	0.132*	-0.0559	0.0180**	0.112*
	(2.995)	(-1.714)	(-1.845)	(1.440)	(1.837)	(-1.593)	(2.141)	(1.888)
$P_t^m \times$ PPENT$^i_{1995}$	0.0679*	-0.293**	0.0068	0.0004	0.0063	0.0405	-0.151***	0.390***
	(1.743)	(-2.243)	(0.0635)	(0.00718)	(0.0409)	(0.534)	(-4.439)	(3.036)
P_t^m	-0.0237**	0.160***	0.0016	0.0382**	-0.136***	-0.0136	-0.0509***	0.0003
	(-2.014)	(4.021)	(0.0491)	(2.174)	(-2.855)	(-0.590)	(-4.893)	(0.00771)
FC	-0.0440***	0.0898**	0.0443	0.0204	-0.104**	0.0646***	-0.0129	-0.102***
	(-3.940)	(2.415)	(1.449)	(1.237)	(-2.340)	(2.992)	(-1.323)	(-2.796)
Profitability	-0.0586**	-0.0121	0.0235	0.0258	-0.119	-0.105**	0.0265	0.160*
	(-2.384)	(-0.143)	(0.338)	(0.688)	(-1.179)	(-2.128)	(1.197)	(1.920)
ln(Sales)	-0.0124**	-0.0184	0.0101	-0.0006	0.0114	-0.0194*	0.0159***	0.001
	(-2.193)	(-0.958)	(0.640)	(-0.0812)	(0.500)	(-1.739)	(3.162)	(0.0561)
M/B	-0.0029	-0.0269***	0.0007	0.0017	0.0026	0.0043	-0.0004	0.0179***
	(-1.640)	(-4.280)	(0.144)	(0.622)	(0.348)	(1.188)	(-0.286)	(2.900)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,405	20,405	20,405	20,405	20,405	20,405	20,405	20,405
R-squared	0.742	0.402	0.527	0.566	0.461	0.441	0.880	0.461

Panel B	Secured	Unsecured	Securitized
FC$\times$P$_t^m\times$ PPENT$_{1995}^i$	0.0298***	-0.0001	0.000***
	(3.074)	(-0.431)	(3.978)
P$_t^m\times$ PPENT$_{1995}^i$	0.0670***	0.0003	-0.000**
	(3.200)	(0.357)	(-2.152)
P$_t^m$	-0.0226***	0.0003	-0.000
	(-3.579)	(1.339)	(-0.400)
FC	-0.0215***	0.0001	-0.000***
	(-3.576)	(0.416)	(-6.228)
Profitability	-0.0279**	0.0005	-0.000
	(-2.107)	(0.905)	(-0.368)
ln(Sales)	-0.0041	0.000	-0.000
	(-1.362)	(0.373)	(-0.693)
M/B	-0.0009	-0.000	-0.000
	(-0.965)	(-0.332)	(-0.295)
Quarter-Fixed Effect	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes
Observations	20,405	20,405	20,405
R-squared	0.783	0.306	0.771

Table 6: **Leverage and real estate prices: owners vs. renters**

This table presents evidence on the differential effect of real estate price growth on firm leverage for real estate owners and renters. Firm is defined as a real estate owner if its rental expense scaled by gross PPE is less than 5%, and as real estate renter otherwise. Dummy variable OWNER equals one if the firm owns its real estate and zero otherwise. In panel A, the dependent variable is total leverage (defined as total debt scaled by market value of total assets). I explore the structure of the firm debt mix—the dependent variable is debt type scaled by total debt. In Panel B, I look at leverage by priority (secured, unsecured, securitized). t-stats are reported in brackets. Standard errors cluster along the MSA dimension.

Panel A	Total	Bank	Program	Bonds	PP	Convertible	Mortgage	Other
Owner$\times \mathrm{P}_t^m \times$ PPENT$_{1995}^i$	0.135***	0.298***	-0.349***	0.0085**	-0.0365	0.0389	0.0651**	-0.0251
	(4.659)	(3.078)	(-4.377)	(2.198)	(-0.315)	(0.690)	(2.557)	(-0.263)
$\mathrm{P}_t^m \times$ PPENT$_{1995}^i$	-0.0317	-0.659***	0.278**	-0.0211	0.147	-0.0299	-0.206***	0.491***
	(-0.650)	(-4.020)	(2.059)	(-0.289)	(0.749)	(-0.313)	(-4.773)	(3.029)
P_t^m	-0.0296***	0.179***	0.0071	0.0414**	-0.154***	-0.003	-0.0525***	-0.0172
	(-2.582)	(4.582)	(0.222)	(2.388)	(-3.306)	(-0.132)	(-5.106)	(-0.447)
Owner	-0.0827***	-0.136***	0.142***	-0.0089	0.0385	0.0137	-0.0403***	-0.009
	(-5.799)	(-2.846)	(3.609)	(-0.421)	(0.672)	(0.493)	(-3.201)	(-0.191)
Profitability	-0.0422*	-0.0004	-0.0062	0.0238	-0.111	-0.112**	0.0334	0.172**
	(-1.723)	(-0.00485)	(-0.0900)	(0.632)	(-1.092)	(-2.266)	(1.502)	(2.056)
ln(Sales)	-0.0133**	-0.0164	0.0122	0.0005	0.0075	-0.0183	0.0158***	-0.0014
	(-2.380)	(-0.858)	(0.774)	(0.0639)	(0.330)	(-1.637)	(3.136)	(-0.0753)
M/B	-0.0025	-0.0264***	-0.0009	0.0015	0.0034	0.0045	-0.0003	0.0182***
	(-1.425)	(-4.212)	(-0.190)	(0.560)	(0.456)	(1.230)	(-0.186)	(2.936)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,405	20,405	20,405	20,405	20,405	20,405	20,405	20,405
R-squared	0.793	0.465	0.355	0.510	0.329	0.384	0.811	0.441

Panel B	Secured	Unsecured	Securitized
Owner$\times$P$_t^m\times$ PPENT$^i_{1995}$	0.0530***	-0.0001	0.000
	(3.392)	(-0.238)	(1.002)
P$_t^m\times$ PPENT$^i_{1995}$	0.0354	0.0002	-0.000
	(1.341)	(0.238)	(-1.178)
P$_t^m$	-0.0258***	0.0003	-0.000
	(-4.162)	(1.432)	(-1.339)
Owner	-0.0279***	-0.0001	-0.000
	(-3.619)	(-0.395)	(-1.105)
Profitability	-0.0214	0.0005	0.000
	(-1.616)	(0.890)	(0.0597)
ln(Sales)	-0.0047	0.000	-0.000
	(-1.566)	(0.461)	(-1.118)
M/B	-0.0006	-0.000	-0.000
	(-0.698)	(-0.434)	(-0.0109)
Quarter-Fixed Effect	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes
Observations	20,405	20,405	20,405
R-squared	0.659	0.451	0.712

Table 7: **Leverage and real estate prices: financially constrained real estate owners**

This tables shows results of the triple-differences specification for financially constrained real estate owners by debt type (as percentage of total debt). Dummy variable OWNER equals one if the firm owns its real estate and zero otherwise. Dummy variable FC = 1 if the firm is ranked in the top 25% each quarter based on the value of its KZ index. Variable FCOWNER is defined as an interaction: FCOWNER = OWNER x FC. t-stats are reported in brackets. Standard errors cluster along the MSA dimension.

	Total	Bank	Program	Bonds	PP	Convertible	Mortgage	Other
FC$\times$Owner$\times P_t^m \times$ PPENT$^i_{1995}$	0.0736**	0.0005	-0.179**	0.0385***	0.137**	-0.166***	0.0744**	0.171
	(2.214)	(0.00493)	(-1.973)	(2.786)	(2.037)	(-2.579)	(2.571)	(1.574)
Owner$\times P_t^m \times$ PPENT$^i_{1995}$	-0.0158	0.0329	-0.0653	-0.0020	0.0216	0.0973***	-0.0236	-0.0609
	(-0.818)	(0.513)	(-1.240)	(-0.0717)	(0.282)	(2.612)	(-1.404)	(-0.965)
FC$\times P_t^m \times$ PPENT$^i_{1995}$	-0.0394	-0.115	0.0681	0.0280	0.0130	0.110*	-0.0492*	-0.0554
	(-1.330)	(-1.161)	(0.840)	(0.639)	(0.110)	(1.918)	(-1.903)	(-0.570)
$P_t^m \times$ PPENT$^i_{1995}$	0.100**	-0.297**	0.0573	-0.0011	-0.0219	-0.0504	-0.130***	0.444***
	(2.378)	(-2.105)	(0.493)	(-0.0190)	(-0.130)	(-0.614)	(-3.527)	(3.190)
P_t^m	-0.0286**	0.156***	0.0036	0.0394**	-0.135***	-0.0073	-0.0528***	-0.0038
	(-2.428)	(3.906)	(0.112)	(2.227)	(-2.828)	(-0.316)	(-5.060)	(-0.0972)
Owner$\times$FC	-0.0280**	0.0998***	0.0588*	0.0193	-0.118***	0.0588***	-0.0161	-0.102***
	(-2.479)	(2.654)	(1.902)	(1.158)	(-2.634)	(2.694)	(-1.632)	(-2.761)
Profitability	-0.0558**	-0.0020	0.0165	0.0249	-0.121	-0.105**	0.0277	0.159*
	(-2.269)	(-0.0241)	(0.237)	(0.663)	(-1.194)	(-2.133)	(1.251)	(1.903)
ln(Sales)	-0.0129**	-0.0171	0.0122	-0.0002	0.0088	-0.0205*	0.0163***	0.0004
	(-2.281)	(-0.888)	(0.771)	(-0.0295)	(0.386)	(-1.831)	(3.234)	(0.0235)
M/B	-0.0029	-0.0265***	0.000	0.0016	0.0028	0.0051	-0.0006	0.0174***
	(-1.631)	(-4.196)	(0.0139)	(0.601)	(0.371)	(1.403)	(-0.403)	(2.808)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,405	20,405	20,405	20,405	20,405	20,405	20,405	20,405
R-squared	0.824	0.442	0.537	0.502	0.632	0.622	0.940	0.837

Table 8: **Leverage and real estate prices: financially constrained real estate owners**

This tables shows results of the triple-differences specification for likely financially constrained real estate owners by debt priority and information sensitivity (as percentage of total assets). Dummy variable OWNER equals one if the firm owns its real estate and zero otherwise. Dummy variable FC = 1 if the firm is ranked in the top 25% each quarter based on the value of its KZ index. Variable FCOWNER is defined as an interaction: FCOWNER = OWNER x FC. t-stats are reported in brackets. Standard errors cluster along the MSA dimension.

	Secured	Unsecured	Securitized
FC$\times$Owner$\times$P$_t^m\times$ PPENT$^i_{1995}$	0.0348*	-0.0007	0.000***
	(1.946)	(-1.007)	(2.984)
Owner$\times$P$_t^m\times$ PPENT$^i_{1995}$	-0.0008	0.000	-0.000
	(-0.0793)	(0.123)	(-0.00175)
FC$\times$P$_t^m\times$ PPENT$^i_{1995}$	-0.0159	0.001	-0.000
	(-0.996)	(1.516)	(-0.709)
P$_t^m\times$ PPENT$^i_{1995}$	0.0782***	-0.0001	-0.000**
	(3.445)	(-0.176)	(-2.027)
P$_t^m$	-0.0250***	0.0004*	-0.000
	(-3.951)	(1.688)	(-0.484)
Owner$\times$FC	-0.0130**	-0.0002	-0.000***
	(-2.142)	(-0.954)	(-6.594)
Profitability	-0.0262**	0.0004	-0.000
	(-1.977)	(0.770)	(-0.356)
ln(Sales)	-0.0045	0.000	-0.000
	(-1.496)	(0.376)	(-0.931)
M/B	-0.0008	-0.000	-0.000
	(-0.883)	(-0.421)	(-0.327)
Quarter-Fixed Effect	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes
Observations	20,405	20,405	20,405
R-squared	0.830	0.504	0.735

Table 9: **Land prices and firm cost of debt**

This table presents evidence of the impact of real estate price growth on firm cost of debt. Average short term borrowing rate was obtained from COMPUSTAT, while average long term borrowing rate was obtained from detailed deal-level data from DealScan. I report results of the baseline IV specification, with the dependent variable being a firm's average long-term and short-term cost of debt. t-stats are reported in brackets. Standard errors cluster along the MSA dimension.

	LT cost of borrowing	ST cost of borrowing	LT cost of borrowing	ST cost of borrowing
FC $\times$ Owner $\times P_t^m \times$ PPENT$_{1995}^i$			-0.078***	-0.022
			(-2.81)	(-0.91)
Owner $\times P_t^m \times$ PPENT$_{1995}^i$			-0.060***	-0.005
			(-3.56)	(-0.69)
FC $\times P_t^m \times$ PPENT$_{1995}^i$			-0.023	-0.007
			(-1.52)	(-0.56)
$P_t^m \times$ PPENT$_{1995}^i$	-0.038**	-0.017	-0.019**	-0.004
	(-2.10)	(-1.18)	(-2.32)	(-1.26)
P_t^m			0.001	1.035
			(0.09)	(0.54)
Owner $\times$ FC			-0.004	-0.136
			(-0.24)	(-0.44)
Profitability	-0.072***	-0.002	0.156**	-0.174
	(-3.39)	(-0.64)	(2.12)	(-1.49)
ln(Sales)	0.207	0.002	-0.029***	0.734*
	(1.01)	(0.79)	(-5.23)	(1.75)
M/B	-0.405**	0.004	0.008***	-0.871
	(-2.38)	(0.62)	(5.34)	(-1.02)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes
Observations	20,405	20,405	20,405	20,405
R-squared	0.742	0.552	0.845	0.649

Table 10: **Summary statistics for financial covenants data**

This table presents summary statistics for a sample of private credit agreements to 3,078 public borrowers obtained from Nini et al.(2009), collected from the SEC's EDGAR electronic filing system over the period 1996-2005. Agreement amount includes total dollar proceeds available to the borrower. LIBOR is the London Interbank Offer Rate. Coverage ratio covenants include interest coverage, fixed charge coverage, and debt service coverage covenants. Debt to balance sheet covenants include debt to total capitalization and debt to net worth covenants. Liquidity covenants include current ratio, quick ratio, and working capital covenants. Credit ratings are from Standard & Poor's, and a rating lower than BBB is considered to be junk rated.

	Mean	Median	St. Dev.	N
Loan Amount (in $ millions)	415	190	850	3078
Loan Amount / Total Assets	0.278	0.212	0.296	3078
Interest rate spread (bp above LIBOR)	150.631	112.5	131.508	3078
Coverage ratio covenant (1,0)	0.776	1	0.418	3078
Debt to Cash Flow covenant (1,0)	0.557	1	0.498	3078
Net worth covenant (1,0)	0.374	0	0.485	3078
Debt to balance sheet covenant (1,0)	0.287	0	0.454	3078
Liquidity covenant (1,0)	0.086	0	0.281	3078
Minimum cash flow covenant (1,0)	0.069	0	0.254	3078
Financial covenant violation within past year (1,0)	0.028	0	0.166	3078
Credit rating (1 = AAA or AA, 2 = A, 3 = BBB ...)	2.295	2	1.061	3078

Table 11: **Real estate prices and presence of financial covenants**

This table presents estimated coefficients from panel IV probit regressions that relate the probability of having a capital expenditure restriction or a financial covenant in a financial contract in one period to real estate price (thus collateral value) appreciation in the immediately preceding period. The dependent variable in all regressions is a dummy variable that equals one if the newly issued financial contract contains a covenant of a particular type (i.e. Debt/Capitalization, Net worth etc.). Panel A shows the results of the unconditional probit IV specification, while in Panel B I report estimates of the probit IV specification conditional on a firm having a capital expenditure restriction at at least one point in time during the sample period.

Panel A	Type of covenant					
Probit regressions - unconditional	New CAPX restriction	Debt/ Capitalisation	Net Worth	Shareholder's Equity	Tangible Net Worth	No. of covenants per deal
$P_t^m \times$ PPENT$^i_{1995}$	-0.017***	-0.023***	-0.020***	-0.047***	-0.017**	-0.015*
	(-2.68)	(-3.21)	(-3.38)	(-2.61)	(-2.07)	(-1.77)
Profitability	-0.736	1.185	0.451	-1.097	-1.453**	-1.231
	(-0.63)	(1.53)	(0.51)	(-0.81)	(-2.17)	(-1.56)
M/B	-0.067	-0.052	-0.136	0.295***	-0.288*	-0.133
	(-0.73)	(-0.72)	(-1.50)	(3.33)	(-1.83)	(-0.66)
ln(Sales)	-0.124	-0.151*	-0.030	-0.065	-0.139**	0.102
	(-1.59)	(-1.94)	(-0.47)	(-0.48)	(-2.10)	(1.33)
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Quarter-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3047	2954	2954	2954	2954	2954
R-squared	0.01	0.02	0.04	0.11	0.03	0.07

Panel B	Type of covenant					
Probit regressions - conditional on CAPX restriction	New CAPX restriction	Net Worth	Senior Debt / Cash Flow	Shareholder's Equity	Tangible Net Worth	No. of covenants per deal
$P_t^m \times$ PPENT$^i_{1995}$	-0.018**	-0.044***	-0.023*	-0.046**	-0.029**	-0.030**
	(-2.18)	(-3.56)	(-1.85)	(-2.12)	(-2.51)	(-1.97)
Profitability	5.308**	5.050*	-1.665	2.734**	3.934*	-1.115
	(2.07)	(1.86)	(-1.21)	(2.57)	(1.81)	(-1.01)
M/B	-0.968**	0.074	0.238	-0.442*	-0.779**	-0.202
	(-2.00)	(0.22)	(0.90)	(-1.90)	(-2.32)	(-0.90)
ln(Sales)	0.134	-0.042	0.037	-0.065	-0.010	-0.142
	(1.21)	(-0.37)	(0.57)	(-1.03)	(-0.08)	(-1.49)
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Quarter-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3047	2954	2954	2954	2954	2954
R-squared	0.01	0.02	0.04	0.11	0.03	0.07

Table 12: **Real estate equity extraction: financially constrained owners**

This table shows results of triple-differences analysis of firm spending with respect to increased borrowing for likely financially constrained real estate owning firms. I measure the level of financing constraints using the KZ index (variable FC), and the firm is defined as a real estate owner if its annual rental expense scaled by gross PPE is less then 5%. The table shows results for R&D expense, dividends, capital expenditure, cash, acquisitions and purchases of equity, scaled by firm total assets. Investment is defined as CAPEX scaled by total assets. t-statistics are reported in brackets. Standard errors cluster along the MSA dimension.

	R&D	Divs pref	Divs common	Divs total	Investment	Cash	Cash and ST	Aquisitions	Equity buybacks
FC×Owner×P_t^m× $PPENT_{1995}^i$	0.0531***	0.0098***	-0.0005	0.0096***	0.0613***	-0.0455**	-0.0496**	-0.105***	0.0736***
	(3.649)	(4.011)	(-0.247)	(3.011)	(7.054)	(-2.154)	(-1.986)	(-2.839)	(4.916)
Owner×P_t^m× $PPENT_{1995}^i$	-0.0265***	-0.0051***	-0.0024**	-0.0075***	0.0007	-0.0364***	0.0079	0.0227	0.0120
	(-5.223)	(-4.549)	(-2.503)	(-5.130)	(0.189)	(-3.780)	(0.694)	(1.359)	(1.396)
FC×P_t^m× $PPENT_{1995}^i$	-0.0069	-0.0024	-0.00488***	-0.0073***	0.0068	-0.0234	-0.0246	-0.0231	0.0009
	(-1.152)	(-1.415)	(-3.254)	(-3.242)	(1.129)	(-1.585)	(-1.403)	(-0.890)	(0.0703)
P_t^m× $PPENT_{1995}^i$	0.0087	0.0029	0.0080***	0.0109***	0.0015	-0.0484***	-0.0334*	-0.004	0.0155
	(1.237)	(1.521)	(4.770)	(4.305)	(0.230)	(-2.916)	(-1.699)	(-0.137)	(1.040)
P_t^m	-0.0011	-0.0022***	-0.0009*	-0.0033***	-0.008***	-0.0007	-0.0024	0.0031	0.0410***
	(-0.344)	(-3.319)	(-1.647)	(-3.678)	(-3.325)	(-0.123)	(-0.356)	(0.297)	(7.900)
Owner×FC	0.0056**	-0.0003	-0.0038***	-0.0041***	-0.0038*	-0.0114**	-0.0078	0.0116	-0.0143***
	(2.450)	(-0.489)	(-6.764)	(-4.828)	(-1.645)	(-2.013)	(-1.167)	(1.143)	(-2.779)
Profitability	-0.0369***	-0.0144***	-0.0006	-0.0152***	0.0275***	0.0035	0.0231	0.015	0.0304**
	(-6.627)	(-10.03)	(-0.559)	(-8.079)	(5.423)	(0.286)	(1.588)	(0.701)	(2.564)
ln(Sales)	-0.0064***	-0.0013***	-0.0001	-0.0015***	-0.0025**	-0.0273***	-0.0264***	-0.0117**	-0.0121***
	(-4.726)	(-4.161)	(-0.531)	(-3.487)	(-2.152)	(-9.670)	(-7.877)	(-2.297)	(-4.611)
M/B	-0.0064***	-0.0002*	-0.0002***	-0.0004***	-0.0025***	-0.0143***	-0.0183***	-0.0017	-0.0005
	(-17.56)	(-1.959)	(-3.036)	(-3.505)	(-6.682)	(-15.65)	(-16.92)	(-1.123)	(-0.671)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,405	20,405	20,405	20,405	20,405	20,405	20,405	20,405	20,405
R-squared	0.345	0.297	0.256	0.300	0.395	0.479	0.584	0.122	0.221

Table 13: **High vs. low dividend payout firms**

This table presents results on the effect of collateral value changes on leverage priority structure for likely (low-dividend payout) vs. unlikely financially constrained (high-dividend payout) real estate owning firms. As a robustness check, I measure the level of financing constraints using an ex-ante clasification scheme based on dividend payout ratio. High-dividend payout sample consists of all firms that are ranked in the top 3 deciles of the total annual payout distribution (common dividends plus stock repurchases). t-statistics are shown in brackets. Standard errors cluster along the MSA dimension.

	Low div payout-total	Secured	Unsecured	Securitized	High div payout-total	Secured	Unsecured	Securitized
$P_t^m \times$ PPENT$_{1995}^i$	0.160***	0.0232	0.0270**	-0.000	0.0835*	-0.0038	0.0065	0.0001
	(2.702)	(0.648)	(2.569)	(-0.170)	(1.755)	(-0.139)	(0.727)	(1.112)
P_t^m	-0.0129	0.0073	-0.0026	-0.000	-0.0284	0.0115	-0.0045	-0.000
	(-0.485)	(0.457)	(-0.558)	(-0.464)	(-1.411)	(0.985)	(-1.197)	(-0.447)
Profitability	-0.0017*	-0.000	-0.0002*	0.000	-0.0014*	-0.000	-0.0005***	-0.000
	(-1.954)	(-0.120)	(-1.666)	(0.193)	(-1.809)	(-0.0375)	(-3.599)	(-0.0954)
ln(Sales)	-0.0028	0.0026	-0.0018*	-0.000*	0.0012	0.0040	0.0002	0.000
	(-0.523)	(0.808)	(-1.926)	(-1.880)	(0.200)	(1.144)	(0.232)	(0.328)
M/B	-0.0002***	-0.0001**	-0.000	-0.000	-0.000	-0.000	-0.000	0.000
	(-2.584)	(-2.131)	(-1.074)	(-0.184)	(-0.676)	(-0.516)	(-0.914)	(0.0199)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,224	7,224	7,224	7,224	6,745	6,745	6,745	6,745
R-squared	0.821	0.913	0.608	0.705	0.626	0.720	0.408	0.507

Table 14: **Summary statistics: industries**

This table shows the data set break down by industry, obtained using the industry classification by Kenneth R. French. Based on the four digit SIC code, I classify each firm in my sample into one of the 12 industry groups. Since the sample does not cover financial companies, the table below excludes their corresponding statistics

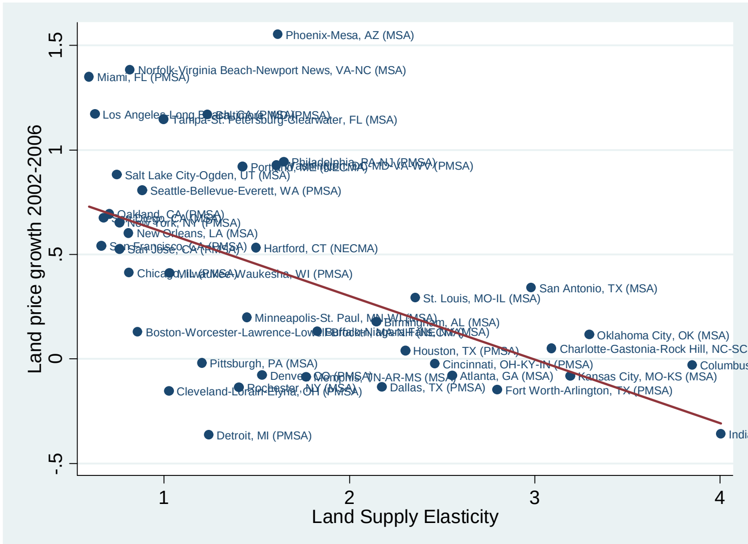
Industry	ind	Freq.	Percent	Cum.
Consumer NonDurables	1	1,222	5.99	5.99
Consumer Durables	2	522	2.56	8.55
Manufacturing	3	2,118	10.38	18.93
Enrgy	4	1,006	4.93	23.86
Chemicals and Allied Products	5	615	3.01	26.87
Business Equipment	6	4,097	20.08	46.95
Telephone and Television Transmission	7	1,177	5.77	52.72
Utilities	8	868	4.25	56.97
Wholesale, Retail, and Some Services	9	2,549	12.49	69.46
Healthcare, Medical Equipment, and Drugs	10	2,719	13.33	82.79
Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment	12	3,512	17.21	100
Total		20,405	100	

Table 15: **Leverage and real estate prices: evidence accross industries**

This tables presents the results of the baseline IV specification, estimated for each of the 11 industry groups (financial companies, as define by Kenneth R. French are excluded). The dependent variable is leverage, defined as total debt scaled by market value of total assets. All regressions control for firm characteristics: profitability (defined as ratio of earnings before income and taxes (after depreciation) and book capital, M/B and size—define as ln(Sales). Specifications include firm-, MSA- and quarter-fixed effects and standard errors cluster along the MSA dimension.

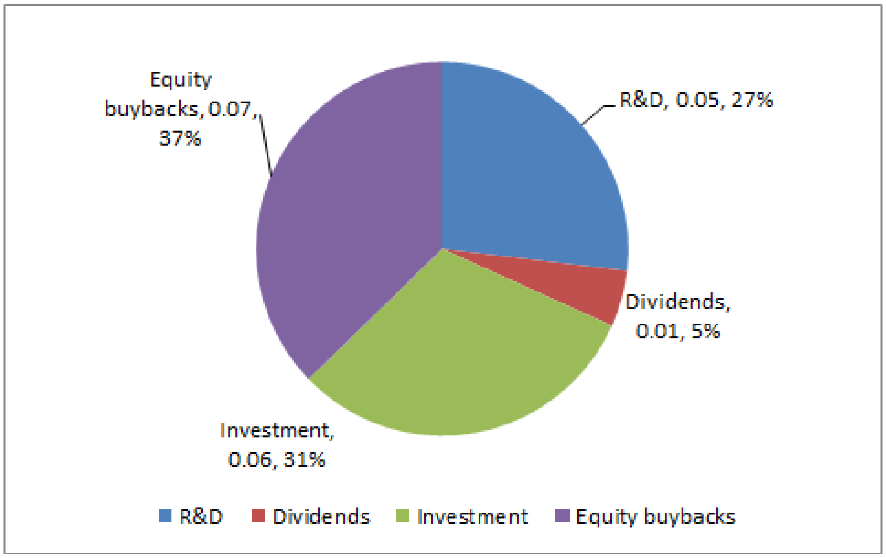
	NoDur	Dur	Manufacturing	Energy	Chemicals	Business equip	Telecomms	Utils	Retail	Health	Other
$P_t^m \times$ PPENT$^i_{1995}$	2.089***	12.41***	-0.0555	0.0092*	1.481***	0.186***	-0.0006*	-0.0398***	-0.0108	0.0253	-0.328*
	(6.180)	(3.403)	(-0.212)	(1.885)	(2.649)	(3.101)	(-1.886)	(-32.91)	(-0.628)	(0.603)	(-1.933)
P_t^m	-0.512***	-2.989***	0.100	-0.0043*	-0.134	-0.0252**	0.000	0.0059***	0.0051	0.0876***	0.0541
	(-5.355)	(-3.570)	(0.967)	(-1.819)	(-1.014)	(-2.278)	(0.290)	(21.47)	(0.564)	(3.889)	(1.425)
Profitability	0.0959	0.318	0.0339	-0.0002	-0.0567	-0.206***	0.000	-0.0037***	-0.0102	0.0197	-0.0900
	(0.398)	(1.492)	(0.519)	(-0.328)	(-0.363)	(-13.37)	(0.134)	(-5.023)	(-0.588)	(0.422)	(-0.802)
ln(Sales)	0.0925*	0.0590**	-0.0348**	0.0002	-0.148**	-0.00219	-0.000	0.0001***	-0.0008	-0.0325***	0.00915
	(1.870)	(2.439)	(-2.158)	(1.453)	(-2.197)	(-0.452)	(-0.252)	(4.663)	(-0.269)	(-2.997)	(0.562)
M/B	0.0157	0.0805	-0.0149*	-0.0001	0.101**	0.0032***	-0.000	0.0045***	-0.001	0.0053*	-0.000
	(0.599)	(1.165)	(-1.867)	(-1.403)	(2.140)	(2.776)	(-0.957)	(24.92)	(-0.784)	(1.925)	(-0.0129)
Quarter-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MSA-Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.335	0.735	0.041	0.097	0.408	0.335	0.211	0.999	0.075	0.676	0.145

Figure 1: **Real estate price growth and land supply elasticity**



This figure plots land price growth from 2002 to 2006 against land supply elasticity, as measured by Saiz (2010) for the 46 MSAs in my sample.

Figure 2: **Estimated usage of $1 increase in collateral value**



This figure shows the estimated real estate equity extraction for financially constrained real estate owning firms. On every $1 increase in the value of their collateral, financially constrained real estate owning firms borrow 19 cents.