INTERNATIONAL REAL ESTATE REVIEW

2024 Vol. 27 No. 1: pp. 117 – 138

Corporate Governance and Collateral Effect of Real Estate

Daxuan Zhao
School of Business, Renmin University of China, 59 Zhongguancun Street, Haidian District, Beijing, China, 100872, Email: zhaodaxuan@ruc.edu.cn

The collateral channel literature predicts that soaring real estate prices increase the debt capacity of firms with more real estate asset holdings. This paper discusses the different relationships between collateral and investment. We find that firms with strong corporate governance were more likely to increase debt capacity via the collateral channel during the real estate boom from 1993 to 2006. Entrenched managers used less debt to finance their investments when their real estate collateral values increased. Our results hold even after controlling for non-collateralized debts and credit rating of the sample firms.

Keywords

Collateral Effect, Corporate Governance, G-Index, Real Estate Assets, Investment Decisions

1. Introduction

Firms use more collateralized debt to finance investment activities when positive shocks cause increases in real estate asset value. This "collateral channel", which is proposed by Fisher (1930), correlates the debt capacity of firms with their real estate collateral values (e.g. Gan 2007a; 2007b; Chaney et al. 2012). However, the effects of collateral among different firms are still unknown. This paper discusses the impact of corporate governance on the usage of collateralized debt when property price soars. We hypothesize that firms with strong corporate governance strategically abide by the pecking order of using low-cost collateralized debt, followed by uncollateralized debt and equity when investing in projects. As a counterfactual, if corporate governance does not matter, we should then expect strongly governed firms to have the same collateralized debt as weakly governed firms in a booming market holding the initial real estate value constant among the firms.

The collateralized debt literature usually models the lending process in a moral hazard setting or as a game with adverse selection (see, for example, Berger and Udell, 1990; Bester, 1985; Boot and Thakor, 1994). In spite of these models, most of the banking literature simply assumes that bank loans are secured, and access to firm assets is the payoff of banks to monitoring or efficient liquidation. Firms with better corporate governance can reduce the agency problems between managers and investors. There are two possible motivations for managers in better-governed firms to use more collateralized debt to finance value-enhanced projects. First, from the perspective of lenders, collateral improves the monitoring and liquidation of bank. Collateralized debt usually has low borrowing costs, and is thus beneficial to stockholders for enhancing their yield spread (Klock et al., 2005). Secondly, from the perspective of borrowers, managers in firms with better corporate governance are more risk-taking (John et al., 2008). These firms have a higher loan-to-value ratio for their real estate holdings and lock less capital in their real estate.

Our paper explores the effects of collateral by observing the different changes in debt capacity among firms with different real estate holdings in 1993 when they experienced a dramatic housing price increase from 1993 to 2006. This identification allows us to exclude the endogeneity issue between real estate holdings and debt issuance. If the collateral channel is significant, we should then expect firms with high initial real estate value to accumulate more real estate wealth in booming real estate markets, and use more collateralized debt. We use the corporate governance index (G-index) developed by Gompers et al. (2003) to represent the corporate governance of firms with respect to minority shareholder rights and managerial vulnerability to takeovers. We use variations in collateralized debts between strongly and weakly governed firms during the real estate boom from 1993 to 2006 to test the effects of rising collateral value on debt choice of firms.

The main empirical result of this paper is that firms with better governance use more collateralized debt. With firms having the same initial real estate base values as in 1993, entrenched managers use less debt than managers who are not entrenched to finance their investments during the property market boom periods. Our results are highly robust. First, by dividing our sample firms into two groups (firms with high G-index versus firms with low G-index), we find that firms in the better corporate governance group (with low G-index score) issue more collateralized debt, ceteris paribus. Second, our results show that corporate governance has significantly positive effects on the collateralized debt issuance of firms, when their initial real estate value, as tracked by the housing price index, increases. Third, we find that firms with better corporate governance issue less non-collateralized debt, and more collateralized debt. Fourth, the positive relationship between corporate governance and the collateral effect persists after controlling the ex-ante credit rating of the sample firms. The above empirical evidence does not reject the hypothesis that corporate governance impacts investment via the collateral channel.

Our study makes several contributions to the extant literature on corporate governance, capital structure, and real estate. First, our paper belongs to the literature on collateral effects, in particular, collateral effect of real estates. Gan (2007a, 2007b) and Chaney et al. (2012) find empirical evidence that support the collateral channel hypothesis by using data on the real estate bursts in Japan in the 1980s, and real estate booms in the US from 2000 to 2006, respectively. On the contrary, Wu et al. (2013) do not find a collateral effect on firm investments in their empirical tests with the use of land price data from 35 major cities in China. Campello et al. (2022) examine the relationship between real estate value and collateral, while Norden and van Kampen (2013) investigate the impact of credit ratings. In studying household finance, Agarwal et al. (2014) show that financially constrained borrowers have incentive to influence the valuation of their real estate collaterals to increase debt leverage. Similarly, Cvijanovic (2014) shows that financially constrained firms use less information-sensitive debt when collateral value increases.

Second, our paper is related to the literature on the debt financing decisions of firms with different types of corporate governance. Managers in weakly governed firms avoid taking risks by only investing in projects that promote growth in firm value (Amihud and Lev, 1981; Hirshleifer and Thakor, 1992; Holmstrom and Ricart I Costa, 1986; John et al., 2008). Less entrenched managers improve the wealth of firm stockholders with a lower cost of collateralized debt financing (Klock et al., 2005). Berger et al. (1997) find that firms operated by CEOs with few direct shareholdings, low option holdings, long tenure, high excess compensation, large boards, and low percentage of outside directors have less leverage. Garvey and Hanka (1999) find that managers reduce leverage when they are shielded from takeovers. Friend and Lang (1988) show that the debt ratio is negatively related to managerial ownership. John and Litov (2010) find a positive relationship between leverage

and entrenchment for a large sample of US firms. In terms of real estate investment, Sirmans (1999) argues that firms with high real estate investments require different sets of corporate governance mechanisms to mitigate agency costs. Bauer et al. (2010) find no significant relationship between corporate governance and corporate performance of real estate investment trusts (REITs). However, they find that corporate governance has positive effects on the performance of the matched sample non-REIT stocks.

The remainder of the paper is organized as follows. Section 2 discusses the empirical methodology and data. Section 3 presents the empirical results and tests the significance of the interactive relationship between corporate governance and collateral effects. Section 4 concludes the study.

2. Empirical Methodology and Data

2.1 Empirical Methodology

We examine the impact of corporate governance on the collateral effects of real estate by using data of US-listed firms from 1993 to 2006. During this period of time, the housing price index shows that housing prices experienced a dramatic increase of almost 2.5 times between 1993 and 2006. This provides a natural test bed for collateral effects. Following the methodologies in Gan (2007a, 2007b) and Chaney et al. (2012), we use variations in the real estate holdings of firms in 1993 to explain for changes in debt capacity in response to real estate price changes during this period of time. If the collateral effect is significant, debt capacity will be explained by variations in real estate holdings as a continuous increase in property prices. The regression specification is as follows:

$$DEBT_{t,i} = \alpha_0 + \alpha_2 RE\ Value_i + \alpha_3 \times G_{i,t} \times RE\ Value_i + \alpha_3 X_{i,t} + \delta_{i,t} \quad (1)$$

where subscript i denotes the firm sample. Variable definitions are as follows: $DEBT_{t,i}$ is the debt capacity at time t; $RE\ Value_i$ is the market value of corporate real estate holdings at the beginning, i.e., 1993 in this paper; $G_{i,t}$ is the proxy for corporate governance; $X_{i,t}$ is a group of control variables; and $\delta_{i,t}$ is a residual of the regression. An interaction term between corporate governance $G_{i,t}$ and corporate real estate holding $RE\ Value_i$ is included in the regression. The collateral effect in this model can be written as: $\alpha_2 + \alpha_3 \times G_{i,t}$. The coefficient α_3 captures the influence of corporate governance on collateral effects. If it is significantly negative, then this implies that firms with better governance have strong collateral effects.

We also control the impact of exogenous property prices in the regression model:

$$DEBT_{t,i} = \alpha_0 + \alpha_2 \times RE\ Value_i \times HPI_t + \alpha_3 \times G_{i,t} \times RE\ Value_i \times HPI_t + \alpha_3 X_{i,t} + \delta_{i,t} \quad (2)$$

where HPI_t is the ratio of the housing price index over the initial housing price index, i.e., in 1993. $RE\ Value_i \times HPI_t$ is the proxy for appreciation of corporate real estate.

2.2 Description of Variables

The following is a brief description of the key variables. Detailed explanations are provided in Table 1, and the summary statistics are shown in Table 2.

Table 1 Definition of Variables

Variable	Definition
Main Variable	
Real Estate Holing in 1993 (RE Value)	Real estate holdings in 1993 are derived from the breakdown of PPE of firm, including costs of buildings (#FATB), land and improvement (#FATP) and costs of construction in progress (#FATC). They are all book value. We take the costs of construction in progress (#FATC) as market value directly. For buildings and land and improvement, we use the accumulated depreciation and amortization over book value and then times 40 (average depreciation and amortization period) to calculate the age of buildings and lands. With the housing price index merged by state, we generate the market value of real estate in 1993.
Debt Capacit (DEBT)	Long term debt in each year (#DLTT) normalized by total book asset (#AT) in 1993.
Corporate Governance Index (G-index)	As per Gompers et al. (2003). An index that counts the presence of 24 antitakeover, voting, compensation-related and state-law-related provisions present in a corporate charter.

(Continued…)

(Table 1 Continued)

Other	
Capital Investment (INV)	Capital expenditure (#CAPX) normalized by total asset (#AT) in 1993.
Tobin's Q	The numerator is the market value of equity, which is calculated by the number of common stocks (#CSHO) at the end of year closing price of common shares (#PRCC_F). The denominator is the book value of debt and quasi equity, which is calculated as book value (#AT) minus common equity (#CET) and deferred taxes (#TXDB).
Cash Flow	Income before extraordinary items (#IB) plus depreciation and amortization (#DP) normalized by total asset (#AT).
Leverage	Initial control variable. Ratio of long term debt (#DLTT) and total book asset (#AT) in 1993.
Size	Initial control variable. Natural log of total book assets (#AT) in 1993.
Housing Price Index (HPI)	Housing price index is published by Federal Housing Finance Agency (FHFA). We use the housing price index at the state level. Since the sample in this research starts in 1993, the index is normalized as 1 in 1993.
Industry Effects	Industry fixed effects are controlled by a series of dummies based on the first two digits of the SIC code.
Year Effects	The sample includes data from 1995, 1998, 2000, 2002, 2004 and 2006.
Credit Rating	Long term issuer credit ratings assigned by Standard & Poor are used as credit rating. The rating indicates the ability and readiness of a debtor to meet its long-term financial commitments (maturities of more than one year) when due. This indicator ranges from AAA (strong ability to pay financial obligations) to CC (vulnerable). A dummy is used in this research to mark firms with credit ratings that range from AAA to A- in 1993.

Table 2 Summary Statistics

	Mean	Median	Std. Dev.	25th percentile	75th percentile	Obs.
Firm Level Data						
DEBT	0.43	0.27	0.63	0.11	0.50	2,948
G-index	9.80	10	2.81	8	12	2,954
Tobin's Q	1.88	1.50	1.24	1.18	2.12	2,709
Cash Flow	0.10	0.10	0.10	0.06	0.14	2,938
INV	0.12	0.08	0.15	0.05	0.13	2,926
Initial Firm Level Data (1993)						
RE Value	0.40	0.30	0.61	0.16	0.47	612
Leverage	0.19	0.17	0.16	0.06	0.29	612
Size	6.66	6.58	1.33	5.72	7.57	612

Notes: Table includes firm level data for 1993, 1995, 1998, 2000, 2002, 2004 and 2006, and initial firm data for 1993. DEBT is defined as long term debt normalized by total asset in 1993; G-index is corporate governance index from Gompers et al. (2003); Tobin's Q is market value of asset over book value of assets; Cash flow is income before extraordinary items plus depreciation and amortization normalized by total asset; INV is investment, defined as capital expenditure normalized by total asset in 1993; RE value is market value of corporate real estate in 1993; Leverage is long term debt over total asset; and Size is the natural log of total asset.

2.2.1 Corporate Real Estate Holdings

Corporate real estate holding information is not directly released by firms. Therefore, we calculate the value of the real estate assets of each firm based on their accounting information. First, three major categories of fixed assets in their balance sheets are classified as real estate assets. They belong to the breakdown of property, plant, and equipment (PPE)[1], including building; land and improvement; and construction in progress. The data are obtained from CompuStat. Unfortunately, these assets are not measured by market value, but valued as historical cost. First, we directly use the historical value of construction in progress as a proxy for market value. Their cost is very close to the market value when the projects are not completed.

Second, we adjust the value of buildings, and land and improvement based on the housing price index and their average age. We use the housing price indexes at the state level from the Federal Housing Finance Agency (FHFA; formerly

[1] The same definition is used by Nelson et al. (1999) and Chaney et al. (2012).

the Office of Federal Housing Enterprise Oversight)[2] to capture the evolution of real estate prices. Constructed from a rich transaction database, the FHFA housing price indexes provide a broad measure of the movement of single-family home prices in the US. More importantly, the indexes meet the requirements of our research by allowing us to track state-level price variations across different markets over time. The state level indexes date back to 1975. CompuStat does not supply accurate information about the locations of assets; the housing price index is then matched to the headquarters locations of each firm at the state level based on the assumption that all real estate assets are located in the same state as the headquarters of the firms. For firms with assets purchased before 1975, we use the national level consumer price index (CPI) data to adjust the value for the average age of real estate assets.

We calculate the average age of a property by using accumulated depreciation. We first assume a 40-year depreciable life[3] for buildings, and land and improvement. Then, the amount of depreciation, i.e. the ratio of the accumulated depreciation to the total historic cost (account value of buildings, and land and improvement plus their accumulated depreciation), is calculated to obtain the average age. Our sample period is leftward truncated in 1993 because the data on accumulated depreciation is not available after 1993. Combined with housing price index data, we can adjust the historical cost to market value in 1993.

We find in total more than 2000 firms in CompuStat that report their corporate real estate holding data in 1993, of which 612 firms are included in our sample based on the availability of corporate governance data. After normalizing the market value of corporate real estate by the book value of total assets, Table 2 shows that the market value of real estate represents 40% of the book value of the total assets in the entire sample. For the median of the corporate real estate holding firms, the market value of real estate represents 30% of the book value of total assets. Real estate thus makes up a sizable portion of the tangible assets that corporations hold on their balance sheet.

2.2.2 Corporate Governance Index

Corporate governance is measured by the G-index developed by Gompers et al. (2003). It is widely used in corporate governance research and acknowledged as the best available broad-sample index of managerial entrenchment (John et

[2] The FHFA is the federal agency which oversees Fannie Mae, Freddie Mac and the Federal Home Loan Banks. The FHFA regularly publishes the house price index, which is a weighted, repeat-sales index that measures the average price changes of the selected properties. To produce the index, the FHFA reviews repeat mortgage transactions on single-family houses where mortgages have been securitized or purchased by Fannie Mae and Freddie Mac.

[3] Nelson et al. (1999) estimate depreciable life to be in the range of 38 to 45 years.

al., 2008; John and Litov, 2010; Williamson, 1988). Gompers et al. (2003) use the data from RiskMetrics (formerly the Investor Responsibility Research Center (IRRC)) to construct an index to proxy for the balance of power between shareholders and managers for approximately 1500 firms during the 1990s. Their methodology is based on 24 anti-takeover indicators across five broad anti-takeover categories – delaying a hostile takeover bid; protection to officers and directors; shareholder voting rights; state laws; and other defenses. This index is also referred to as an "entrenchment index" since higher values indicate higher levels of entrenchment. Firms with higher index values are referred to as having the "highest management power" or the "weakest shareholder rights"; otherwise, they are described as having the "lowest management power" or the "strongest shareholder rights." This index is only available for our sample firms in the years 1990, 1993, 1995, 1998, 2000, 2002, 2004, and 2006. We merge the G-index with US listed firms based on the available real estate information, and generate a sample of 2,117 firm-year observations on 612 industrial firms from 1993 to 2006.

2.2.3 Accounting Variables

The CompuStat data do not contain debt information that distinguishes common debt from collateral data. We measure the debt capacity with the long term debt in each year normalized by total assets in 1993. The collateral effect is captured by the variation of debt capacity among the different corporate real estate holdings. Tobin's Q and internal cash flow ratio are included to control for the effects of the equity market and internal operations. Tobin's Q is calculated by the ratio of the market value of an equity – which is calculated by the number of common stocks at the end of year closing price of common shares – to the book value of debt and quasi-equity, which is calculated as the book value minus common equity and deferred taxes. Internal cash flow includes income before extraordinary items plus depreciation and amortization. We normalize internal cash flow by the total book asset.

We also control other variables, which include leverage in 1993, which is the ratio of long term debt to total asset; the size of the firm, defined by the natural log of total asset in 1993; and industry dummies based on the first two digits of the SIC codes that control the industry effects.

3. Empirical Results

3.1 Overall Results

We test whether the variations in corporate real estate holdings in 1993 can explain the debt capacity changes from 1993 to 2006. Our research focuses on

the influence of corporate governance on the collateral effect. The relationship between the collateral effect and corporate governance is captured by the coefficient on the interactive term. The regression results are summarized in Table 3.

Table 3 Collateral Effects, Real Estate Holdings and Corporate Governance

Panel A

Variable	DEBT			
	(1)	(2)	(3)	(4)
RE Value	0.173***	0.188***	0.455***	0.788***
	(0.021)	(0.022)	(0.066)	(0.120)
RE Value × Dummy (G-index >10)		-0.097**		
		(0.044)		
RE Value × G-index			-0.034***	
			(0.008)	
RE Value × G-index × Dummy (G-index >10)				-0.056***
				(0.010)
RE Value × G-index × Dummy (G-index ≤10)				-0.079***
				(0.016)
Tobin's Q	-0.059***	-0.061***	-0.061***	-0.058***
	(0.013)	(0.013)	(0.013)	(0.013)
Cash Flow	-0.428***	-0.432***	-0.431***	-0.422***
	(0.156)	(0.156)	(0.155)	(0.155)
Initial Leverage (1993)	0.766***	0.757***	0.735***	0.726***
	(0.103)	(0.103)	(0.102)	(0.102)
Initial Size (1993)	-0.058***	-0.056***	-0.054***	-0.055***
	(0.012)	(0.012)	(0.012)	(0.012)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,117	2,117	2,117	2,117
R-squared	0.211	0.213	0.218	0.223

Panel B

Variable	DEBT			
	(1)	(2)	(3)	(4)
RE Value × HPI	0.114***	0.124***	0.364***	0.635***
	(0.015)	(0.015)	(0.047)	(0.077)
RE Value × HPI × Dummy (G-index >10)		-0.064**		
		(0.030)		
RE Value × HPI × G-index			-0.029***	
			(0.0052)	
RE Value × HPI × G-index × Dummy (G-index >10)				-0.046***
				(0.006)
RE Value × HPI × G-index × Dummy (G-index ≤10)				-0.064***
				(0.010)
Tobin's Q	-0.060***	-0.062***	-0.062***	-0.058***
	(0.013)	(0.013)	(0.013)	(0.013)
Cash Flow	-0.430***	-0.434***	-0.429***	-0.413***
	(0.156)	(0.156)	(0.155)	(0.154)
Initial Leverage (1993)	0.780***	0.771***	0.735***	0.719***
	(0.103)	(0.103)	(0.102)	(0.102)
Initial Size (1993)	-0.057***	-0.056***	-0.053***	-0.055***
	(0.012)	(0.012)	(0.012)	(0.012)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,117	2,117	2,117	2,117
R-squared	0.209	0.211	0.221	0.228

Notes: Sample includes U.S. listed firms in 1995, 1998, 2000, 2002, 2004 and 2006 with real estate market value in 1993 and governance index in each year. The interaction term between real estate value and governance index indicates the impact of governance on debt capacity via collateral channels. The control variables include Tobin's Q and cash flow each year. Initial leverage and firm size are also controlled. Industry fixed effects are controlled based on the first two digits of the SIC code. Panel A only includes real estate holdings in 1993. Real estate value in Panel B is adjusted by using housing price index. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

In Panel A, we do not consider the variation in property prices across the sample. Column (1) only includes the variation in corporate real estate holdings in 1993. The results show, after controlling for other factors, that real estate holdings can explain for debt capacity in our sample. Firms with more real estate holdings will issue more debt when they experience increasing property prices. The result is similar to that in Gan (2007a), which looks at a declining property market. Other controlled variables also have significant results – all coefficients are significant at the 1% level. The coefficients of Tobin's Q and internal cash flow are negative. This implies that firms will reduce their debt if they have better alternative finance channels with the use of equities or internal cash flow. The initial controlled variables report small firms with high leverage in 1993 tend to use more debt in our sample.

Columns (2) to (4) consider the interaction between corporate governance and real estate holdings in regressions. Column (2) divides all firms into two groups. One group has less investor protection, or worse corporate governance, which is defined as having a G-index more than 10; the remaining firms are placed in the group with better governance. A dummy is defined based on this division, and then interacted with real estate holdings. Column (2) shows that the coefficient of real estate holdings for better-governed firms is 0.097, which is higher than that of the other group of firms. For firms with better governance, they will issue $0.188 debt in the following year with $1 real estate holdings in 1993; otherwise they only borrow $0.097 less than the previous figure.

Column (3) shows that the coefficient of the interaction term between the G-index and real estate holdings is negative and significant at the 1% level, which indicates that firms with better governance have a stronger collateral effect. Considering the variation of the G-index in the sample, the results show that firms in the top quartile of governance issue $0.136 more debt than firms in the bottom quartile, with $1 real estate assets in 1993. Column (4) considers the different impacts on collateral effect in different G-index ranges. We add the interaction terms between the G-index and real estate holdings for the groups with better- and poor-governance separately. The results report different coefficients for these two groups. The collateral effect for the group with better governance is more sensitive. The coefficient of the interaction term when the G-index is larger than 10 is -0.056, but -0.079 when the G-index is smaller than 10. Meanwhile, we find that the performance of the controlled variables in Columns (2) to (4) does not have a significant difference from those in Column (1). They all report significant results with the expected sign. The adjusted R-square increases from 21.1% to 22.3% thus implying that corporate governance can contribute to the validity of this model.

Panel B includes the property price change in the model. The corporate real estate value in 1993 is adjusted by the price index; the coefficient of the interaction term associate debt capacity with a $1 real estate market value. Column (1) indicates that the firms in our sample can use 11.4% debt via the

collateral channel.[4] Columns (2) to (4) consider the corporate governance variations among firms. From Column (2), we find that firms with more managerial power borrow less with the same real estate market value. Column (3) shows that every one point increase in corporate governance score reduces 2.9% debt capacity for the same collateral real estate value; that is, better corporate governance will enhance the collateral effect. We divide all firms into two groups based on the G-index and investigate the different impacts on the collateral effects. The results in Column (4) show that firms with better corporate governance will borrow more. The adjusted R-square increases from Column (1) to (4), and other controlled variables all share similar results with those in Panel A. The empirical results in Panels A and B provide evidence that corporate governance will impact the collateral effect of firms. Firms with better corporate governance borrow more with the same collateral value.

As the collateral in our model is set as real estate holdings of firms in 1993, the empirical result reports that the debt capacity changes since 1993 are triggered by the variation in the corporate real estate holdings in the same year. This setup has three advantages. First, real estate assets, as the most important collateral asset, are easy to identify. Secondly, the increasing real estate prices from 1993 to 2006 provide a natural experimental sample. Thirdly, we only consider the initial corporate real estate holdings in our model to avoid the endogeneity issue that arises from the simultaneous decision of debt issuance and property purchase.

Our empirical work is limited by our data source, which does not distinguish the different types of debts. Due to this limitation, the dependent variable in our model includes both long term debt and non-collateralized debt, therefore resulting in a value larger than the real collateralized debt. This, however, has little impact on our results based on two facts. First, the long term debt used by most firms is secured on valuable collateral. This is consistent with the empirical evidence provided by Chaney et al. (2012). They observe only a small, positive, and slight net increase in short term debts with collateral increase. Secondly, on the non-collateralized debt side, lines of credit might be easier to obtain when secured on valuable assets (Sufi, 2009). The non-collateralized debt capacity will be indirectly impacted by the collateral effects.

Overall, we find that the collateral behavior among firms with different levels of corporate governance can be differentiated by observing the debt capacity change according to changes in corporate real estate holdings. The results from US-listed firms from 1993 to 2006 show that firms with better corporate governance and the same collateral asset value used more debt.

[4] The debt capacity here is different from the loan-to-value of real estate, which is much higher than 10%. The debt capacity derived from regressions has excluded the influences of other finance factors, such as equity issuance, internal cash, and credit rating. It is the pure debt issued based on real estate assets.

3.2 Validation of Results

In this section, we examine whether the results above are robust in the more complex context of corporate governance, as well as also after controlling for possible omitted variables. First, we consider the possible influence of corporate governance on non-collateralized debt. The credit rating information is included in the model to test its influence on collateralized and non-collateralized debt. Finally, we look at how corporate governance impacts investment behaviors through collateral channels.

3.2.1 Corporate Governance on Non-collateralized Debt

A large pool of the literature shows mixed results on the relationship between corporate financing policy and corporate governance (e.g. Berger et al., 1997; John and Litov, 2008; Klock et al., 2005). Due to data unavailability, the left side of our model does not distinguish between collateral and non-collateralized debts. The impacts of corporate governance on these two types of debts may be in different directions. We re-run our regressions on collateral effect of real estates by controlling the corporate governance factors on collateral assets. The models capture the variation of debts, which cannot be explained by real estate values. The results are shown in Table 4.

Column (1) uses the real estate value in 1993 as a proxy of collateral asset and includes the G-index as an independent variable. First, the result shows that real estate has a significantly positive collateral effect, and strong corporate governance enhances the collateral effects. Secondly, the coefficient of a single G-index in the regression model is significantly positive. This implies that firms with weak corporate governance issue more non-collateralized debt. The controlled variables all share similar results with those in our benchmark model. Column (2) uses the real estate appreciation value instead of the initial value shown in Column (1). The results support the collateral effects of real estate, where corporate governance reduces non-collateralized debt capacity.

In comparing the coefficients of the interaction term in Table 4 with the corresponding models[5] in Table 3, we find that a one point increase in the G-index score results in a lower debt capacity after we control for corporate governance in the model. The results show that corporate governance has different influences on both collateralized and non-collateralized debts –firms with entrenched managers use less collateralized debt, but more non-collateralized debt. Our empirical results differentiate the different impacts of corporate governance on collateralized and non-collateralized debts, potentially explaining for the mixed results in the relationship between corporate governance and leverage in previous studies in the literature.

[5] They are in Column (3) of Panels A and B respectively.

Table 4 Collateral Effects after Controlling for Corporate Governance

Variable	DEBT	
	(1)	(2)
RE Value	0.671***	
	(0.080)	
RE Value × G-index	-0.059***	
	(0.009)	
RE Value × HPI		0.521***
		(0.055)
RE Value × HPI × G-index		-0.047***
		(0.006)
G-index	0.033***	0.035***
	(0.007)	(0.007)
Tobin's Q	-0.058***	-0.058***
	(0.013)	(0.013)
Cash Flow	-0.446***	-0.442***
	(0.154)	(0.154)
Initial Leverage (1993)	0.687***	0.682***
	(0.102)	(0.102)
Initial Size (1993)	-0.056***	-0.056***
	(0.012)	(0.010)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Observations	2,117	2,117
R-squared	0.228	0.232

Notes: Tables shows regressions of debt capacity on real estate holdings, corporate governance and their interaction. Besides, Tobin's Q, cash flow, initial leverage, firm size, and industry and year effects are controlled. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels.

3.2.2 Credit Rating and Collateral Effect of Real Estate

Credit rating, as a public signal of debt quality, is closely related to debt issuance. We control for credit rating on both collateralized and non-collateralized debts in the regressions to exclude possible noise from credit rating[6]. Due to the issue of endogeneity between debt capacity and credit rating, we follow our strategy on real estate value and control the initial credit rating (1993) to observe the predictability of debt capacity in the following years. The

[6] Graham and Harvey (2001), Faulkender and Petersen (2006) and Kisgen (2006) argue and show evidence that credit ratings have a direct impact on financing decisions.

data on credit rating are obtained from long term issuer credit ratings of Standard & Poor. The credit rating indicators range from AAA (strong ability to pay financial obligations) to CC (vulnerable). In our regression, a credit rating dummy is used to differentiate between high- and low-rated debts. The dummy is defined as 1 when the credit rating is between AAA and A-; otherwise, it is 0.

We use our benchmark model, but consider the influences of credit rating on collateralized and non-collateralized debts at the same time. The results are shown in Table 5. Columns (1) and (2) use real estate value in 1993 and Columns (3) and (4) consider the current (appreciated) real estate value. The credit rating dummy is used as an independent variable in Columns (1) and (3), but included in the interaction terms in Columns (2) and (4). The results in Columns (1) and (3) report significantly positive coefficients for the credit rating dummy, thus implying that high-rated firms can issue more non-collateralized debts. The credit rating is an ex ante indicator of the borrowing constraints of firms. Those with a better credit rating are able to access the debt market more easily. Columns (2) and (4) show that firms with a low credit rating are more likely to use collateralized debts, where this rating gives firms negative signals to the financing market. This in turn causes financing with collateral to be their first choice. More importantly, our regressions still show a significant collateral effect after controlling for credit rating; that is, corporate governance affects collateral effects. The results on the controlled variables are consistent with previous regressions.

3.2.3 Corporate Investment and Collateral Effect of Real Estate

The collateral effect of real estate is used to explain for the expansion of corporate investment when real estate appreciates in an expansive economic environment (Chaney et al., 2012; Gan, 2007a, 2007b). The existing literature points out that firms can finance their investments through collateral channels if the value of durable assets increases. Our study considers the impacts of corporate governance on collateral effects, and finds that firms with better governance are more likely to utilize their collateral assets. Due to agency problems between managers and investors, managers avoid taking risks, including those that enhance firm value. Better investor protection and more effective monitoring mitigate such conservative behavior, and result in more investment in value-enhancing projects (Amihud and Lev, 1981; Hirsleifer and Thakor, 1992; Holmstrom and Ricart I Costa, 1986). John et al. (2008) use both US and international samples and empirically find that firms with better investor protection are more risk-taking, and their aggressive investment behaviors incentivize higher growth rates. Using the context of these previous studies, we test whether the impacts of corporate governance on collateral effects will extend to investment behavior.

Table 5 Collateral Effects after Controlling for Credit Rating

Variable	DEBT			
	(1)	(2)	(3)	(4)
RE Value	0.550***	0.465***		
	(0.050)	(0.057)		
RE Value × G-index	-0.040***	-0.026***		
	(0.006)	(0.008)		
RE Value × Rating Dummy (1993)		-0.116***		
		(0.043)		
RE Value × HPI			0.433***	0.348***
			(0.035)	(0.042)
RE Value × HPI × G-index			-0.032***	-0.018***
			(0.004)	(0.006)
RE Value × HPI × Rating Dummy (1993)				-0.001***
				(0.000)
Rating Dummy (1993)	0.097**		0.103***	
	(0.038)		(0.037)	
Tobin's Q	-0.041***	-0.034***	-0.040***	-0.032**
	(0.013)	(0.013)	(0.013)	(0.013)
Cash Flow	-0.482**	-0.360*	-0.483**	-0.373*
	(0.197)	(0.195)	(0.193)	(0.191)
Initial Leverage (1993)	0.836***	0.665***	0.840***	0.648***
	(0.104)	(0.101)	(0.103)	(0.099)
Initial Size (1993)	-0.035**	-0.011	-0.035**	-0.008
	(0.016)	(0.015)	(0.016)	(0.015)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,038	1,038	1,038	1,038
R-squared	0.438	0.439	0.457	0.459

Notes: Table shows regressions of debt capacity on real estate holdings, corporate governance credit rating and their interaction term, controlling for corporate governance. The rating dummy is defined based on long term issuer credit ratings of Standard & Poor in 1993. If credit rating is between AAA and A- , it is 1; otherwise 0. Besides, Tobin's Q, cash flow, initial leverage, firm size, and industry and year effects are controlled. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels.

We follow our benchmark model, but firm investment is used as the dependent variable instead of debt capacity. The regressions will show whether variations in real estate value can explain for the differences in investment in the following years, and the interaction terms with corporate governance are added to capture the influences of corporate governance. Column (1) in Table 6 shows that the coefficient on initial real estate value is significantly positive. Firms with more

real estate collateral will invest more in the following years. In contrast, the coefficient on the interaction term is significantly negative. Firms with better investor protection invest more with constant real estate collateral. Column (2) adds a corporate dummy into the regression. The dummy is 1 when the G-index is more than 10; otherwise, it is 0. We test the ability of the dummy to capture the unexplainable variations in investment by using the collateral model. Column (2) finds that the coefficients on real estate value and interaction term are still significant and comparable with those in Column (1), but the corporate governance dummy is not significant. This implies that the impact of corporate governance on investment is only effective through collateral channels. Columns (3) and (4) use the real estate appreciation value to repeat the tests in Columns (1) and (2). They also report similar results.

Table 6 Collateral Effects, Investment Behavior and Corporate Governance

	INV			
Variable	**(1)**	**(2)**	**(3)**	**(4)**
RE Value	0.041**	0.044**		
	(0.016)	(0.019)		
RE Value × G-index	-0.004**	-0.004*		
	(0.002)	(0.002)		
RE Value × HPI			0.031***	0.035***
			(0.011)	(0.013)
RE Value × HPI × G-index			-0.003**	-0.003**
			(0.001)	(0.001)
Dummy (G-index >10)		0.001		0.001
		(0.002)		(0.002)
Tobin's Q	0.008**	0.008**	0.007**	0.008**
	(0.003)	(0.003)	(0.003)	(0.003)
Cash Flow	0.228***	0.228***	0.228***	0.228***
	(0.037)	(0.037)	(0.037)	(0.037)
Initial Leverage (1993)	-0.052**	-0.053**	-0.052**	-0.053**
	(0.024)	(0.024)	(0.024)	(0.024)
Initial Size (1993)	-0.016***	-0.016***	-0.016***	-0.016***
	(0.003)	(0.003)	(0.003)	(0.003)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,101	2,101	2,101	2,101
R-squared	0.248	0.248	0.248	0.248

Notes: Table shows regressions of investment behavior on real estate holdings, corporate governance and their interaction term. Tobin's Q, cash flow, initial leverage, firm size, and industry and year effects are controlled. The corporate governance dummy is defined based on G-index. If G-index is larger than 10, it is 1; otherwise 0. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels.

Our regression also includes Tobin's Q, internal cash flow, initial leverage ratio and size as the control variables. The coefficients are all significant. Firms with a high Tobin's Q value, high internal cash flow, and low initial leverage are able to finance their investments more easily, with smaller firms usually showing more aggressive investment behavior.

4. Conclusion

Better corporate governance reduces agency problems between managers and investors, provides stronger protection to investors, and incentivizes managers to invest in value-enhancing projects. Firms with better corporate governance use more real estate assets as collateral. As a result, managers of better-governed firms choose more efficient financing tools and aggressive investment strategies. Collateralized debts will be a natural choice for such managers, giving them the ability to finance their investments at a low cost.

This paper empirically tests the relationship between corporate governance and collateral effect by using a large panel of US-listed firms from 1993 to 2006. The sample period coincided with the boom in the US real estate market with steeply rising prices mitigating potential endogeneity problems in the tests of the collateral effects. The corporate real estate value of firms is based on the initial year of 1993, which is calculated based on the breakdown of PPE value. We match the data with the G-indexes in our sample, and use an interactive term between real estate value and the G-indexes to test the impact of corporate governance on firms. Our empirical results show that a one point increase in the G-index significantly reduces 3.4% of the debt capacity of firms on average after controlling for initial real estate value.

Our findings are robust. Our main results hold when we control for the influences of corporate governance on non-collateralized debt, and signaling effects of credit rating. We also test the causal effects of collateral channels on corporate investments and the results show that initial real estate value can explain for the variations in capital investment in the following years. Nevertheless, the scale of investment is related to corporate governance through collateralized debt but not directly significant in our regression.

References

Agarwal, S., Ben-David, I., and Yao, V. (2014). Collateral valuation and institutional pressures: Evidence from the residential real estate market. *Management Science*, 61(9), 2220-2240.

Amihud, Y., and Lev, B. (1981). Risk reduction as a managerial motive for conglomerate mergers. *The Bell Journal of Economics*, 12(2), 605-617.

Bauer, R., Eichholtz, P., and Kok, N. (2010). Corporate governance and performance: The REIT effect. *Real Estate Economics*, 38(1), 1-29.

Berger, A. N., and Udell, G. F. (1990). Collateral, loan quality, and bank risk. *Journal of Monetary Economics*, 25(1), 21-42.

Bester, H. (1985). Screening vs rationing in credit markets with imperfect information. *The American Economic Review*, 75(4), 850-855.

Berger, P. G., Ofek, E., and Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *Journal of Finance*, 52(4), 1411-1438.

Boot, A. W. A., and Thakor, A. V. (1994). Moral Hazard and Secured Lending in an Infinitely Repeated Credit Market Game. I*nternational Economic Review*, 35(4), 899-920.

Campello, M., Connolly, R. A., Kankanhalli, G., and Steiner, E. (2022). Do real estate values boost corporate borrowing? Evidence from contract-level data. *Journal of Financial Economics*, 144(2), 611–644.

Chaney, T., Sraer, D., and Thesmar, D. (2012). The Collateral Channel: How Real Estate Shocks Affect Corporate Investment. *American Economic Review*, 102(6), 2381-2409.

Cvijanovic, D. (2014). Real Estate Prices and Firm Capital Structure. *The Review of Financial Studies*, 27(9), 2690-2735.

Faulkender, M., and Petersen, M. A. (2006). Does the Source of Capital Affect Capital Structure? *The Review of Financial Studies*, 19(1), 45-79.

Fisher, I. (1930). *The Theory of Interest.* New York: Macmillan.

Friend, I., and Lang, L. H. P. (1988). An Empirical Test of the Impact of Managerial Self-Interest on Corporate Capital Structure. *The Journal of Finance*, 43(2), 271-281.

Gan, J. (2007a). Collateral, Debt Capacity, and Corporate Investment: Evidence from a Natural Experiment. *Journal of Financial Economics*, 85(3), 709-734.

Gan, J. (2007b). The Real Effects of Asset Market Bubbles: Loan- and Firm-Level Evidence of a Lending Channel. *The Review of Financial Studies*, 20(6), 1941-1973.

Garvey, G. T., and Hanka, G. (1999). Capital Structure and Corporate Control: The Effect of Antitakeover Statutes on Firm Leverage. *The Journal of Finance*, 54(2), 519-546.

Gompers, P., Ishii, J., and Metrick, A. (2003). Corporate Governance and Equity Prices. *Quarterly Journal of Economics*, 118(1), 107-156.

Graham, J. R., and Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economic*s, 60, 187-243.

Hirshleifer, D., and Thakor, A. (1992). Managerial conservatism, project choice, and debt. *Review of Financial Studies*, 5, 437-470.

Holmstrom, B., and Ricart I Costa, J. (1986). Managerial incentives and capital management. *Quarterly Journal of Economics*, 101(4), 835-860.

Ivashina, V., Nair, V. B., Saunders, A., Massoud, N., and Stover, R. (2009). Bank Debt and Corporate Governance. *Review of Financial Studies*, 22(1), 41-77.

Jensen, M. C., and Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3(4), 305-360.

John, K., Litov, L., and Yeung, B. (2008). Corporate Governance and Risk-Taking. *The Journal of Finance*, 63(4), 1679-1728.

John, K., and Litov, L. P. (2010). 'Corporate Governance and Financing Policy: New Evidence', *AFA 2006 Boston Meetings, CELS 2009 4th Annual Conference on Empirical Legal Studies Paper.* Available at SSRN: https://ssrn.com/abstract=637341 or http://dx.doi.org/10.2139/ssrn.637341

Kisgen, D. J. (2006). Credit Ratings and Capital Structure. *The Journal of Finance*, 61(3), 1035-1072.

Klock, M. S., Mansi, S. A., and Maxwell, W. F. (2005). Does Corporate Governance Matter to Bondholders? *Journal of Financial and Quantitative Analysis*, 40(4), 693-719.

Nelson, T. R., Potter, T., and Wilde, H. H. (1999). Real estate assets on corporate balance sheets. *Journal of Corporate Real Estate*, 2(1), 29-40.

Norden, L., and van Kampen, S. (2013). Corporate leverage and the collateral channel. *Journal of Banking and Finance*, 37(12), 5062–5072.

Porta, R. L., Lopez-de-Silanes, F., Shleifer, A., and Vishny, R. W. (1998). Law and Finance. *Journal of Political Economy*, 106(6), 1113-1155.

Shleifer, A., and Vishny, R. W. (1997). A Survey of Corporate Governance. *The Journal of Finance*, 52(2), 737-783.

Sirmans , C. F. (1999). 'Governance Issues in Real Estate Investing: The Case of REITs', RICS Research Conference: The Cutting Edge. University of Cambridge, Cambridge.

Sufi, A. (2009). Bank Lines of Credit in Corporate Finance: An Empirical Analysis. *The Review of Financial Studies*, 22(3), 1057-1088.

Williamson, O. E. (1988). Corporate Finance and Corporate Governance. *The Journal of Finance*, 43(3), 567-591.

Wu, J., Gyourko, J., and Deng, Y. (2013). *Is there evidence of a real estate collateral channel effect on listed firm investment in China?* National Bureau of Economic Research Working Paper 1876. Cambridge, MA, USA.