One size does not fit all: REIT capital structure and firm value

Timothy Riddiough[A] and Eva Steiner*[B]

[A] *University of Wisconsin-Madison*

[B] *University of Cambridge*

Abstract

We analyse the equity Real Estate Investment Trust (REIT) sector, whose structural idiosyncrasies exemplify shortcomings of received theory to comprehensively explain capital structure outcomes at the industry level. A customised theory of REIT capital structure is outlined that highlights liquidity management in total leverage and secured v. unsecured debt choices. Empirical testing shows that firm value is highly sensitive to capital structuring decisions. Starting from a high base level of leverage, a statistically robust and economically significant negative relationship between leverage and firm value is documented. We also find that the use of unsecured debt, which commits management to the preservation of debt capacity, generally has a positive effect on firm value. Our work further highlights the effects of taxes at the individual level, a muted pecking order, and an inverted free cash flow effect.

Key words: Real estate investment trusts; capital structure

* *Corresponding Author:* Department of Land Economy, The University of Cambridge, 19 Silver Street, Cambridge CB3 9EP, United Kingdom, es434@cam.ac.uk
We thank Sheridan Titman, Brent Ambrose as well as seminar participants at the University of Wisconsin-Madison, the University of Cambridge, Penn State University and the AREUEA National Conference 2015 for helpful comments and suggestions.
We gratefully acknowledge the financial support of the European Public Real Estate Association. Eva Steiner also thanks the Cambridge Endowment for Research in Finance for their support. All remaining errors are our own.

1 Introduction

The robustness and real world applicability of traditional corporate capital structure theory has come under intense scrutiny in recent years. Perhaps the most influential study in this regard is Lemmon, Roberts, and Zender (2008), who find that capital structure is largely insensitive to variables suggested by received theory, and is instead determined by unobserved firm-specific and time-invariant factors. In another influential study, MacKay and Phillips (2005) find that most of the cross-sectional variation in leverage is driven by differences between firms within a given industry rather than between industries. They conclude that simply controlling for industry classification in empirical models of capital structure choices "does not tell us how industry affects firm financial structure, nor why financial structure and real side characteristics vary so widely across firms within a given industry". Graham and Leary (2011) summarise these recent criticisms and conclude that "one size fits all" approaches spanning multiple industries both do a poor job in explaining observed financing choices and seem to produce a value function that is surprisingly insensitive to capital structure.

The current state of affairs has led to an acknowledgement that new approaches are required to better understand how firms make financing decisions and why these decisions do or do not affect firm value. A promising recent literature is emphasizing the role of liquidity management and financial flexibility (see, e.g., Denis (2011) for a concise summary of the emerging literature). Until recently, any considered effects of financial flexibility were typically subsumed as a cost of financial distress. But lost financial flexibility is something quite different from a cost of financial distress; rather, it is more closely aligned with liquidity risk management and intertemporal decision-making in which time consistency is paramount. DeAngelo and DeAngelo (2007) sum up the issue as "managers being mindful of the consequences of today's decisions on the feasible set of decisions at each future date", with financial flexibility possibly supplying the "missing link" needed to resolve many of the empirical irregularities associated with traditional capital structure theory.

With these issues in mind we conduct an in-depth study of a particular industry - the equity Real Estate Investment Trust (REIT) sector. Doing so concretely exemplifies the poor performance of generic, cross-industry theories in explaining capital structure choices within a particular sector. The most prominent empirical anomaly is that REITs display approximately twice the leverage of industrial firms, yet pay no taxes at the corporate level (see, e.g., Barclay, Heitzman, and Smith (2013)). Furthermore, the REIT industry is governed by regulations that severely limit cash retention, which magnifies and enables more direct insight into the role of financial flexibility in capital structure choices and their effects on firm value.

Further relevant characteristics are that REITs hold long-lived, income-producing commercial real estate assets that offer significant debt capacity. This capacity facilitates the sourcing of long-term debt financing, especially in the form of non-recourse mortgage debt, which helps explain the relatively high observed leverage across firms. A further defining feature is that REITs are subject to a diversified ownership rule, and most REITs are incorporated in the incumbent-management friendly state of Maryland. This combination weakens shareholder monitoring incentives and the ability to discipline management. [1]

Traditional theories of capital structure were not created to account for these collective institutional features of REITs, which leads us to develop a customised theory of REIT capital structure. The model we outline is simple, intuitive and static in nature. In our model the firm is asset-collateral rich and cash poor, paying no taxes at the firm level. It faces three categories of frictions when sourcing outside capital: Personal tax and security issuance costs, costs of financial distress and costs associated with a loss of financial flexibility.

The first set of frictions includes differential debt v. equity tax effects at the individual level as well as differential transaction costs associated with security issuance. In contrast to the usual dominating effect of corporate-level taxation, with non-taxed REITS tax effects at the individual level favour equity over debt. Alternatively, due to the information sensitivity of equity relative to debt, security issuance costs favour debt over equity. The typical large difference in debt v. equity security issuance costs is, however, reduced because of the REITs' inability to retain cash. [2] Given the opposing effects of taxes and issuance costs, it is an empirical question as to which effect dominates at the time of security issuance.

[1] In addition to these unique institutional features, the REIT industry is also economically significant. The National Association of Real Estate Investment Trusts (NAREIT) and reit.com, summarised in Premises - REIT Issue, for NYU Schack Centre of Real Estate (2015), report that there are currently over 200 listed equity REITs, 42 of which show a total market value of at least \$5 billion and 21 of which are currently included in the S&P 500. REITs currently own c. \$1.7 trillion of commercial real estate assets in the US, with total equity market capitalisation of about c. \$1.0 trillion. This puts them on par with the capitalisations of the Materials, Utilities, and Telecommunications sectors. REITs have also been recognised as a distinct sector in the Global Industry Classification Standards (GICS), with S&P breaking out REITs from Financials starting in 2016.

[2] Exogenous restrictions on cash retention effectively eliminate the firm's ability to finance new investment with internal funds, which in turn mitigates (but does not eliminate) the firm's ability to adversely select against shareholders when issuing equity.

The second friction we highlight is costs of financial distress. These costs in our model are largely attributable to underinvestment incentives, as the more direct bankruptcy costs to REITs, which hold highly durable and redeployable income-producing assets, are thought to be relatively small. But underinvestment distortions are generally not material until the firm is moderately to highly levered, which in the case of REITs means particularly high leverage.

The third, most prominent, friction results from costs of lost financial flexibility. Financial flexibility is crucial for the cash poor but asset-collateral rich firms we analyse. As such, access to liquidity is closely tied to the debt capacity of the income-producing real estate assets held by REITs. But debt capacity, which functions as a precautionary liquidity store to address income and investment shocks, must be available to be useful, creating a significant wedge between the firm's total exhaustable debt capacity and the extent to which it is prudently used. This dominating need to manage liquidity through preservation of debt capacity results in an inverted version of Jensen's (1986) agency-based free cash flow theory of debt, in which debt will optimally be *reduced* to prevent management from undertaking funding actions today that might cause value-reducing outcomes in the future.

The significant debt capacity of REIT assets implies that the lower leverage bound above which capacity depletion effects begin to matter is above that of most other industrial firms, whose assets are largely human capital and fast-depreciating physical capital. This in turn implies that even though cost of capital may be increasing in leverage over a wide range, leverage levels of REITs may nonetheless exceed those of industrial firms by a significant margin.

In light of the underinvestment and inverse cash incentive problems noted above, our theory further considers the choice between non-recourse mortgage debt and corporate-level unsecured debt. We first observe that, in contrast to usual characterisations that secured debt provides more intensive monitoring of the firm (Fama, 1985; James, 1987), non-recourse mortgage debt as secured by income-producing real estate actually works in the opposite direction. This debt is typically collateralised by one or more specified assets, without recourse to other assets of the firm in the case of default, which serves to limit the attention of debtholders to the asset(s) in question. Thus non-recourse mortgage debt provides little or no monitoring at the firm level. It also lacks commitment, as there are typically no predefined barriers on tapping the firm's available debt capacity through the incremental issuance of non-recourse mortgage debt.

Unsecured debt addresses both the monitoring and commitment issues through firm-level monitoring by rating agencies and unsecured debtholders, as well as standard bond covenants that place strict limits on total leverage and mortgage debt utilisation. The commitment value associated with managerial compliance to strict bond covenants is particularly noteworthy, as the covenants counteract managerial incentives to deplete debt capacity with funds diverted to further their own interests. Finally, we further note that, conditional on high leverage, non-recourse mortgage debt can be useful in addressing financial distress costs associated with the underinvestment problem identified in Myers (1977).

Our theory generates a set of empirically testable predictions about the firm's value as a function of its capital structure. Empirical tests of these predictions are, however, fraught with identification challenges that have plagued many previous empirical capital structure studies. First, both firm value and capital structure may be affected by unobservable factors, particularly firm fixed effects. Second, there may be reverse causality in the sense that firm value can feed back to capital structure. Third, when firm value is measured using the market-to-book (MB) ratio, as we do in this study, there may be a confounding effect because the MB ratio also reflects growth opportunities, investment choices, firm risk, and their dynamics. Fourth, there may be a certain mechanical relationship between the MB ratio and common balance sheet-based measures of leverage that can create spurious correlations.

As a consequence of these concerns we develop an identification strategy building up to a dynamic instrumental variable panel estimator, and conduct a set of robustness tests. Firm and time fixed effects are included in all estimations, as are control variables for realised and anticipated investment opportunities and common determinants of firm value, i.e. profitability, the fixed-assets ratio and firm age. To address concerns regarding a mechanical relation between the MB ratio and total leverage, we employ an alternative measure of leverage that does not rely on book or market value measures of the firm's assets.

Based on a battery of specifications we find that firm value is decreasing in leverage across a wide range, which conforms with the importance of maintaining financial flexibility to meet demands associated with potential income and investment shocks. We observe, however, that even the highest-value REITs typically display significant levels of leverage, consistent with asset tangibility and debt capacity being an important determinant of baseline leverage choices. We also find that firm value increases in unsecured debt usage, except for high-leverage firms, which benefit from a higher share of secured debt. This provides broad support for the use of unsecured debt as a commitment device that is valuable to shareholders that lack other available means with which to monitor and discipline management for actions that might otherwise deplete a valuable store of liquidity.

In economic terms, our estimates suggest that REIT firm value is highly sensitive to leverage. Unconditionally, a 15% increase in the leverage ratio leads to a 50% reduction in firm value as a percentage of assets in place. In the conditional analysis, and after controlling for investment effects and other relevant factors, we find that a 10% increase in leverage leads to a 10% decrease in firm value. These are economically significant effects, and contrast with previous findings summarised by Graham and Leary (2011). Magnitudes are less dramatic with secured debt usage, but remain significant.

Overall, our findings suggest that industry-specific theories offer a suitable way to address the shortcomings of "one size fits all" approaches as discussed by Graham and Leary (2011). Within our particular industry of focus, it is worth restating that results are robust to the unobserved firm-specific and time-invariant factors, standing in sharp contrast to the cross-industry findings of Lemmon, Roberts, and Zender (2008) and Flannery and Rangan (2006).

There are other relevant implications as well. First, our results suggest that taxes at the individual level may have marginal effects on capital structure choices that bare closer examination, similar to the argument in Gentry, Kemsley, and Mayer (2003), while standard pecking order effects are muted to some extent when firms face constraints on funding investment with internal resources. Further, our findings directly illustrate the link between capital structure choices and liquidity management that is outlined in DeAngelo and DeAngelo (2007); DeAngelo, DeAngelo, and Whited (2011); Denis (2011), and Holmström and Tirole (2011). Relatedly, our findings highlight a wider application of the free cash flow problem described in Jensen (1986), which persists in firms that don't have cash laying around for management to squander. In our case the leverage mechanism is inverted due to the need to preserve rather than disgorge liquidity, where commitment to maintaining low leverage prevents management from exhausting debt capacity of assets in place.

We proceed as follows. Sections 2 and 3 discuss the relevant background and introduce our theory of REIT capital structure. Section 4 presents our empirical approach. Section 5 describes the sample. Section 6 discusses our findings. Section 7 concludes.

2 Background

2.1 Relevant characteristics of REITs

Tax-based regulation of REITs stipulates that at least 75% of REIT assets must be real estate. Most REITs hold considerably more than the minimum. Real estate is tangible, durable, traded in an active secondary market, not highly specific to the owner and thus generally redeployable. Investor demand for tangible assets like commercial real estate has increased in recent years, in part due to a shortage of such assets in the global capital markets (Caballero, 2006). As a result, REIT assets are suitable and sought after as debt collateral, providing REITs with significant debt capacity (Cvijanović, 2014; Giambona, Golec, and Schwienbacher, 2014).

Secondly, REITs must distribute at least 90% of taxable income as dividends. To the extent that REITs distribute taxable income as dividends, they are not liable for corporate taxation. [3] REITs are therefore typically unable to retain much of their earnings (Hardin, Highfield, Hill, and Kelly, 2009; Hardin and Hill, 2008). As a result, they rely almost exclusively on external equity and debt capital for liquidity (Ott, Riddiough, and Yi, 2005), creating a direct link between REIT capital structure choices and liquidity risk management. [4]

A third distinguishing feature is the REIT equity ownership structure. A dispersed ownership rule requires REITs to have at least 100 distinct shareholders, where five or fewer of those shareholders cannot own more than 50% of the REIT's stock. As a result, almost all REITs (generally through their articles of incorporation) limit individual shareholders to less than a 10% equity stake in the firm. Dispersed share ownership limits incentives for shareholder monitoring and significantly weakens the market for corporate control, leaving shareholders vulnerable to manager-shareholder conflicts of interest (Armstrong, Guay, and Weber, 2010; Shleifer and Vishny, 1997). [5]

These defining characteristics of equity REITs - significant debt capacity, the inability to retain cash, no taxes at the firm level, and limits to shareholder control that give way

[3] US REITs are subject to taxes on incremental profits if they pay between 90% and 100% of taxable income as dividends. This causes most REITs to pay out at least 100% of taxable income as dividends.

[4] This link is also highlighted, for instance, in Almeida, Campello, and Weisbach (2011); DeAngelo and DeAngelo (2007); DeAngelo, DeAngelo, and Whited (2011); Denis and McKeon (2012); and Holmström and Tirole (2011). A review of this literature is provided in Denis (2011).

[5] Most listed equity REITs are incorporated in Maryland, which has extremely management-friendly legislative standards. A recent takeover attempt of Macerich by Simon Property Group illustrates the issues, where Macerich deployed the Maryland Unsolicited Takeover Act to successfully rebuke Simon's advances. This act allowed Macerich to, among other things, change from a de-staggered to a staggered board in response to the takeover attempt, laying bare the governance gap that exists with equity REITs.

to potential conflicts with management - generate significant implications for capital structure choices, and effectively require a customised theory of REIT capital structure. In order to be relevant, such a theory must simultaneously explain the following stylised empirical facts: (i) REITs use more leverage than industrial firms (Barclay, Heitzman, and Smith, 2013; Harrison, Panasian, and Seiler, 2011); (ii) REIT investment performance generally decreases in leverage (Giacomini, Ling, and Naranjo, 2015; Sun, Titman, and Twite, 2015); (iii) Active-growing industrial firms rarely issue equity, while active REITs commonly issue equity (Ooi, Ong, and Li, 2010); (iv) Significant variation exists among REITs in their use of unsecured debt, while most REITs use at least some non-recourse mortgage debt as a source of long-term debt financing (Brown and Riddiough, 2003).

2.2 The inability of received capital structure theory to explain REIT capital structure

The traditional tradeoff theory, which weighs up corporate tax shield benefits versus financial distress costs of debt, predicts little to no debt for tax-exempt REITs (Howe and Shilling, 1988; Shilling, 1994). Tracing tax effects to the individual investor level suggests a tax disadvantage to debt, because returns to equity have a lower effective individual tax rate than returns to debt (DeAngelo and Masulis, 1980; Jaffe, 1991). The observation that REIT investment performance decreases in leverage is thus consistent with predictions of the tradeoff theory. However, *levels* of REIT leverage persistently exceed those of industrial firms. Therefore, the tradeoff theory by itself cannot fully explain REIT capital structure. Nor can it explain more nuanced capital structure decisions such as the choice between secured and unsecured debt.

The pecking order theory argues that equity is expensive to issue because incentives to issue equity increase when management perceives shares to be overvalued (Myers and Majluf, 1984). However, because REIT payout rules limit the firm's ability to hold cash reserves, discretion on the part of REIT managers to avoid issuing outside equity is reduced significantly, which in part defeats management's ability to select against existing shareholders (Feng, Ghosh, and Sirmans, 2007). In fact, studies show that REIT share prices respond less negatively to announcements of new equity issues than industrial firms (Howe and Shilling, 1988), implying that standard pecking order results with respect to new outside equity appear to be partially muted, albeit not completely eliminated. But, in any case, REITs frequently issue equity, even though the use of non-recourse secured debt and REIT assets' significant debt capacity mean that debt remains informationally insensitive even at moderate to high levels of debt.

The free cash flow theory suggests that debt can impede managers from squandering retained cash (Jensen, 1986). The REIT payout rule limits the retention of existing cash, muting the free cash flow effect (Hardin, Highfield, Hill, and Kelly, 2009; Hardin and Hill, 2008; Riddiough and Wu, 2009). Nevertheless, the high debt capacity of REIT assets implies that leverage levels should be much higher than they are in order to limit managerial access to that liquidity. Because REITs are highly cash-constrained to begin with, they require alternative liquidity funding channels to properly manage earnings and investment shocks. With this in mind, shareholders will be concerned that REIT managers could generate fresh cash by depleting debt capacity against shareholder interests who, as noted, are less able to rely on traditional shareholder monitoring or the market for corporate control to impose managerial discipline. This issue is closely related to what Myers and Rajan (1998) call the *paradox of liquidity*, where the ease of converting an asset into cash through a sale or financing is inversely related to managerial commitment to shareholder interests. In our case, we label the ability to convert the debt capacity of commercial property assets into liquidity through leverage, contrary to shareholder interests, as the *inverse cash incentive problem.*

The significant debt capacity of REIT assets provides a one-sided rationale for using debt, particularly secured debt. Giambona, Golec, and Schwienbacher (2014) make this point clearly when they find a strong positive relationship between leverage and real estate collateral based on the types of assets held by industrial firms. However, Shleifer and Vishny (1992) point out the sensitivity of liquidation values to macroeconomic shocks, implying real limits to debt capacity. The recent financial crisis has vividly illustrated these limits, even as they apply to commercial property (Pavlov, Steiner, and Wachter, 2015; Sun, Titman, and Twite, 2015). Yet, the literature has only just begun to distinguish between total available debt capacity and the extent to which it is prudently used. [6]

In conclusion, none of the traditional capital structure theories is fully consistent with the relevant defining REIT characteristics, nor can any of the received theories fully explain the stylised facts about REIT capital structure choices. This motivates the next section, which outlines a customized theory of optimal REIT capital structure that emphasizes liquidity management and managerial commitment to retaining financial flexibility.

[6] See, for instance, Hennessy, Levy, and Whited (2007) or Giambona, Mello, and Riddiough (2012).

3 A customised theory of REIT capital structure

Our theory builds on the descriptive work of DeAngelo and DeAngelo (2007) in its focus on financial flexibility, and on that of Hennessy, Levy, and Whited (2007) in its consideration of the relevant set of financial market frictions. In order to set the stage for hypothesis development and empirical testing, the theory we outline considers a cash-constrained firm that holds assets with high debt capacity. Cash constraints and high asset debt capacity create a desire by owners to maintain a collateral-liquidity buffer to help manage potential cash flow and/or investment shocks. A role for *precautionary debt capacity* implies optimal leverage that is much lower than that which is available should the firm decide to utilize its exhaustible debt capacity. This creates a starring role for liquidity management in capital structure determination, supplying a "missing link" that can help rectify shortcomings in received theory (DeAngelo and DeAngelo, 2007).

But, although the firm may currently maintain relatively low leverage levels, in contrast to most industrial firms REIT shareholders lack mechanisms to effectively monitor and discipline managers, creating shareholder concerns over managers' commitment to maintain necessary debt capacity going forward. This creates a unique role for unsecured debt that contains covenants that limit leverage and secured debt, and therefore subjects management to clearly defined standards governing the use of leverage.

3.1 The debt-equity funding choice

To start, assume that firm value, FV, is a function of total leverage, ω_D. In a frictionless world, FV is invariant to leverage, with the firm's cost of capital depending solely on the risk characteristics of its assets. In our theory, FV specifically depends on three sets of frictions associated with the sourcing of outside funding and that are operative across uniquely different ranges of leverage. Net relative costs associated with these frictions are forecasted forward by investors, where their impact on relative firm value is measured by a present value calculation.

The first set of frictions relates to taxes and security issuance costs, where these costs are relevant across the entire range of leverage levels. As noted earlier, no-taxes at the firm level combined with taxes at the individual level generally favour equity relative to debt (DeAngelo and Masulis, 1980). Security issuance costs favour debt over equity, however, because, according to the pecking order theory, adverse selection costs are lower for debt than they are for equity. The difference in issuance costs is reduced in the case of REITs, however, due to limited discretion in financing the firm with inside equity (cash). But these costs are typically meaningful nonetheless.[7] Whether the net tax benefits to issuing equity exceed the associated net issuance costs is an empirical question. In either case, as a result of these effects we would expect FV to monotonically increase or decrease over the entire range of ω_D, but with a slope that is only weakly positive or negative.

The second set of frictions relates to the costs of financial distress, and include: (i) deadweight costs of financial distress, which are thought to be low with REITs due to the high durability and redeployability of the commercial real estate asset; and (ii) debt overhang costs associated with the funding of new investment.[8] Given assets with high debt capacity and low deadweight costs of financial distress, underinvestment costs predominate. Altogether this implies costs of financial distress begin to become meaningful only at moderate to higher leverage levels. We will denote the relatively high threshold leverage value at which financial distress costs are operative as ω_D^H. Below this threshold costs of financial distress are for simplicity assumed to be zero, whereas above the threshold costs increase at an increasing rate to reduce firm value.

The third and most prominent financial market friction in our model is the cost to reductions in financial flexibility. As emphasized by DeAngelo and DeAngelo (2007), the costs of lost financial flexibility as they depend on total leverage are relevant over a wide range. DeAngelo and DeAngelo (2007) even suggest these costs are relevant starting from zero leverage.[9] However, because of the significant debt capacity of REIT assets, these costs may not begin to matter right at zero leverage. As a result we assume these costs are trivial (zero) when leverage is below a minimum threshold value of ω_D^L, where $\omega_D^L > 0$. For $\omega_D > \omega_D^L$, the exact shape of the cost function has not been established empirically. Consequently we posit that following empirically plausible shape. Costs of lost financial flexibility begin to matter at much lower leverage levels than costs of financial distress, implying $0 < \omega_D^L << \omega_D^H$. Once the threshold is breached these costs are monotonically increasing. At first costs increase quickly as a function of ω_D, but eventually dissipate as incremental costs to lost financial flexibility don't matter much

7 Adverse selection costs with new equity issuances of REITs are statistically significant, and approximately half the size of those documented in studies of industrial firms; see, e.g., Howe and Shilling (1988) and Feng, Ghosh, and Sirmans (2007).

8 The under-investment problem (Myers, 1977) is particularly relevant because REITs have experienced strong investment growth, including ground-up development (Geltner, Riddiough, and Stojanovic, 1996; Riddiough, 1997) and redevelopment (Childs, Riddiough, and Triantis, 1996; Williams, 1991). Ongoing maintenance and capital expenditures are also required with these capital intensive assets.

9 "Given a reasonable probability that future shocks to earnings or investment opportunities will create a significant need for external capital, the marginal value of preserving debt capacity is non-trivial even at zero leverage." (p. 17)

since substantive flexibility has already been lost.

Incentives to maintain a precautionary *collateral-liquidity buffer* as protection against earnings and investment shocks, like the ones that occurred during the recent financial crisis, drives a wedge between *exhaustible* and *effective* debt capacity. For example, Sun, Titman, and Twite (2015) document significant and persistent costs of financial distress associated with REITs that had high leverage going into the financial crisis. On the flip side, maintaining debt capacity to fund investment when good opportunities present themselves is also critical, as it minimizes the risk of losing them due to an absence of outside funding liquidity (DeAngelo, DeAngelo, and Whited, 2011).

One can conceptualize the difference between ω_D^H and ω_D^L as determining the approximate size of the wedge between exhaustible and prudently utilized debt capacity. Figure 1 visually depicts the threshold values along the [0,1] total leverage range. We can also use this figure to summarize the relevant ranges at which the various frictions are operative: (i) Tax and security issuance costs are relevant across the entire $\omega_D \in [0,1]$; (ii) Costs of financial distress are relevant for $\omega_D \in [\omega_D^H, 1]$; and (iii) costs associated with lost financial flexibility are relevant for $\omega_D \in [\omega_D^L, 1]$.

[Insert Figure 1 about here.]

Figure 2 displays firm value $FV(\omega_D)$, depending on whether the net tax-security issuance costs favour debt or equity. When net tax-issuance costs favour equity over debt, then $FV(\omega_D)$ is decreasing in leverage for all ω_D (Case 2). In other words, the optimal capital structure is in theory all equity. Alternatively, when net tax-security issuance costs favour debt over equity, an internal optimum exists (Case 1). In this case we expect that, for $\omega_D \leq \omega_D^L$, because adverse selection costs to issuing equity are muted to some extent due to high payout requirements, $FV(\omega_D)$ is increasing slowly in the proportion of debt. Then for $\omega_D > \omega_D^L$, $FV(\omega_D)$ begins to decrease relatively quickly as a function of ω_D to generate the internal optimum, ω_D^*, situated at a point that is not much greater than ω_D^L.

[Insert Figure 2 about here.]

3.2 The choice of secured versus unsecured debt

Non-recourse mortgage debt is a one-to-one mapping of the debt to individual assets (or a small group of assets) that serve as security to the debt. The partitioning of cash flow and recourse rights between existing and new debtholders may help reduce underinvestment costs for more highly levered firms.[10] The downside to this partitioning is that secured debt holders have little incentive to monitor the firm beyond the collateral assets that secure their specific loans, conforming well to the costly state verification model of Townsend (1979).[11] Non-recourse mortgage debt therefore lacks commitment, raising concerns that REIT shareholders cannot rely on blockholder monitoring or the market for corporate control to discipline management.[12]

Note that the combination of a desire to preserve debt capacity and managerial commitment concerns on the part of shareholders creates something of an inverted free cash flow problem. In both the traditional and inverted cases a manager-shareholder conflict exists, where shareholders worry that managers may squander cash for their own self-interested purposes. But in the case of REITs, which hold assets with high debt capacity but have limited access to cash, the concern is over too much leverage rather than too little. Said differently, Jensen's model is one about disgorging liquidity in order to limit conflicts, whereas our model is one about hoarding liquidity in order to limit costs of lost financial flexibility resulting from unanticipated shocks.

Against this backdrop it follows that outside shareholders will value commitment mechanisms that impede the unnecessary depletion of debt capacity, where effects are relevant beginning at low-to-moderate leverage levels ($\omega_D \geq \omega_D^L$). Unsecured debt is capable of addressing both the monitoring and commitment concerns of shareholders. Long-maturity unsecured debt introduces monitoring of the firm by credit rating agencies and possibly bondholders. More importantly, unsecured debt incorporates covenants that directly address management-shareholder conflict by protecting the collateral-liquidity buffer that shareholders value but are unable to effectively control through other means.[13] This management commitment perspective is consistent with the recent evidence that shows higher credit quality firms issue unsecured debt and equity

[10] We also note that cost advantages to issuing traditional corporate debt may be reduced at higher leverage levels, as the debt is no longer informationally insensitive. This creates an advantage to issuing non-recourse mortgage debt, which retains its informational insensitivity due to being isolated from other financial claims.

[11] Note that secured non-recourse mortgage debt of the type used by REITs differs from corporate secured debt, which is often in the form of bank debt. See Fama (1985) and James (1987) who analyse the monitoring benefits associated with bank debt.

[12] DeAngelo and DeAngelo (2007) offer a discussion about how listed industrial firms have several mechanisms in place to ensure managers behave in the face of commitment problems. The identified mechanisms prominently include monitoring by outside shareholders and the threat of takeover, which as discussed are lacking in the case of REITs. In their model, DeAngelo and DeAngelo (2007) assume away the commitment problem we focus on, which provides a unique role for the use of unsecured debt in capital structuring as a commitment mechanism.

[13] The relevant major covenants that are included in a vast majority of REIT unsecured debt issuance are: i) Total leverage no greater than 60%; ii) Secured debt to total assets no greater than 40%; iii) EBITDA to interest expense no less than 1.50 times; and iv) Unencumbered assets to total unsecured debt outstanding no less than 1.50 times. Most firms try to operate well under the stated limits to provide a buffer for unanticipated cash flow and investment shocks. Compliance with these major covenants is also thought to reinforce accounting transparency; see Bharath, Sunder, and Sunder (2008) for a discussion of the commitment to transparency.

while lower credit quality firms favour secured debt (Giambona, Mello, and Riddiough, 2012; Rauh and Sufi, 2010).

It is important to note that highly levered firms may, for two reasons, prefer secured debt to unsecured debt. First, high leverage with high levels of unsecured debt implies that the firm has or has nearly violated one or more of its leverage-based debt covenants, placing it in the 'penalty box', with management-shareholders surrendering control and possibly cash flow rights to outside debt holders. Non-recourse mortgage debt has no such provisions at the firm level. Second, as leverage increases, so does the underinvestment problem. As noted, non-recourse secured debt is more effective at mitigating those costs than unsecured debt.

3.3 Empirical implications

We can summarise the empirically testable hypotheses as follows. These testable hypotheses explain the stylized facts noted earlier that are unique to REITs and that cannot be collectively explained by received theory.

Hypothesis 1: On average, REITs carry leverage in excess of the levels typically observed in listed industrial firms. This hypothesis reflects the debt capacity of real estate, which keeps the financial flexibility and distress costs of debt below those of other types of firms for a relatively wide lower- and middle-end range of leverage levels.

Hypothesis 2: On the margin, over a wide middle range of leverage levels, REIT firm value is decreasing in leverage. This hypothesis primarily reflects the increasing cost of equity that is imposed when REIT managers begin to exhaust the collateral-liquidity buffer by issuing more debt. Implicit is that investment-active REITs frequently issue equity to limit leverage.

Hypothesis 3: Firm value is decreasing in secured debt over a wide middle range of leverage levels. This hypothesis reflects the increasing cost of equity imposed by shareholders to compensate them for the loss of managerial commitment that is associated with non-recourse mortgage debt relative to the use of covenant-restricted unsecured debt.

Hypothesis 4: Conditional on high leverage, firm value is increasing in secured debt. This hypothesis reflects restricted access to unsecured debt and the suitability of secured debt to manage the underinvestment problem associated with high leverage.

4 Empirical model specification

4.1 Measuring firm value

To test the empirical predictions of our theory, we require a measure of relative firm value. For this purpose we appeal to Tobin's (1969) q theory in the presence of financial frictions. In the original theory, set in frictionless financial markets, q is a marginal concept measuring the shadow value of capital; i.e., the productivity of the next unit of capital relative to its cost. Beginning with Fazzari, Hubbard, and Petersen (1988), the literature recognises that capital market frictions may impose added costs that affect the investment choices of the firm and thus influence the firm's shadow value of capital.[14] In other words, there are interactions between the real and financial sides of the firm. Hennessy, Levy, and Whited (2007) consider the specific frictions of costly external finance, collateral constraints and debt overhang. These frictions are particularly relevant for REITs as cash-constrained going-concerns whose assets offer significant debt capacity.

Marginal q is generally unobservable. Empiricists can observe *average* q (commonly denoted as Q), however, which gauges the firm's productivity across all assets, with the present value of growth opportunities accounted for in capital productivity. Average asset productivity is then (implicitly) compared with the firm's weighted average cost of capital. In the presence of financial frictions, the weighted average cost of capital, and therefore firm value, will be a function of the firm's capital structure choices.

Q is often measured empirically by the firm's market-to-book (MB) ratio. Empirically extracting cost of capital from Q, conditional on the firm's in-place capital structure, requires isolating this cost from other factors affecting Q. These include the characteristics of assets-in-place, real-side operational efficiencies and investment activity. Because we analyse a particular industry that almost exclusively holds income-producing commercial real estate assets, there is relatively little variability in asset characteristics across firms (we will use firm fixed effects in all of our specifications in any case).

Following McConnell and Servaes (1995) and others we apply the market-to-book (MB) ratio as an empirical proxy for Q, where, after appropriate model specification (to be discussed in the next sub-section), a higher MB ratio implies a lower cost of capital and therefore a higher firm value.[15]

[14] Also see, for example, Bolton, Chen, and Wang (2011) or Almeida, Campello, and Weisbach (2011).

[15] While *average* q is observable, it may be subject to measurement error when replacement costs are proxied by

4.2 Identification strategy

Our focus is on the cross-section of firm value, as measured by the MB ratio, as it depends on capital structure. There are four resulting empirical difficulties in identifying capital structure effects: (i) Both the MB ratio and capital structure choices may be driven by unobservable firm characteristics; (ii) There may be reverse causality when the firm's MB ratio influences its capital structure choices; (iii) The MB ratio may also capture growth opportunities; (iv) There may be a mechanical relationship between the MB ratio and common measures of leverage that are based on the ratio of total debt to the book or market value of total assets. In this section, we outline our approach for addressing these difficulties.

First, when capital structure and firm value are related to unobserved firm characteristics, for instance managerial ability (Zwiebel, 1996), there is omitted variable bias. In a panel setting, firm fixed effects capture time-invariant unobservables that influence capital structure and firm value (Dessí and Robertson, 2003). The use of firm fixed effects is consistent with the observation that a large proportion of variation in leverage is driven by a 'permanent component' (Lemmon, Roberts, and Zender, 2008) or 'missing stable factor' (Flannery and Rangan, 2006). In addition, there may be unobserved time-varying drivers of capital structure and value that are common to all firms, such as real estate market sentiment (Ling, Naranjo, and Scheick, 2014). These may be captured using time fixed effects.

Second, there may be contemporaneous feedback from firm value to capital structure. [16] Therefore, the estimation of firm value as a function of capital structure suffers from reverse causality bias. These issues may be addressed by lagging the explanatory variables (Billett, King, and Mauer, 2007; Datta, Iskandar-Datta, and Raman, 2005; Johnson, 2003).

The third concern relates to the effects of growth opportunities on the MB ratio. Firms with more growth opportunities may have lower leverage and/or higher secured debt in

the depreciated book value of assets (Erickson and Whited, 2000). However, Hartzell, Sun, and Titman (2006) and Ott, Riddiough, and Yi (2005) show that the depreciated book value of real estate assets is closely correlated with their replacement cost, mitigating a potential measurement error. Also see Riddiough and Wu (2009) for evidence on the relative measurement accuracy of *average q* in the case of REITS.

[16] Berger and Bonaccorsi di Patti (2006) suggest two possible reasons why firm value may influence leverage: (i) more efficiently managed (valuable) firms may have higher leverage because efficiency substitutes for equity capital in protecting against negative shocks; (ii) more efficiently managed (valuable) firms have lower leverage to protect the economic rents or franchise value associated with high efficiency from liquidation by debt holders. Similar arguments may apply to a relationship between firm value and secured debt. More efficiently managed (valuable) firms may have higher secured debt because their efficiency substitutes for the need to maintain a collateral-liquidity buffer. Alternatively, less valuable firms may have higher secured debt because their balance sheet isn't healthy enough to meet the covenants embedded in unsecured debt contracts.

order to mitigate the underinvestment problem (Myers, 1977; Stulz and Johnson, 1985). Further, firms with higher MB ratios generally also have greater growth opportunities. We control for the confounding influence of forward-looking as well as realised growth effects by including the price-to-FFO ratio as an alternative proxy for growth opportunities (McConnell and Servaes, 1995) and the realised rate of real estate investment growth.

Finally, measuring leverage as the ratio of total liabilities to the market value of assets may cause a mechanical relationship with the MB ratio because the numerator of the MB ratio is the same as the denominator in the market leverage ratio. Replacing the market value of assets with their book value in the denominator of leverage is not effective in mitigating this problem because, in that case, the left-hand side and right-hand side variables share the same denominator, simply giving rise to a different mechanical relationship (Barraclough, 2007). We address this issue as follows. In our main analysis, we rely on a measure of market leverage defined as total liabilities to the market value of assets, but for robustness we replicate our analysis using the EBITDA/interest ratio as an alternative proxy for the indebtedness of the firm, where a higher ratio of EBITDA to interest expense implies lower indebtedness. This alternative measure does not depend on the market or book value of assets.

With these issues in mind we adopt the following identification strategy. First, we estimate a baseline panel model of firm-quarter observations on the MB ratio as a function of market leverage and the ratio of secured debt to total debt as follows:

$$MB_{it} = \gamma_1 Lev_{it} + \gamma_2 Sec_{it} + \beta \mathbf{x}_{it} + f_i + d_t + u_{it} \tag{1}$$

where $\mathbf{x_{it}}$ is the vector of observables and u_{it} is the residual. The vector $\mathbf{x}$ contains the control variables of real estate investment growth, profitability, the price-to-FFO ratio, the fixed-assets ratio, and firm age. We control for time-invariant unobservable firm characteristics using firm fixed effects, f_i, and for time-varying unobservables using time (quarter) fixed effects, d_t.

Next, we address possible simultaneity bias in two steps. First, we replicate Equation 1 but lag the right-hand side variables. [17] While firm value may influence capital structure contemporaneously, firm value today is unlikely to affect previous capital structure

[17] Bellemare, Masaki, and Pepinsky (2015) note that lagged explanatory variables address endogeneity when there is (i) serial correlation in the potentially endogenous explanatory variable, and (ii) no serial correlation among the unobserved sources of endogeneity.

choices. Conversely, previous capital structure choices may have persistent effects on firm value that remain observable in the current period. Therefore, we estimate:

$$MB_{it} = \gamma_1 L.Lev_{it} + \gamma_2 L.Sec_{it} + \beta L.\mathbf{x}_{it} + f_i + d_t + u_{it} \tag{2}$$

where coefficients and variables are defined as in Equation 1 and $L.$ denotes the lag operator. Fixed effects are included as before.

Further, we employ instrumental variables (IV) to estimate simultaneous equations for leverage and firm value (Agrawal and Knoeber, 1996; Dessí and Robertson, 2003; Harvey, Lins, and Roper, 2004). We use earnings growth volatility and firm size (measured as ln of total revenue) as instruments for leverage (Dessí and Robertson, 2003). Suitable instruments must be relevant to the endogenous variable. Bradley, Jarrell, and Kim (1984) show that firms with more volatile earnings have higher credit risk and thus lower leverage. Leary and Roberts (2005) and Altinkiliç and Hansen (2000) show that in the presence of transaction costs large firms have cheaper access to outside financing per dollar borrowed. Further, suitable instruments must not influence the dependent variable directly. Firms with a higher MB ratio may have higher growth opportunities. Those firms may be young and thus have smaller size and more volatile earnings. However, we mitigate this possibility directly through our control variable for growth opportunities (Dessí and Robertson, 2003), the price-to-FFO ratio (McConnell and Servaes, 1995). Beyond this theoretical discussion, instrument quality is an empirical question.

We now estimate the following system of equations using 2SLS:

$$\begin{aligned} Lev_{it} &= \alpha \mathbf{z}_{it} + \phi Sec_{it} + \delta \mathbf{x}_{it} + f_i + d_t + v_{it} \\ MB_{it} &= \gamma_1 Lev_{it} + \gamma_2 Sec_{it} + \beta \mathbf{x}_{it} + f_i + d_t + u_{it} \end{aligned} \tag{3}$$

where $\mathbf{z_{it}}$ contains the instruments for leverage, $\mathbf{x_{it}}$ contains the control variables, and fixed effects are included as before. The inclusion of the share of secured debt in the leverage equation reflects the debt capacity of REIT assets as well as the borrowing restrictions imposed by unsecured debt covenants (where unsecured debt is 1 minus the share of secured debt).

In the third step, we address one more specification error arising from possible autocorrelation in the MB ratio. This autocorrelation may be driven by the dynamics and possible path-dependency of investment and financing choices. To capture this autocorrelation, we would like to add the lag of the MB ratio on the right-hand side, in addition to the capital structure variables, the regular control variables, and the firm as well as time fixed effects. However, firm fixed effects bias the dynamic panel estimator (Wooldridge, 2002). In order to mitigate this bias, we adopt the IV technique suggested in Anderson and Hsiao (1982).

The resulting dynamic IV panel model is estimated in first differences to remove the influence of firm fixed effects, and the first lag of the dependent variable is instrumented using its second lag, as specified below:

$$\begin{aligned} \Delta Lev_{it} &= \alpha \Delta \mathbf{z}_{it} + \delta \Delta \mathbf{x}_{it} + \Delta d_t + v_{it} \\ \Delta MB_{it} &= \rho L.\Delta MB_{it} + \gamma \Delta Lev_{it} + \beta \Delta \mathbf{x}_{it} + \Delta d_t + u_{it} \end{aligned} \tag{4}$$

where Δ is the difference operator, $L.\Delta MB_{i,t}$ is instrumented using the second lag $L2.\Delta MB_{i,t}$ and the remaining terms are as defined in Equation 3.

In the subsequent analysis we explore possible interactions between leverage and secured debt in determining firm value in two ways: i) We estimate an interaction term between leverage and secured debt, and ii) we explore the individual effects of different combinations of high/low leverage and high/low secured debt. For case ii), we create variables that indicate whether a firm is in the low/high leverage and low/high secured debt groups. These groups are defined across the median of the capital structure variables, leverage and secured debt, in each quarter. Based on Equation (2), we estimate:

$$MB_{it} = \alpha Inter_{it} + \gamma L.Lev_{it} + \beta L.\mathbf{x}_{it} + f_i + d_t + u_{it} \tag{5}$$

where $Inter$ denotes the respective interaction terms of the lagged capital structure variables (indicators), and all other components of the model are defined as in Equation (2). Fixed effects are also included as before.

Lastly, recall that we replicate our analysis using the EBITDA/interest ratio as an alternative proxy for leverage in order to mitigate any possible spurious correlation between the MB ratio and the capital structure variables of interest. Results are presented in the Appendix.

5 The sample

To test the predictions of our theory on REIT capital structure and firm value we obtain data on listed US equity REITs from the *SNL Financial* database. We begin the sample period in 1993, which corresponds to the inception of the 'modern REIT era' marked by the introduction of the UPREIT legislation. [18] We end the study period in 2014. All firm-level data is obtained from *SNL*. Our final sample contains 8,017 complete firm-quarter observations, an average of about 100 firms per quarter. The evolution of the number of firms in our sample is shown in Figure 3.

[Insert Figure 3 about here.]

We adopt an unbalanced panel approach to mitigate survivorship bias (Baum, 2006). Firms enter the sample when they first appear on *SNL* and meet the data requirements, and exit when they become inactive (acquired/defunct). Entry and exit may be related to capital structure. Fama and French (1999) study the cost of capital of *Compustat* firms and find that the capital structure of firms exiting the sample is no different from other firms. However, they also find that younger firms have more equity capital, perhaps because they entered the sample in a 'hot' equity market. We address this issue through time fixed effects and the firm age control variable.

We measure each firm's Q using the MB ratio as calculated on a quarterly basis. Observations with an MB ratio outside of [0.5,2] are excluded in order to mitigate any undue influence of outliers. For the same purpose, firm characteristics and capital structure variables are winsorised at the 1^{st} and 99^{th} percentiles.

Table 1 presents the characteristics of the sample firms during the study period. The MB ratio is on average 1.26. The average market leverage ratio is 0.48. This is higher than for average industrial firms with an average of 0.18 (Barclay, Heitzman, and Smith, 2013). Consistent with Brown and Riddiough (2003), the firms in our sample generally use a mix of secured and unsecured debt, where the mean secured debt ratio is 0.63. As expected on the basis of the institutional/regulatory features of REITs, the mean cash to assets ratio is low at less than 0.02.

[Insert Table 1 about here.]

[18] UPREIT stands for umbrella partnership REIT, and is a creature of the US tax code that allows individuals or other entities to exchange real estate assets for equity partnership units without incurring capital gains taxes. This mechanism was and continues to be key in facilitating the transition of privately held firms to listed public companies.

Table 2 presents pairwise correlation coefficients between the variables in our study. We find significant inverse correlations between the MB ratio and market leverage as well as secured debt, consistent with our predictions that, at least within certain wide ranges, shareholders penalise excessive leverage and the use of secured debt. High leverage is correlated with higher secured debt, consistent with the observation that secured debt may help mitigate the costs of underinvestment when leverage levels are high (Stulz and Johnson, 1985). Higher shares of secured debt are correlated with smaller firm size, higher earnings volatility, lower profitability, lower growth opportunities, lower interest coverage ratios and younger firm age, suggesting that higher credit quality firms favour unsecured debt (Giambona, Mello, and Riddiough, 2012; Rauh and Sufi, 2010). Beyond that, Table 2 generally indicates no excessive correlations, alleviating concerns surrounding multicollinearity in our regressions.

[Insert Table 2 about here.]

6 Results

6.1 Preliminary unconditional analysis

Figure 4 shows a scatterplot of the MB ratio as a function of leverage, where a higher MB ratio indicates a lower WACC. A cubic spline fitted to the plot indicates that the MB ratio is increasing at low leverage levels, around less than 20%. Then the MB ratio peaks and begins to decrease rapidly when leverage exceeds 30%, consistent with our theory that shareholders penalise firms for depleting debt capacity once a lower bound leverage level is breached. The positive relationship between the MB ratio and leverage at very low leverage levels suggest that low issuance costs may favour the use of debt over equity.

[Insert Figure 4 about here.]

Figure 5 displays a scatterplot of the MB ratio versus the proportion of secured debt to total debt, along with a cubic spline fitted to the data. The fitted line shows a slight downward trend in the MB ratio as a function of secured debt, indicating that unsecured debt is (at least weakly) preferable to secured debt. Note, however, the significant number of firms that use entirely secured debt (at secured debt = 1.0), as well as the number of firms that generate relatively high MB ratios at that point, suggesting that the effect of secured debt on firm value is nuanced and may depend on firm and capital structure characteristics in place.

[Insert Figure 5 about here.]

Table 3 shows a 2x2 matrix for the MB ratios of firms above/below the quarterly median values for leverage and secured debt. Consistent with our theory, firms with low leverage have higher MB ratios. Within the low leverage stratification, firms with more unsecured debt have higher average MB ratios, consistent with the financial flexibility-commitment value argument. However, conditional on high leverage in place, indicating moderate to severe reductions in financial flexibility, firms with more secured debt have slightly higher MB ratios than firms with more unsecured debt. This latter relation is consistent with our arguments that unsecured debt is not preferable for firms that are highly levered and therefore potentially in the 'penalty box' for violating bond covenants, and that, conditional on high leverage, underinvestment costs are better controlled with secured debt (Stulz and Johnson, 1985).

[Insert Table 3 about here.]

Table 4 presents the results of an unconditional, multivariate analysis to identify the combinations of capital structure and firm characteristics that are empirically associated with a higher MB ratio. Here we sort all firm-quarter observations into quintiles ranked by the MB ratio, with quintile 1 containing the lowest MB ratio firms and quintile 5 containing the highest MB ratio firms. We tabulate the corresponding mean capital structure and firm characteristics in each quintile and then test the hypothesis that these means differ significantly across the top and bottom quintiles.

[Insert Table 4 about here.]

We find significant variation in the MB ratio across the quintiles. Again, we find a negative relationship between the MB ratio and leverage. The highest MB ratio firms on average have a leverage ratio of 0.40 whereas the lowest MB ratio firms on average have a leverage ratio of 0.55. Graham and Leary (2011) report that the firm value function is essentially flat across a wide range of leverage outcomes for a large number of firms. We find that the value function is highly sensitive to capital structure. Unconditionally, approximately a 15% variation in total leverage leads to about a 50% change in firm value as a percentage of assets in place.

Further, we find that the firms in the highest MB ratio quintile simultaneously have significantly lower shares of secured debt as compared to the lowest MB ratio quintile (0.53 compared to 0.76). These findings are consistent with our theoretical prediction that, unconditionally, firms with low leverage and more unsecured debt achieve higher measures of firm value.

6.2 Conditional analysis

6.2.1 The role of leverage and secured debt in determining firm value

Table 5 presents the results of the regression analysis exploring the marginal impact of changes in capital structure on firm value.[19] The dependent variable is the MB ratio. The capital structure variables we focus on are market leverage and secured to total debt. The columns report the parameter estimates corresponding to the four specifications that serve to address the identification challenges we identified.

[Insert Table 5 about here.]

As noted, we control for other value-relevant firm characteristics, including real estate investment growth and the price-to-FFO multiple. Before discussing the results in relation to the capital structure variables of interest, it is worth noting that real estate investment growth has an inverse relationship with the MB ratio. This finding is intuitive in the sense that real estate investment growth measures the degree to which the firm has capitalised on previous growth opportunities. Unless these opportunities are fully replaced, the MB ratio, to the extent that it reflects the firm's growth opportunities, declines. Our control variable for growth opportunities, the price-to-FFO multiple, has the expected positive sign.

Our results indicate a significant inverse relationship between leverage and the MB ratio, implying the firm's WACC increases as a function of total leverage over a wide range. Recalling that our theory allows for non-linear and non-monotonic relations between total leverage and the MB ratio, we have explored specifications that include higher-order terms for total leverage.[20] We have also included an interaction term between total leverage and secured debt, which we discuss in more detail in the next sub-section. None of these alternative specifications change the basic relation that the firm's MB ratio is decreasing in leverage over a wide range.[21] Together with the high average leverage levels for REITs as compared to industrial firms, we believe this finding

[19] The robustness checks employing the EBITDA/interest ratio as an alternative measure of leverage are shown in the Appendix. The results are qualitatively equivalent to our main results discussed here and do not change our conclusions.

[20] Results are not reported here.

[21] This conclusion holds for the EBITDA/interest multiple as an alternative measure of leverage as well.

provides initial support of the importance of financial flexibility in the determination REIT capital structure outcomes.

Our findings are also consistent with recent empirical evidence on the detrimental impact of leverage on REIT performance as measured by realised equity returns presented in Sun, Titman, and Twite (2015) and Giacomini, Ling, and Naranjo (2015). Both studies place particular emphasis on the period around the recent global financial crisis, during which REITs registered substantial negative cash flow and real estate asset value shocks. Our finding is further consistent with the finding presented in Pavlov, Steiner, and Wachter (2015) that REITs which reduced leverage just prior to the financial crisis fared better during the subsequent crisis period.

On the other hand, our results differ from earlier findings on industrial firms in two respects. First, recent work in corporate capital structure for industrial firms reports an overwhelming influence of unobserved firm characteristics on capital structure choices that subsumes the marginal effects of many traditional capital structure theories, reducing their explanatory power significantly (Flannery and Rangan, 2006; Lemmon, Roberts, and Zender, 2008). Our basic findings are, in stark contrast, robust in the presence of firm and time fixed effects, underscoring the empirical relevance of our customised theory for REIT capital structure choices.

Second, where the literature on industrial firms identifies significant effects of capital structure on firm value directly, these effects tend to be positive. McConnell and Servaes (1995) find that leverage has a positive effect on the value of US firms, at least for firms with low growth opportunities, due to the disciplining effects of debt suggested in Jensen (1986). Dessí and Robertson (2003) confirm a positive relationship between leverage and value for UK firms, although they also report that this relationship is sensitive to alternative model specifications. Yet, our finding may be reconciled with results using industrial firm data, as REITs are less sensitive to the agency costs of managerial discretion due to the limitations on free cash flow imposed by the dividend payout rules (Hardin, Highfield, Hill, and Kelly, 2009; Hardin and Hill, 2008; Riddiough and Wu, 2009). Rather, with REITs it appears to be the inverse problem of depleting debt capacity and therefore exhausting the collateral-liquidity buffer that drives the negative relationship between leverage and value.

Further, we find that, over a wide range, a higher share of secured debt is related to a lower MB ratio, consistent with the hypothesised inverse cash incentive problem. That is, the evidence is consistent with the notion that long-term non-recourse mortgage debt lacks monitoring and commitment at the firm level, whereas unsecured debt provides suitable mechanisms to address both problems that exist due to limitations on share blockholdings and an ability to discipline management. The combination of low leverage and prominent use of unsecured debt therefore indicates higher firm value, providing direct empirical support of the importance of liquidity management and financial flexibility in the determination of optimal REIT capital structures.

Some have argued that corporate governance provisions protecting shareholder rights are less relevant for firm value in REITs due to the restrictions on managerial discretion imposed by the REIT regulation (Bauer, Eichholtz, and Kok, 2010; Campbell, Ghosh, Petrova, and Sirmans, 2011; Hartzell, Kallberg, and Liu, 2008). That would imply that the market for corporate control is not actually required for imposing managerial discipline in REITs. Our findings suggest that the agency cost of the inverse cash incentive problem has a significant influence on firm value, the costs of which may be mitigated through unsecured debt. Our findings may as a result partly explain the weak relationship between measures of corporate governance and REIT value-performance sometimes found in empirical studies that do not consider the governance mechanisms implied in the composition of the firm's capital structure - in particular the monitoring and commitment value of unsecured debt. [22]

The economic impact of our findings is significant. In our conditional analysis described here, and after controlling for investment effects, we find that a 10% increase in leverage leads to approximately a 10% decrease in firm value. These are significant effects, and contrast sharply with the findings summarised by Graham and Leary (2011). Magnitudes are less dramatic with secured debt but remain significant.

6.2.2 The interaction between leverage and secured debt

We now test the hypothesis that the value effects of secured debt depend on the amount of leverage in place. Previously we argued that firms with high leverage may be excluded from the market for unsecured debt. Further, non-recourse mortgage debt may help manage underinvestment problems associated with higher leverage. In order to explore these interrelationships, we augment our regressions with an interaction term between leverage and secured debt. Additionally, we sort firms into four groups according to their leverage and secured debt levels, where we distinguish between low and high leverage and secured debt along their quarterly medians.

[22] See also Giambona, Mello, and Riddiough (2012) for similar arguments.

[Insert Table 6 about here.]

Table 6 continues to show an inverse relationship between leverage and the MB ratio, as well as between secured debt and the MB ratio, respectively. After controlling for these main effects, our results also show significant interactions between these two dimensions of capital structure. We find that the combination of maintaining low leverage and simultaneously keeping low levels of secured debt is associated with higher MB ratios. These findings are consistent with our theory that shareholders reward the preservation of a collateral-liquidity buffer and the commitment mechanisms embedded in the use of unsecured debt.

When leverage is high, these relationships change. We find a significant positive interaction between high leverage and high secured debt, both in terms of the direct interaction and in terms of a positive and significant effect of the indicator for this group. This is consistent with our argument of the prominence of debt overhang costs for highly levered firms. Further, we find a significant negative interaction between high leverage and low secured debt (high unsecured debt). A highly levered firm that has issued unsecured debt may have already violated unsecured debt covenants, or may do so shortly. This precludes the firm from obtaining further unsecured funding, threatening liquidity, and risking the loss of cash flow and control rights to unsecured debt holders. As a result, the combination of high leverage and low secured debt has a negative marginal effect on the MB ratio.

The literature on the choice determinants and value effects of secured debt is divided into two competing hypotheses. In adverse selection models, borrowers use collateral to signal quality (Besanko and Thakor, 1987a,b; Bester, 1985; Chan and Kanatas, 1985). In moral hazard models, collateral incentivises borrowers to honour their debt commitments (Boot and Thakor, 1994; Chan and Thakor, 1987). In both cases, secured borrowing is associated with better credit outcomes. Alternatively, some studies advocate that collateral is associated with lower credit quality (Boot, Thakor, and Udell, 1991; Giambona, Mello, and Riddiough, 2012; Inderst and Mueller, 2007; Jimenez, Salas, and Saurina, 2006; Rauh and Sufi, 2010). Our evidence is generally more consistent with the latter set of predictions. However, our results suggest that the value effect of secured debt depends on leverage in place, implying a more subtle role for the influence of secured debt than previously reported.

Ambrose, Bond, and Ooi (2010) examine the relationship between REIT returns and secured debt utilisation. They find that higher shares of secured debt are associated with higher subsequent stock returns, and attribute this effect to the higher riskiness of borrowers who pledge collateral. Importantly, they begin to address the interrelationship between leverage and secure debt by showing that high-leverage firms are more likely to increase secured debt. Our findings are consistent with this result but we add to the evidence by assessing the differential effect of secured debt on the value of high- versus low-leverage firms. We are thus able to provide evidence that non-recourse mortgage debt is not universally associated with lower firm values, but that it supports the MB ratio in high-leverage firms because it ring-fences the claims of existing debt holders and thus reduces agency costs of underinvestment.

Lastly, our findings of significant interactions between leverage and secured debt relate to the literature that considers capital structure as a multi-dimensional choice problem, where leverage and other relevant dimensions, such as maturity, have to be chosen simultaneously. Within this literature, leverage and maturity, as individual dimensions of capital structure, are viewed as substitutes or complements (Barclay, Marx, and Smith, 2003; Giambona, Harding, and Sirmans, 2008; Johnson, 2003). Our results imply that unsecured debt complements low leverage as a signal of a commitment to a conservative capital structure that preserves the collateral liquidity buffer, restraining management from depleting the firm's debt capacity. Secured debt on the other hand partly substitutes for low leverage in mitigating underinvestment costs, as evidenced by the positive interaction between high leverage and high secured debt in determining the MB ratio.

7 Conclusion

The motivating observation for our study is the reportedly weak empirical performance of traditional capital structure models that take a "one size fits all" approach that is applied across multiple industries. Instead, in order to highlight the importance of industry-specific determinants of capital structure, we focus on the REIT sector. This industry is defined by a set of unique institutional and regulatory features with first-order implications for capital structure choices, particularly as related to issues of liquidity management and financial flexibility.

The theory we outline in this paper is based on the observation that REITs are non-taxed cash-constrained going concerns, whose assets offer significant debt capacity, especially in the form of supporting non-recourse secured mortgage debt, but whose shareholders have limited incentives and scope for monitoring and disciplining managers. Against this background, we propose a simple model of REIT capital structure that highlights the maintenance of financial flexibility. In this same vein we develop predictions about the balance of non-recourse mortgage debt secured by individual assets versus corporate-level unsecured debt, where shareholders value the commitment to low leverage associated with the use of unsecured debt.

Our theory generates a set of empirically testable predictions about the relationships between firm value and corporate capital structure. However, empirical testing these predictions is fraught with a number of identification challenges that have plagued many empirical capital structure studies. We develop an identification strategy building up to a dynamic instrumental variable panel estimator to address these empirical challenges.

Consistent with model predictions, we find that firm value is decreasing in leverage over a wide range, but also find that many of the highest-value REITs have significant levels of leverage. Firm value generally decreases in secured debt, except for high-leverage firms, which benefit from a higher share of secured debt.

There are also a number of wider implications. Our findings highlight the implications of limits to debt capacity for firm value. They further illustrate that Jensen's (1986) free cash flow problem is not limited to firms with excess cash on hand, but also extends to firms that can generate fresh cash by tapping into their available debt capacity. In this case, increasing leverage is not the solution to the manager-shareholder conflict but rather a source of the problem. Our findings provide novel evidence on the commitment value of unsecured debt in this context.

Directions for future research may include the following. First, our theory is embedded in a static framework. While this simple framework allows us to isolate fundamental drivers of REIT capital structure choices and illustrate their impact on firm value in an intuitive way, richer predictions about the evolution of capital structure through time and varying market conditions may be obtained in a dynamic framework. This is especially relevant given the intertemporal nature of liquidity management and preservation of financial flexibility. Second, also related to our theoretical framework, we focus on the role of long-term debt, which is prominent in REIT capital structure. However, we do not explicitly model the use of short-term debt, such as bank lines of credit, which are also an important source of liquidity for cash-constrained REITs (Riddiough and Wu, 2009), and which might lead to more detailed insight into the balance of various types of REIT debt. Third, we focus on the effects of joint leverage and secured debt choices on firm value, but we do not attempt to model how they themselves are jointly determined by other choice variables, as Barclay, Marx, and Smith (2003) or Johnson

(2003) do for the joint drivers of leverage and debt maturity choices. The exact nature of the interrelationship between determinants of leverage and secured debt choices thus remains under-explored.

References

Agrawal, A., and C. R. Knoeber (1996): "Firm Performance and Mechanisms to Control Agency Problems between Managers and Shareholders," *Journal of Financial and Quantitative Analysis*, 31(3), 377–397.

Almeida, H., M. Campello, and M. S. Weisbach (2011): "Corporate financial and investment policies when future financing is not frictionless," *Journal of Corporate Finance*, 17(3), 675–693.

Altinkiliç, O., and R. S. Hansen (2000): "Are There Economies of Scale in Underwriting Fees? Evidence of Rising External Financing Costs," *Review of Financial Studies*, 13(1), 191–218.

Ambrose, B. W., S. A. Bond, and J. T. L. Ooi (2010): "Secured Debt and Corporate Performance: Evidence from REITs," *RERI Working Paper*.

Anderson, T. W., and C. Hsiao (1982): "Formulation and estimation of dynamic models using panel data," *Journal of Econometrics*, 18(1), 47–82.

Armstrong, C. S., W. R. Guay, and J. P. Weber (2010): "The role of information and financial reporting in corporate governance and debt contracting," *Journal of Accounting and Economics*, 50(2-3), 179–234.

Barclay, M. J., S. M. Heitzman, and C. W. Smith (2013): "Debt and taxes: Evidence from the real estate industry," *Journal of Corporate Finance*, 20(0), 74–93.

Barclay, M. J., L. M. Marx, and C. W. Smith (2003): "The joint determination of leverage and maturity," *Journal of Corporate Finance*, 9(2), 149–167.

Barraclough, K. (2007): "Scaling regression equations: Solution or problem?," Working paper, Vanderbilt University.

Bauer, R., P. Eichholtz, and N. Kok (2010): "Corporate governance and performane: The REIT effect," *Real Estate Economics*, 31(1), 1–29.

Baum, C. F. (2006): *An Introduction to Modern Econometrics*, Stata Press books. StataCorp LP, College Station, Texas.

Bellemare, M. F., T. Masaki, and T. B. Pepinsky (2015): "Lagged Explanatory Variables and the Estimation of Causal Effects," MPRA Paper 62350, University Library of Munich, Germany.

Berger, A. N., and E. Bonaccorsi di Patti (2006): "Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry," *Journal of Banking and Finance*, 30(4), 1065–1102.

Besanko, D., and A. V. Thakor (1987a): "Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets," *International Economic Review*, 28(3), 671–689.

Besanko, D., and A. V. Thakor (1987b): "Competitive equilibrium in the credit market under asymmetric information," *Journal of Economic Theory*, 42(1), 167–182.

Bester, H. (1985): "Screening vs. Rationing in Credit Markets with Imperfect Information," *American Economic Review*, 75(4), 850–855.

Bharath, S. T., J. Sunder, and S. V. Sunder (2008): "Accounting Quality and Debt Contracting," *Accounting Review*, 83(1), 1–28.

Billett, M. T., T.-H. D. King, and D. C. Mauer (2007): "Growth opportunities and the choice of leverage, debt maturity, and covenants," *Journal of Finance*, 62(2), 697–730.

Bolton, P., H. Chen, and N. Wang (2011): "A Unified Theory of Tobin's q, Corporate Investment, Financing, and Risk Management," *Journal of Finance*, 66(5), 1545–1578.

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

Boot, A. W. A., A. V. Thakor, and G. F. Udell (1991): "Secured Lending and Default Risk: Equilibrium Analysis, Policy Implications and Empirical Results," *Economic Journal*, 101(406), 458–472.

Bradley, M., G. Jarrell, and E. Kim (1984): "On the existence of an optimal capital structure: theory and evidence," *Journal of Finance*, 39(3), 857–878.

Brown, D. T., and T. J. Riddiough (2003): "Financing Choice and Liability Structure of Real Estate Investment Trusts," *Real Estate Economics*, 31(3), 313–346.

Caballero, R. J. (2006): "On the Macroeconomics of Asset Shortages," NBER Working Papers 12753, National Bureau of Economic Research, Inc.

Campbell, R., C. Ghosh, M. Petrova, and C. Sirmans (2011): "Corporate Governance and Performance in the Market for Corporate Control: The Case of REITs," *Journal of Real Estate Finance and Economics*, 42(4), 451–480.

Chan, Y.-S., and G. Kanatas (1985): "Asymmetric Valuations and the Role of Collateral in Loan Agreements," *Journal of Money, Credit and Banking*, 17(1), 84–95.

Chan, Y.-S., and A. V. Thakor (1987): "Collateral and Competitive Equilibria with Moral Hazard and Private Information," *The Journal of Finance*, 42(2), 345–363.

Childs, P. D., T. J. Riddiough, and A. J. Triantis (1996): "Mixed Uses and the Redevelopment Option," *Real Estate Economics*, 24(3), 317–339.

Cvijanović, D. (2014): "Real Estate Prices and Firm Capital Structure," *Review of Financial Studies*, 27(9), 2690–2735.

Datta, S., M. Iskandar-Datta, and Raman (2005): "Managerial stock ownership and the maturity structure of corporate debt," *Journal of Finance*, 60(5), 2333–2350.

DeAngelo, H., and L. DeAngelo (2007): "Capital structure, payout policy, and financial flexibility," *Marshall School of Business Working Paper*.

DeAngelo, H., L. DeAngelo, and T. M. Whited (2011): "Capital structure dynamics and transitory debt," *Journal of Financial Economics*, 99(2), 235–261.

DeAngelo, H., and R. Masulis (1980): "Optimal capital structure under corporate and personal taxation," *Journal of Financial Economics*, 8(1), 3–29.

Denis, D. J. (2011): "Financial flexibility and corporate liquidity," *Journal of Corporate Finance*, 17(3), 667–674, Financial Flexibility and Corporate Liquidity.

Denis, D. J., and S. B. McKeon (2012): "Debt Financing and Financial Flexibility Evidence from Proactive Leverage Increases," *Review of Financial Studies*, 25(6), 1897–1929.

Dessí, R., and D. Robertson (2003): "Debt, Incentives and Performance: Evidence from UK Panel Data," *Economic Journal*, 113(490), 903–919.

Erickson, T., and T. M. Whited (2000): "Measurement Error and the Relationship between Investment and q," *Journal of Political Economy*, 108(5), 1027–1057.

Fama, E. F. (1985): "What's different about banks?," *Journal of Monetary Economics*, 15(1), 29–39.

Fama, E. F., and K. R. French (1999): "The Corporate Cost of Capital and the Return on Corporate Investment," *Journal of Finance*, 54(6), 1939–1967.

Fazzari, S. M., R. G. Hubbard, and B. N. L. Petersen (1988): "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity*, 19(1), 141–206.

Feng, Z., C. Ghosh, and C. Sirmans (2007): "On the Capital Structure of Real Estate Investment Trusts (REITs)," *Journal of Real Estate Finance and Economics*, 34(1), 81–105.

Flannery, M. J., and K. P. Rangan (2006): "Partial adjustment toward target capital structures," *Journal of Financial Economics*, 79(3), 469–506.

Geltner, D., T. Riddiough, and S. Stojanovic (1996): "Insights on the Effect of Land Use Choice: The Perpetual Option on the Best of Two Underlying Assets," *Journal of Urban Economics*, 39(1), 20–50.

Gentry, W. M., D. Kemsley, and C. J. Mayer (2003): "Dividend Taxes and Share Prices: Evidence from Real Estate Investment Trusts," *Journal of Finance*, 58(1), 261–282.

Giacomini, E., D. C. Ling, and A. Naranjo (2015): "Leverage and Returns: A Cross-Country Analysis of Public Real Estate Markets," *Journal of Real Estate Finance and Economics*, 51(2), 125–159.

Giambona, E., J. Golec, and A. Schwienbacher (2014): "Debt Capacity of Real Estate Collateral," *Real Estate Economics*, 42(3), 578–605.

Giambona, E., J. P. Harding, and C. Sirmans (2008): "Explaining the variation in REIT capital structure: the role of asset liquidation value," *Real Estate Economics*, 36(1), 111 – 137.

Giambona, E., A. S. Mello, and T. J. Riddiough (2012): "Collateral and the Limits of Debt Capacity: Theory and Evidence," *Working Paper*.

Graham, J. R., and M. T. Leary (2011): "A Review of Empirical Capital Structure Research and Directions for the Future," *Annual Review of Financial Economics*, 3, 309–345.

Hardin, W. G., M. J. J. Highfield, M. D. Hill, and G. W. Kelly (2009): "The Determinants of REIT Cash Holdings," *The Journal of Real Estate Finance and Economics*, 39(1), 39–57.

Hardin, W. G., and M. D. Hill (2008): "REIT dividend determinants: Excess dividends and capital markets," *Real Estate Economics*, 36(2), 349–369.

Harrison, D. M., C. A. Panasian, and M. J. Seiler (2011): "Further Evidence on the Capital Structure of REITs," *Real Estate Economics*, 39(1), 133–166.

Hartzell, J. C., J. G. Kallberg, and C. H. Liu (2008): "The Role of Corporate Governance in Initial Public Offerings: Evidence from Real Estate Investment Trusts," *Journal of Law and Economics*, 51(3), 539–562.

Hartzell, J. C., L. Sun, and S. Titman (2006): "The Effect of Corporate Governance on Investment: Evidence from Real Estate Investment Trusts," *Real Estate Economics*, 34(3), 343–376.

Harvey, C. R., K. V. Lins, and A. H. Roper (2004): "The effect of capital structure when expected agency costs are extreme," *Journal of Financial Economics*, 74(1), 3–30.

Hennessy, C. A., A. Levy, and T. M. Whited (2007): "Testing Q theory with financing frictions," *Journal of Financial Economics*, 83(3), 691–717.

Holmström, B., and J. Tirole (2011): *Inside and Outside Liquidity*, vol. 1 of *MIT Press Books*. MIT Press.

Howe, J. S., and J. D. Shilling (1988): "Capital Structure Theory and REIT Security Offerings," *Journal of Finance*, 43(4), 983–993.

Inderst, R., and H. M. Mueller (2007): "A lender-based theory of collateral," *Journal of Financial Economics*, 84(3), 826–859.

Jaffe, J. F. (1991): "Taxes and the Capital Structure of Partnerships, REITs, and Related Entities," *Journal of Finance*, 46(1), 401–407.

James, C. (1987): "Some evidence on the uniqueness of bank loans," *Journal of Financial Economics*, 19(2), 217–235.

Jensen, M. C. (1986): "Agency costs of free cash flow, corporate finance, and takeovers," *American Economic Review*, 76(2), 323–329.

Jimenez, G., V. Salas, and J. Saurina (2006): "Determinants of collateral," *Journal of Financial Economics*, 81(2), 255–281.

Johnson, S. A. (2003): "Debt maturity and the effects of growth opportunities and liquidity risk on leverage," *Review of Financial Studies*, 16(1), 209–236.

Leary, M. T., and M. R. Roberts (2005): "Do Firms Rebalance Their Capital Structures?," *Journal of Finance*, 60(6), 2575–2619.

Lemmon, M. L., M. R. Roberts, and J. F. Zender (2008): "Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure," *Journal of Finance*, 63(4), 1575–1608.

Ling, D. C., A. Naranjo, and B. Scheick (2014): "Investor Sentiment, Limits to Arbitrage and Private Market Returns," *Real Estate Economics*, 42(3), 531–577.

MacKay, P., and G. M. Phillips (2005): "How Does Industry Affect Firm Financial Structure?," *Review of Financial Studies*, 18(4), 1433–1466.

McConnell, J. J., and H. Servaes (1995): "Equity ownership and the two faces of debt," *Journal of Financial Economics*, 39(1), 131–157.

Myers, S. (1977): "Determinants of corporate borrowings," *Journal of Financial Economics*, 5(2), 147–275.

Myers, S., and N. Majluf (1984): "Corporate financing and investment decisions when firms have information that investors do not have," *Journal of Financial Economics*, 13(2), 187–221.

Myers, S. C., and R. G. Rajan (1998): "The Paradox Of Liquidity," *Quarterly Journal of Economics*, 113(3), 733–771.

Ooi, J. T., S.-E. Ong, and L. Li (2010): "An Analysis of the Financing Decisions of REITs: The Role of Market Timing and Target Leverage," *Journal of Real Estate Finance and Economics*, 40(2), 130–160.

Ott, S. H., T. J. Riddiough, and H.-C. Yi (2005): "Finance, Investment and Investment Performance: Evidence from the REIT Sector," *Real Estate Economics*, 33(1), 203–235.

Pavlov, A., E. Steiner, and S. Wachter (2015): "REIT Financing Choices: Preparation Matters," *Working Paper.*

Rauh, J. D., and A. Sufi (2010): "Capital Structure and Debt Structure," *Review of Financial Studies*, 23(12), 4242–4280.

Riddiough, T. J. (1997): "Debt and Development," *Journal of Urban Economics*, 42(3), 313–338.

Riddiough, T. J., and Z. Wu (2009): "Financial Constraints, Liquidity Management and Investment," *Real Estate Economics*, 37(3), 447–481.

Shilling, J. D. (1994): "Taxes and the Capital Structure of Partnerships, REITs, and Other Related Entities," Working Paper 94-16, Wisconsin-Madison CULER.

Shleifer, A., and R. Vishny (1992): "Liquidation Values and Debt Capacity: A Market Equilibrium Approach," *Journal of Finance*, 47(4), 1343–1366.

Shleifer, A., and R. W. Vishny (1997): "A survey of corporate governance," *Journal of Finance*, 52(2), 737–783.

Stulz, R., and H. Johnson (1985): "An analysis of secured debt," *Journal of Financial Economics*, 14(4), 501–521.

Sun, L., S. D. Titman, and G. J. Twite (2015): "REIT and Commercial Real Estate Returns: A Postmortem of the Financial Crisis," *Real Estate Economics*, 43(1), 8–36.

Tobin, J. (1969): "A General Equilibrium Approach To Monetary Theory," *Journal of Money, Credit and Banking*, 1(1), 15–29.

Townsend, R. M. (1979): "Optimal contracts and competitive markets with costly state verification," *Journal of Economic Theory*, 21(2), 265–293.

Williams, J. T. (1991): "Real estate development as an option," *Journal of Real Estate Finance and Economics*, 4(2), 191–208.

Wooldridge, J. M. (2002): *Econometric analysis of cross-section and panel data.* The MIT Press, Cambridge, MA.

Zwiebel, J. (1996): "Dynamic Capital Structure under Managerial Entrenchment," *American Economic Review*, 86(5), 1197–1215.

Figures and Tables

Relevant ranges of leverage (ω_D) for financial frictions

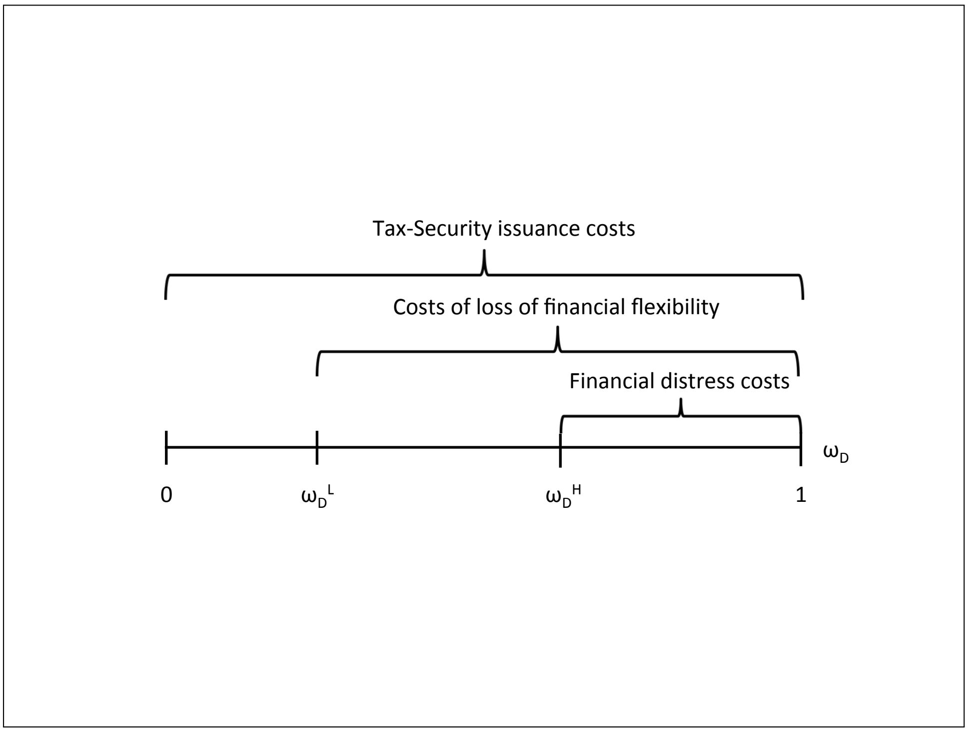

Fig. 1. The figure shows the threshold values along the $[0, 1]$ total leverage range: (i) Tax and security issuance costs are relevant across the entire $\omega_D \in [0, 1]$; (ii) Costs of financial distress are relevant for $\omega_D \in [\omega_D^H, 1]$; and (iii) costs associated with lost financial flexibility are relevant for $\omega_D \in [\omega_D^L, 1]$.

Firm value (FV) as a function of the weight to debt ω_D

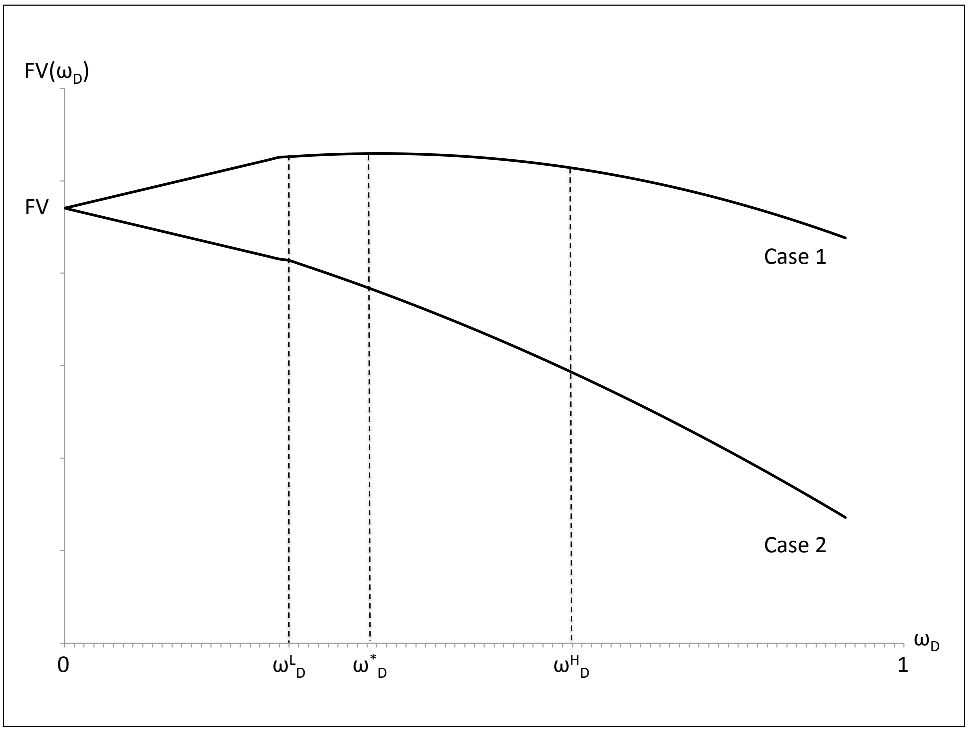

Fig. 2. The figure shows the evolution of firm value (FV) as a function of net tax-security issuance costs depending on total leverage, measured as the weight to debt in the capital structure $\omega_D \in [0,1]$. ω_D^L is the threshold value of leverage at which the cost of the loss of financial flexibility begin to affect firm value. ω_D^H is the threshold value of leverage at which financial distress costs begin to affect firm value. ω_D^* is the internal optimum of leverage at which firm value is maximised. In Case 1, net tax-security issuance costs favour debt over equity. In Case 2, net tax-security issuance costs favour equity over debt.

Evolution of the number of sample firms

Fig. 3. The figure shows the evolution of the quarterly number of firms with complete observations in our sample over the study period 1993-2014. The total number of observations is 8,017 from an average of 100 firms per quarter.

Scatter plots of MB ratio versus market leverage

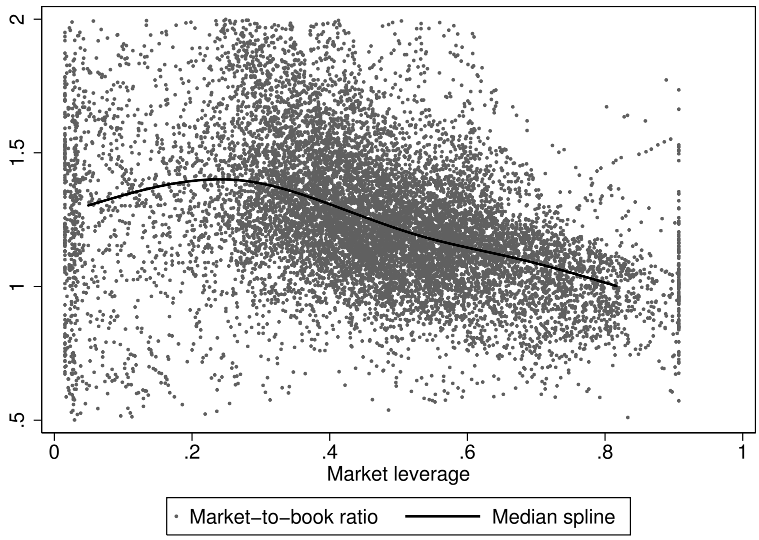

Fig. 4. The figure shows a scatter plot of the market-to-book (MB) ratio of listed US equity REITs as a function of leverage. A cubic median spline is fitted to the scatterplot.

Scatter plots of MB ratio versus secured debt

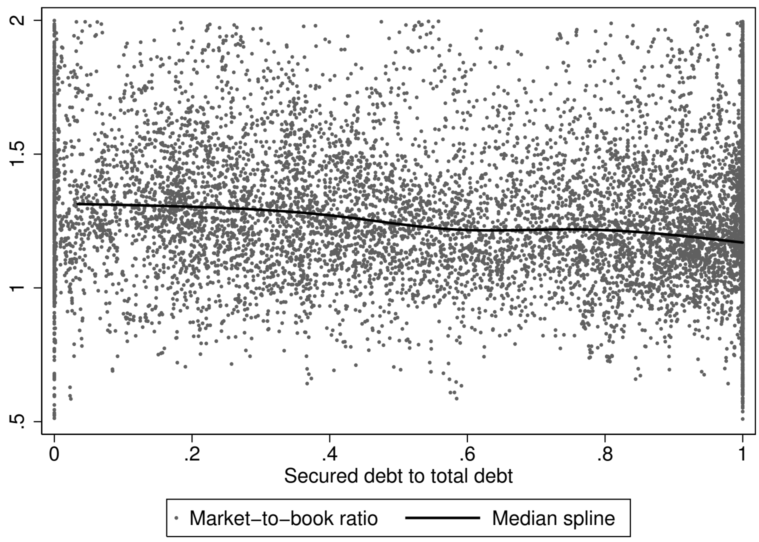

Fig. 5. The figure shows a scatter plot of the market-to-book (MB) ratio of listed US equity REITs as a function of the share of secured debt to total debt. A cubic median spline is fitted to the scatterplot.

Firm characteristics, 1993-2014

VARIABLES	Mean	SD	Min	P25	P50	P75	Max
MB ratio	1.264	0.238	0.558	1.102	1.232	1.399	1.996
Market leverage	0.475	0.148	0.028	0.375	0.466	0.575	0.907
Secured debt	0.632	0.343	0.000	0.317	0.710	0.996	1.000
Log of firm size (assets)	20.297	1.566	15.194	19.376	20.437	21.345	23.520
Log of firm size (revenue)	17.607	1.347	12.433	16.821	17.672	18.563	20.565
Volatility	0.006	0.009	0.000	0.001	0.003	0.006	0.116
Profitability	0.094	0.027	0.000	0.082	0.097	0.109	0.187
Price/FFO ratio	12.389	5.425	2.303	9.050	11.430	14.598	39.333
EBITDA/interest multiple	3.588	2.851	-0.702	2.417	3.008	3.748	27.426
Fixed-assets ratio	0.835	0.117	0.000	0.789	0.863	0.915	0.978
Cash to total assets	0.017	0.027	0.000	0.004	0.008	0.019	0.304
RE investment growth	0.166	0.423	-0.484	-0.019	0.042	0.186	3.096
Firm age	14.894	6.104	4.250	9.750	14.000	20.500	25.750

Table 1
The table presents the descriptive statistics for the firm characteristics of the US equity REITs in the sample on a quarterly basis over the period 1993-2014. All firm-level information is obtained from *SNL*. The total number of observations is 8,017 from an average of 100 firms per quarter. The market-to-book (MB) ratio is the market value of assets over the book value of assets. The market value of assets is the book value of assets (defined as all assets owned by the company as of the date indicated, as carried on the balance sheet and defined under the indicated accounting principles) minus book value of common equity plus market value of equity (number of common shares outstanding multiplied by the end of quarter share price). Market leverage is the ratio of total liabilities plus mezzanine items to the market value of assets. Secured debt is the ratio of secured debt to total debt. Firm size is measured as the log of the total book value of assets or, alternatively, total revenue. Volatility is measured as the standard deviation in EBITDA growth over four quarters, scaled by the average book value of assets over this period. Profitability is the ratio of the rental net operating income (NOI) to the average value of the REIT's properties in a quarter. The price to FFO ratio is the ratio of the share price to funds from operation (FFO) per share. The fixed-assets ratio is the ratio of net property investment to total book value of assets. The cash to total assets ratio measures cash and cash equivalents as a proportion of total assets. Real estate (RE) investment growth is the rate of growth in net real estate investment. Firm age is measured in years.

Cross-correlation table

	VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Market-to-book ratio	1.0000												
(2)	Market leverage	-0.4642*	1.0000											
(3)	Secured debt to total debt	-0.2261*	0.3764*	1.0000										
(4)	Log of firm size (assets)	0.4636*	-0.3471*	-0.4759*	1.0000									
(5)	Log of firm size (revenue)	0.2954*	-0.0555*	-0.3662*	0.9171*	1.0000								
(6)	Earnings volatility	-0.1038*	0.0974*	0.1207*	-0.1396*	-0.0738*	1.0000							
(7)	Profitability	0.1769*	-0.0648*	-0.0705*	-0.1419*	-0.2564*	-0.1016*	1.0000						
(8)	Price to FFO multiple	0.4324*	-0.3272*	-0.0834*	0.3823*	0.2371*	-0.0385*	-0.2537*	1.0000					
(9)	EBITDA/interest multiple	0.1458*	-0.5296*	-0.1499*	0.0468*	-0.0732*	-0.0521*	0.1187*	-0.0075	1.0000				
(10)	Fixed-assets ratio	-0.0801*	0.0926*	0.0518*	-0.1178*	-0.0711*	-0.1470*	-0.0191	-0.1376*	0.0002	1.0000			
(11)	Cash to total assets	-0.0038	-0.0699*	0.1667*	-0.0958*	-0.1162*	0.1494*	-0.0668*	0.1257*	0.0534*	-0.3029*	1.0000		
(12)	RE investment growth	0.0161	-0.0800*	0.0226	0.0111	-0.0584*	-0.0337*	0.0885*	0.0728*	0.0410*	0.0249	1.0000		
(13)	Firm age	0.2474*	-0.1240*	-0.1335*	0.4974*	0.4785*	-0.0066	-0.4548*	0.4308*	-0.0125	-0.1389*	-0.1184*	1.0000	

Table 2: The table presents the pairwise Pearson correlation coefficients for the capital structure and firm characteristics of the US equity REITs in the sample over the period 1993-2014. All variables are defined as in Table 1.The asterisk denotes significance of the difference of correlation coefficients from zero at the 5% level.

2x2 matrix of MB ratios as a function of leverage and secured debt

Leverage / Secured debt groups	Mean MB ratio	Low	High
	Low	1.360	1.284
	High	1.186	1.196

Differences in group mean MB ratios	Low leverage-low secured debt	Low leverage-high secured debt	High leverage-low secured debt
Low leverage - high secured debt	-0.076	–	–
(p-value)	(0.000)	–	–
High leverage - low secured debt	-0.173	-0.097	–
(p-value)	(0.000)	(0.000)	–
High leverage - high secured debt	-0.163	-0.087	0.010
(p-value)	(0.000)	(0.000)	(1.000)

Table 3

The top panel of the table presents the the market-to-book ratios of the US equity REITs in the sample over the period 1993-2014, sorted into for groups depending on the combinations of low/high leverage and secured debt. The groups are defined along the median values for leverage and secured debt, respectively, in a given quarter. The bottom panel of the table presents the results of pairwise mean comparison tests for statistically significant differences in the group means across the four low/high leverage and secured debt groups. Variables are defined as in Table 1.

Firm characteristics by market-to-book ratio quintile, 1993-2014

VARIABLES	1	2	3	4	5	Difference	(t-statistic)
Market-to-book ratio	1.003	1.146	1.242	1.351	1.589	0.586***	(105.85)
Market leverage	0.550	0.511	0.473	0.440	0.398	-0.152***	(-30.69)
Secured debt to total debt	0.757	0.690	0.621	0.564	0.525	-0.231***	(-19.63)
Log of firm size (assets)	19.307	20.052	20.450	20.808	20.904	1.597***	(30.82)
Log of firm size (revenue)	16.986	17.503	17.730	17.954	17.882	0.896***	(18.74)
Earnings volatility	0.008	0.006	0.006	0.005	0.005	-0.003***	(-8.46)
Profitability	0.081	0.090	0.095	0.098	0.107	0.027***	(26.45)
Price to FFO multiple	10.604	11.724	12.402	13.168	14.127	3.523***	(18.27)
EBITDA/interest multiple	3.076	3.188	3.543	3.986	4.170	1.094***	(10.94)
Fixed-assets ratio	0.837	0.847	0.839	0.828	0.826	-0.012**	(-2.81)
Cash to total assets	0.023	0.015	0.015	0.014	0.018	-0.005***	(-4.13)
RE investment growth	0.150	0.182	0.183	0.169	0.147	-0.002	(-0.16)
Firm age	14.870	14.914	14.874	14.914	14.898	0.028	(0.13)

Table 4

The table presents the capital structure characteristics of the US equity REITs in our sample over the period 1993-2014 by quarterly market-to-book ratio quintile. All variables are defined as in Table 1. The Table also shows the spread (Difference) between the mean variable values across the 5th (highest) and 1st (lowest) market-to-book ratio quintile alongside the corresponding t-statistic from a two-group mean-comparison test. Significance is indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Regression results for market-to-book ratio, 1993-2014

Dependent variable: MB ratio	(1)	(2)	(3)	(4)
VARIABLES	Baseline	RHS lagged	IV-2SLS	Anderson-Hsiao
Market leverage	-0.661***	-0.580***	-1.086***	-0.981***
	(-7.40)	(-6.98)	(-8.71)	(-5.58)
Secured debt to total debt	-0.050	-0.039	-0.034***	-0.070***
	(-1.54)	(-1.25)	(-3.90)	(-4.80)
RE investment growth	-0.010*	-0.009*	-0.009***	-0.009**
	(-1.77)	(-1.76)	(-2.92)	(-2.20)
Profitability	2.470***	2.444***	2.040***	0.203***
	(5.43)	(5.33)	(13.44)	(3.35)
Price to FFO multiple	0.006***	0.004***	0.004***	0.001***
	(5.82)	(4.10)	(6.44)	(5.63)
Fixed-assets ratio	0.154***	0.174***	0.182***	0.147***
	(2.73)	(2.83)	(9.59)	(6.46)
Firm age	0.006	0.003	0.028***	n/a
	(1.47)	(0.61)	(4.66)	n/a
L.MB ratio	n/a	n/a	n/a	0.185**
	n/a	n/a	n/a	(2.22)
Observations	8,017	8,017	8,017	7,882
R-squared	0.801	0.782	0.783	0.494
Firm fixed effects	Yes	Yes	Yes	n/a
Quarter fixed effects	Yes	Yes	Yes	Yes

Table 5

The table presents the regression results estimating the firm-quarter observations of the MB ratio for US equity REITs as a function of their capital structure characteristics and firm characteristic control variables. Variables are defined as in Table 1. Column (1) shows the baseline results of the contemporaneous relationships. Column (2) addresses simultaneity between leverage and the MB ratio by estimating the MB ratio as a function of lagged capital structure and firm characteristics. Column (3) addresses the endogeneity of leverage through an instrumental variable (2SLS) model that estimates leverage in a first stage as a function of the log of firm size (total revenue) and earnings volatility as excluded instruments. The under-identification LM statistic (instrument relevance) is 134.39 (p-value < 0.01) and the over-identification Sargan statistic (instrument validity) is 1.14 (p-value 0.29), confirming the suitability of our instrumental variables. Column (4) addresses autocorrelation in the dependent variable using the Anderson-Hsiao dynamic panel estimator in first differences to remove the time-invariant influence of firm fixed effects, where the lag of the MB ratio is instrumented using its second lag and leverage is instrumented as before. Otherwise, firm and quarter fixed effects are included as indicated to control for time- and firm-invariant unobservables, respectively. Robust t-statistics, with standard errors clustered by firm, are shown in parentheses. Significance is indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The interaction between leverage and secured debt, 1993-2014

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MB ratio	MB ratio	MB ratio	MB ratio	MB ratio
Leverage*Secured debt	0.689***				
	(5.44)				
Low leverage and low secured debt		0.039***			
		(3.33)			
Low leverage and high secured debt			-0.021		
			(-1.24)		
High leverage and low secured debt				-0.046***	
				(-5.19)	
High leverage and high secured debt					0.029**
					(2.08)
Market leverage	-1.086***	-0.532***	-0.610***	-0.522***	-0.619***
	(-10.45)	(-6.36)	(-7.47)	(-6.29)	(-7.74)
Secured debt to total debt	-0.324***	-0.012	-0.025	-0.061*	-0.053*
	(-5.25)	(-0.39)	(-0.80)	(-1.94)	(-1.67)
Real estate investment growth	-0.008*	-0.009*	-0.009*	-0.009*	-0.009*
	(-1.65)	(-1.75)	(-1.76)	(-1.84)	(-1.81)
Profitability	2.341***	2.441***	2.438***	2.409***	2.416***
	(5.63)	(5.39)	(5.35)	(5.37)	(5.36)
Price to FFO multiple	0.004***	0.004***	0.004***	0.004***	0.004***
	(4.29)	(4.15)	(4.10)	(4.15)	(4.09)
Fixed-assets ratio	0.133**	0.174***	0.168***	0.172***	0.166***
	(2.09)	(2.83)	(2.67)	(2.79)	(2.65)
Firm age	0.003	0.002	0.003	0.002	0.003
	(0.51)	(0.52)	(0.66)	(0.37)	(0.60)
Observations	8,017	8,017	8,017	8,017	8,017
R-squared	0.793	0.784	0.783	0.785	0.783
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes

Table 6
The table presents the regression results estimating the firm-quarter observations of the MB ratio for US equity REITs as a function of their capital structure characteristics and firm characteristic control variables. Variables are defined as in Table 1. The right-hand side variables are lagged. The columns show the effects on the MB ratio of different combinations of leverage and secured debt. High/low leverage and secured debt indicators are defined along the cross-sectional median value of these variables in each quarter. Firm and quarter fixed effects are included as indicated to control for time- and firm-invariant unobservables, respectively. Robust t-statistics, with standard errors clustered by firm, are shown in parentheses. Significance is indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendices

A Robustness checks with EBITDA/Interest ratio

Regression results for market-to-book ratio, 1993-2014

VARIABLES	(1) MB ratio	(2) RHS lagged	(3) IV-2SLS	(4) Anderson-Hsiao
EBITDA to interest multiple	0.012***	0.010***	0.071***	-0.053***
	(5.49)	(4.71)	(6.18)	(-3.50)
Secured debt to total debt	-0.063**	-0.051*	-0.013	0.014
	(-1.99)	(-1.65)	(-0.94)	(1.14)
Real estate investment growth	-0.012**	-0.011**	-0.020***	-0.022***
	(-2.12)	(-2.16)	(-4.34)	(-5.25)
Profitability	2.878***	2.817***	1.648***	0.757***
	(6.16)	(6.05)	(6.17)	(4.80)
Price to FFO multiple	0.009***	0.007***	0.010***	0.000
	(9.71)	(7.67)	(21.27)	(0.28)
Fixed-assets ratio	0.110*	0.128**	0.102***	0.004
	(1.89)	(2.03)	(4.32)	(0.12)
Firm age	-0.002	-0.002	0.022***	n/a
	(-0.39)	(-0.57)	(2.70)	n/a
LD.qratio	n/a	n/a	n/a	0.013
	n/a	n/a	n/a	(0.08)
Observations	8,017	8,017	8,017	7,882
R-squared	0.764	0.752	0.591	n/a
Firm fixed effects	Yes	Yes	Yes	n/a
Quarter fixed effects	Yes	Yes	Yes	Yes

Table A.1

The table presents the regression results from Table 5 using the EBITDA/interest multiple as an alternative proxy for market leverage. As leverage increases, the EBITDA/interest multiple decreases, all else equal. Firm and quarter fixed effects are included as indicated to control for time- or firm-invariant unobservables, respectively. Robust t-statistics, with standard errors clustered by firm, are shown in parentheses. Significance is indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The interaction between leverage and secured debt, 1993-2014

VARIABLES	(1) MB ratio	(2) MB ratio	(3) MB ratio	(4) MB ratio	(5) MB ratio
EBITDA to interest multiple*Secured debt	-0.003				
	(-0.67)				
High leverage and low secured debt		-0.050***			
		(-4.42)			
High leverage and high secured debt			-0.028**		
			(-2.21)		
Low leverage and low secured debt				0.045***	
				(4.24)	
Low leverage and high secured debt					0.043***
					(3.04)
EBITDA to interest multiple	0.012***	0.009***	0.010***	0.009***	0.009***
	(3.05)	(4.04)	(4.35)	(4.20)	(4.11)
Secured debt to total debt	-0.037	-0.074**	-0.036	-0.019	-0.077**
	(-0.97)	(-2.33)	(-1.10)	(-0.61)	(-2.37)
Real estate investment growth	-0.011**	-0.012**	-0.012**	-0.012**	-0.012**
	(-2.15)	(-2.38)	(-2.25)	(-2.28)	(-2.37)
Profitability	2.823***	2.717***	2.800***	2.755***	2.765***
	(6.09)	(5.93)	(6.02)	(5.97)	(5.99)
Price to FFO multiple	0.007***	0.007***	0.007***	0.007***	0.008***
	(7.66)	(7.77)	(7.69)	(7.76)	(7.77)
Fixed-assets ratio	0.126**	0.126**	0.139**	0.127**	0.143**
	(1.98)	(1.99)	(2.23)	(2.02)	(2.25)
Firm age	-0.002	-0.003	-0.002	-0.002	-0.003
	(-0.55)	(-0.58)	(-0.50)	(-0.47)	(-0.58)
Observations	8,017	8,017	8,017	8,017	8,017
R-squared	0.752	0.756	0.753	0.755	0.754
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes

Table A.2

The table presents the regression results from Table 6 using the EBITDA/interest multiple as an alternative proxy for market leverage. A low EBITDA/interest multiple implies high leverage and vice versa. Firm and quarter fixed effects are included as indicated to control for time- or firm-invariant unobservables, respectively. Robust t-statistics, with standard errors clustered by firm, are shown in parentheses. Significance is indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.