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Capital Structure and the Redeployability of Tangible Assets

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Abstract

We characterize the relation between corporate asset structure and capital structure by exploiting variation in the salability of tangible assets. Theory suggests that tangibility increases borrowing capacity because it allows creditors to more easily repossess a firm's assets. Tangible assets, however, are often illiquid. We show that the *redeployability* of tangible assets is a main determinant of corporate leverage. To establish this link, our analysis uses an instrumental variables approach that incorporates measures of supply and demand for various types of tangible assets (e.g., machines, land, and buildings). Consistent with a credit supply-side view of capital structure, we find that asset redeployability is a particularly important driver of leverage for firms that are likely to face credit frictions (small, unrated firms). Our tests also show that asset redeployability facilitates borrowing the most during periods of tight credit. Our work contributes new evidence to capital structure models that are based on contract incompleteness and limited enforceability. It does so characterizing a well-defined channel through which credit frictions affect firm financial decisions.

Key words: Asset tangibility, redeployability, capital structure, credit frictions, instrumental variables, asset demand.
JEL classification: G32.

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Abstract

We characterize the relation between corporate asset structure and capital structure by exploiting variation in the salability of tangible assets. Theory suggests that tangibility increases borrowing capacity because it allows creditors to more easily repossess a firm's assets. Tangible assets, however, are often illiquid. We show that the *redeployability* of tangible assets is a main determinant of corporate leverage. To establish this link, our analysis uses an instrumental variables approach that incorporates measures of supply and demand for various types of tangible assets (e.g., machines, land, and buildings). Consistent with a credit supply-side view of capital structure, we find that asset redeployability is a particularly important driver of leverage for firms that are likely to face credit frictions (small, unrated firms). Our tests also show that asset redeployability facilitates borrowing the most during periods of tight credit. Our work contributes new evidence to capital structure models that are based on contract incompleteness and limited enforceability. It does so characterizing a well-defined channel through which credit frictions affect firm financial decisions.

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1 Introduction

Theory suggests that contract incompleteness and limited enforceability reduce a firm's access to external financing (Hart and Moore (1994) and Holmstrom and Tirole (1997)). In the presence of such frictions, assets that are tangible are more desirable from the perspective of creditors because they are easier to repossess in bankruptcy states ("verifiable by the courts"). Tangible assets, however, often lose value when they are liquidated (see evidence in Pulvino (1998) and Acharya et al. (2007)). These losses imply that only those tangible assets that can be easily redeployed should sustain high debt capacity. Differently put, tangible assets should facilitate corporate borrowing only to the extent that they are salable. While this distinction is intuitively clear, it is rarely articulated in capital structural tests considering asset tangibility.

This paper characterizes the relation between asset tangibility and capital structure by exploiting variation in the supply and demand for corporate assets. Assets that are less firm-specific should allow for higher debt capacity because they are easier to resell; for example, to other firms in the same industry (Shleifer and Vishny (1992)). Assets that respond to supply and demand forces in their secondary markets are also more likely to be redeployable (see Gavazza (2010) for evidence). Using these insights, we decompose the measure of asset tangibility commonly used in capital structure studies ("plant, property and equipment," or PP&E) into its main components. We then assess variation in redeployability across each of those different components by way of an instrumental approach that exploits variation in asset salability in secondary markets. Our study reports new findings on the relation between asset tangibility and capital structure, identifying when and how tangibility affects corporate leverage. Consistent with the view that tangibility facilitates access to credit, we show that the redeployability of tangible assets is an important driver of leverage for firms that are more likely to face credit frictions, especially during periods of tight credit in the economy. Differently from the notion that tangibility is a "general" determinant of leverage, however, we show that fixed asset liquidity has little explanatory power over the leverage ratios of firms that are large, pay high dividends, or are rated.

Our analysis proceeds in several steps. Our first, basic step is to study the importance of asset tangibility relative to traditional determinants of leverage. Replicating standard empirical tests, we find a strong positive relation between the common proxy for tangibility (the ratio of PP&E to total assets) and firm leverage. Comparing variables on the basis of estimated economic impact, we find that tangibility is one of the single most important drivers of leverage.

We then examine the economic relevance of different components of tangibility. This examination is new to the literature and entails breaking down tangible assets into its identifiable parts, which include land and buildings, machines and equipment, and other miscellaneous assets. Notably, we evaluate the importance of these different categories using variation coming from the *redeployability* of their underlying assets. We do so via an instrumental variables approach that identifies the component (or "margin") of tangibility that responds to shifts in liquidity and salability proxies. The instrumental approach not only helps us pin down the channel we are interested in, but also has the added advantage of ameliorating concerns about endogeneity between leverage and tangibility that arise in standard OLS models.[1]

Our tests employ a set of instruments that speak to the liquidity of land and buildings owned by firms. Instruments in this set contain proxies for the supply and demand conditions in the real estate markets where firms operate, including proxies for the local number of real estate operators, the local disposal of real estate assets by the Federal Government (the largest real estate supplier in the U.S.), as well as the pricing and volatility of local rental rates (see Sinai and Souleles (2005) and Ortalo-Magne and Rady (2002)). Additional sets of instruments relate to the liquidity of the market for machinery and equipment. These include proxies for the volume of transactions of second-hand machinery and equipment in the industries our sample firms operate. The list of instruments also includes information on workforce, which affects capital/labor ratios and the demand for fixed assets (MacKay and Phillips (2005) and Garmaise (2008)). Sources of data for our instruments range from standard COMPUSTAT, to the SNL real estate database, to authors' filings of information requests under the Freedom of Information Act.

Our evidence shows that tangible assets drive capital structure *only to the extent* that they are redeployable. Put differently, only the component of asset tangibility that responds to salability ("marketable tangibility") has explanatory power over firm leverage. In addition, across the various categories of tangible assets, we find that land and buildings — arguably, the least firm-specific fixed assets — have the most explanatory power over leverage ratios.[2] Our results are consistent with the argument that frictions such as contract incompleteness and limited enforceability are important determinants of capital structure. While prior literature (discussed shortly) has considered the idea that these types of financing imperfections are relevant, we report encompassing evidence showing that they have first-order effects on corporate leverage.

[1] As we discuss below, PP&E is ultimately a choice variable and OLS estimates of the relation between leverage and PP&E might be affected by issues such as reverse-causality (debt may allow firms to acquire fixed assets) and omitted variables (good firm fundamentals may lead to *both* more external financing and asset acquisition). Stories of this kind could lead to a spurious relation between PP&E and leverage.

[2] Our tests show that other tangible asset categories, such as machines and equipment, have only a small explanatory power over leverage.

To further characterize our inferences about corporate assets and leverage, we contrast firms that are more likely to face credit frictions (small, unrated, and low dividend payout firms) with firms that are less likely to face those frictions (large, rated, and high payout firms). We find that the redeployability–leverage relation is pronounced across the set of constrained firms — firms for which collateral recourse is particularly important in the borrowing process. For example, our small-firm estimates imply that a one-interquartile range change in asset redeployability is associated with a 39% increase in market leverage. This is equivalent to a shift in leverage from its mean of 22% to about 31%. For large firms, in contrast, redeployability is an irrelevant driver of leverage. These cross-sectional contrasts are consistent with the logic of the financing friction argument: Variation in asset redeployability only affects the borrowing capacity of firms that are credit constrained.

Macroeconomics research shows that the extent to which credit frictions bind and affect firm behavior is often a function of the state of the economy (e.g., Gertler and Gilchrist (1994) and Bernanke and Gertler (1995)). This observation points to time-series variation that can be exploited to further identify the redeployability–leverage channel. Following Kashyap and Stein (2000), we employ a two-step estimator that builds on this intuition and find that the role of redeployability in alleviating financing frictions is heightened during periods of tight credit. We estimate, for example, that a 100-basis point increase in the Fed funds rate (a proxy for credit tightening) leads to a 42% increase in the sensitivity of leverage to asset redeployability. Consistent with the supply-side view of capital structure, our macro tests also suggest that asset redeployability increases debt capacity by ameliorating credit frictions.

It is important that we put our findings in context with recent literature that closely relates to our work. Faulkender and Petersen (2006) find that firms with credit ratings (a broad proxy for access to the public debt markets) have higher leverage. Our paper complements Faulkender and Petersen's results in that we explore different sources of data variation to provide evidence of a supply-side view of capital structure. Notably, we find that the economic effect of redeployability on leverage can be as large as that of ratings, suggesting that supply-side determinants of capital structure might be even stronger than previously thought. The substantive contribution of our study is that we identify and explore a well-characterized channel through which features of financial contracting — liquidity of collateral recourse — affect credit supply and corporate leverage.

We also experiment with Lemmon et al.'s (2008) leverage model to check whether our inferences about asset tangibility pass those authors' "fixed-effects stress tests." Lemmon et al. show that traditional determinants of leverage become largely irrelevant once the econometrician accounts for time-invariant firm effects. Like those authors, we find that regression coefficients of traditional leverage drivers become insignificant after accounting for firm effects. The coefficients associated with our tangibility proxies are notable exceptions, however. Relative to the baseline OLS model of Lemmon et al., the effect of land and buildings on leverage increases by a factor of almost 3 in firm-fixed effects instrumental variables estimations. Our inferences also survive the inclusion of "initial leverage" in the regression specification (also following Lemmon et al.). These experiments highlight the robustness of the redeployability–leverage channel we propose. Our results suggest that the estimation performance of other traditional leverage determinants might also improve upon better empirical characterization.

Our paper adds to current research on capital structure by considering credit supply-side frictions as determinants of leverage. A few recent papers have explored related ideas. Benmelech (2009) uses variation in the width of track gauges of 19^{th} century railroads to measure asset salability. Empirically, he finds that railroad companies that used more liquid track gauges were able to raise debt with longer maturities, but not necessarily have higher leverage. Using data from the airline industry, Benmelech and Bergman (2009) find that debt tranches secured by more liquid collateral pay lower interest rates and sustain higher loan-to-value ratios.[3] Ortiz-Molina and Phillips (2010) find that asset liquidity lowers the implied cost of capital. The authors, however, do not examine the relation between liquidity and leverage. Examining the introduction of certificates of deposits, Leary (2009) finds that shocks to the supply of bank lending affected leverage in the 1960s. Lemmon and Roberts (2010) use the 1989 collapse of the junk bond market to study the effect of a credit supply shock on bond issuers. The authors do not find an effect of credit supply on leverage. Our paper contributes to this literature by providing systematic evidence (across firms, time, and industries) of first-order effects of credit supply on firm leverage. Our study uniquely pins down a well-defined channel — the redeployability of tangible assets — in identifying how credit frictions affect capital structure.[4]

The remainder of the paper is organized as follows. The next section describes the data and compares our sample to those of standard capital structure studies. Section 3 presents our central results on the effect asset tangibility (and its various components) on capital structure. Section 4 contrasts results across sample partitions where firms are likely to face different degrees of financing frictions. It also contrasts our findings across times of tight and easy

[3]Relatedly, Benmelech et al. (2005) find a positive relation between the liquidation value of commercial real estate and the size of mortgage contracts.

[4]In contemporary work, Rampini and Viswanathan (2010) report evidence of positive correlation between fixed assets (PP&E) and leverage. In contrast to our study, however, those authors do not look at the redeployability of tangible assets, do not differentiate between different types of tangible assets, nor account for the endogeneity of tangibility.

credit in the economy. Section 5 compares the impact of asset tangibility with that of other leverage determinants discussed in recent studies. Section 6 concludes the paper.

2 Base Analysis

2.1 Sampling and Variable Construction

Our sample consists of active and inactive firms from COMPUSTAT with main operations in the U.S. for the years between 1984 and 1996. We focus on that time window because one of our goals is to gauge the relative importance of the different components of firms' property, plant and equipment, and COMPUSTAT does not report that decomposition in other years. The raw sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. We exclude firm-years for which the value of total assets or net sales is less than $1 million. We further exclude firm-years observing an increase in size or sales of more than 100%, or for which market-to-book ratios are greater than 10. Similarly, we exclude firms involved in major restructuring, bankruptcy, or merger activities.

We combine the COMPUSTAT data with several data sources. We do this in order to implement an instrumental variables approach that deals with the endogeneity of asset tangibility. We model the endogeneity of tangibility as a function of industry characteristics, real estate market conditions, and the liquidity of the secondary market for machinery and equipment, among others. To streamline the discussion, we dedicate the remainder of this section to describing sample statistics, variable construction, and regression models that are commonly found in the existing literature. We describe our instruments in the next section.

The basic left-hand side variable of the models we estimate is market leverage. Following the literature, *MarketLeverage* is the ratio of total debt (COMPUSTAT's items $dltt + dlc$) to market value of total assets, or $at - ceq + (prcc\_f \times cshpri)$. In every estimation performed, we also look at book values of debt, where we compute *BookLeverage* as the ratio of total debt to book value of total assets (at). The drivers of leverage that we examine are also standard, coming from an intersection of papers written on the topic in the last two decades.[5] *Size* is the natural logarithm of the market value of total assets (measured in millions of 1996 constant dollars). *Profitability* is the ratio of income before interest, taxes, depreciation and amortization ($oibdp$) to book value of total assets. Q is the ratio of market value of total assets to book value of total assets. *EarningsVolatility* is the ratio of the standard deviation

[5] The literature we follow in our variable selection process includes Barclay and Smith (1995), Rajan and Zingales (1995), Graham (2000), Baker and Wurgler (2002), Frank and Goyal (2003), Korajczyk and Levy (2003), Campello (2006), Faulkender and Petersen (2006), Flannery and Rangan (2006), and Lemmon et al. (2008).

of income before interest, taxes, depreciation and amortization to total book assets, computed from four-year windows of consecutive firm observations. *MarginalTaxRate* is Graham's (2000) marginal tax rate, available from John Graham's website. *RatingDummy* is a dummy variable that takes a value of 1 if the firm has either a bond rating (*splticrm*) or a commercial paper rating (*spsticrm*), and set to 0 otherwise.

Our focus is on asset tangibility and its components. We denote the standard measure of asset tangibility by *OverallTangibility*, which is defined as the ratio of total tangible assets (*ppent*; or "PP&E") to book value of total assets. *Land&Building* is the ratio of net book value of land and building (*ppenli* + *ppenb*) to the book value of total assets. *Machinery&Equipment* is the ratio of net book value of machinery and equipment (*ppenme*) to book value of total assets. *OtherTangibles* is the ratio of plant and equipment in progress and miscellaneous tangible assets (*ppenc* + *ppeno*) to book value of total assets.

2.2 Descriptive Statistics

Table 1 presents the descriptive statistics of our data. Our sampling methods and variable construction approaches are similar to those used in existing capital structure studies and, not surprisingly, the associated descriptive statistics mimic those of existing papers. Faulkender and Petersen (2006), for example, report average market and book leverage of, respectively, 19.9% and 26.1%. This is very similar to the corresponding averages of 20.2% and 25.6% that we find for our sample. Similarly, the average *OverallTangibility* of 35.6% that we report is comparable to the average of 34% reported in the Lemmon et al. (2008) and Frank and Goyal (2003) studies; or the 33.1% figure reported by Faulkender and Petersen.

A novel feature of our study is the decomposition of asset tangibility. Table 1 shows that *Land&Building* and *Machinery&Equipment* are both key components of *OverallTangibility*. These items are also quite relevant in terms of the total asset base of the firms in COMPUSTAT. The mean (median) ratio of *Land&Building* to total assets is equal to 11.8% (10.3%). For *Machinery&Equipment* the mean (median) ratio is 18.9% (16.1%). In contrast, *OtherTangibles* accounts for only 1.5% of total assets.

TABLE 1 ABOUT HERE

2.3 Standard Leverage Regressions

We verify that our sample is representative of previous capital structure studies by running "standard leverage regressions" for both the 1984–1996 window (which we use due to data availability) and a larger 1971–2006 window (for comparability with other papers). Similar to previous studies, we estimate a benchmark regression model for *Leverage* (either market or book values) of the following form:

$$Leverage_{i,t} = c + \alpha OverallTangibility_{i,t} + \boldsymbol{\beta}\mathbf{X}_{i,t} + \sum_i Firm_i + \sum_t Year_t + \varepsilon_{i,t}, \quad (1)$$

where the index i denotes a firm, t denotes a year, c is a constant, and $\mathbf{X}$ is a matrix containing the standard control variables just described (*Size*, *Q*, *Profitability*, etc.). *Firm* and *Year* absorb firm- and time-specific effects, respectively. Our current focus is on the importance and robustness of the coefficients returned for *OverallTangibility*. We will use these estimates as a benchmark for the tests conducted later in the paper.[6] All of our regressions are estimated with heteroskedasticity-consistent errors clustered by firm (Petersen (2009)).

The results are reported in Table 2. The standard leverage regression (Eq. (1)) is estimated four times, considering different combinations of leverage definitions (*MarketLeverage vs. BookLeverage*) and sample periods (1984–1996 *vs.* 1971–2006). For our purposes, the key finding from Table 2 is that the coefficients returned for *OverallTangibility* are of similar magnitudes across the 1984–1996 and 1971–2006 windows. The coefficients are also similar to those reported in prior studies. For the *MarketLeverage* model, we find that the coefficient on *OverallTangibility* is 0.212 in the 1984–1996 baseline sample, compared to 0.220 in the 1971–2006 extended sample.[7] These estimates are economically and statistically indistinguishable from each other. Inferences are similar for the *BookLeverage* model. The magnitudes of the coefficients associated with the other regressors are also generally similar across samples. To avoid repetition, we discuss the coefficients of the other regressors in the tests performed in the next section.

Table 2 About Here

3 Main Results

3.1 The Components of Asset Tangibility

We now investigate whether redeployability of a firm's assets is a first-order determinant of observed dispersion in capital structure. We first focus on the commonplace measure of asset tangibility, which we call *OverallTangibility*. We then partition this measure into its identifiable components from COMPUSTAT (*Land&Building*, *Machinery&Equipment*, and *OtherTangibles*) under an instrumental variables approach that considers the redeployability of each

[6] Our inferences are the same whether or not we lag the right-hand side variables of Eq. (1).

[7] In the capital structure literature, coefficients for *OverallTangibility* range from 0.18 in Frank and Goyal (2003) to 0.32 in Rajan and Zingales (1995).

of these asset classes. In what follows, we discuss univariate evidence on the relation between asset tangibility and leverage. Multivariate evidence is discussed subsequently.

3.1.1 Leverage and Asset Tangibility: Univariate Analysis

We start out by presenting univariate evidence on how leverage varies with overall tangibility (PP&E), and across the different components of tangibility. Table 3 presents mean comparison tests for leverage across subsamples of firms in the bottom and top quartiles of the distribution of *OverallTangibility*; alternatively, *Land&Building*, *Machinery&Equipment*, and *OtherTangibles*. We note that this detailed analysis has not been presented in the literature.

The evidence in Table 3 suggests that asset tangibility and leverage are related, and this relation varies across the different components of tangible assets. The first row of Panel A shows that going from the bottom to the top quartile of the distribution of *OverallTangibility* is associated with an increase in market leverage of 50% (from 16% to 24%). For book leverage (Panel B), the increase associated with an equivalent change in *OverallTangibility* is 40% (from 21.4% to 30%). Similarly, going from the bottom to the top quartile of the distribution of *Land&Building* implies an increase in market leverage of 33%. The increase in leverage associated with a bottom-to-top quartile change in *Machinery&Equipment* is considerably lower, only 20%. The patterns that are associated with *Land&Building* and *Machinery&Equipment* are similar when we look at book leverage. These cross-sectional differences are all highly statistically significant. The evidence is less clear-cut for *OtherTangibles*. In fact, firms in the bottom quartile of the distribution for *OtherTangibles* tend to have higher (not lower) leverage.

Table 3 About Here

The univariate evidence suggests that asset tangibility and leverage are positively correlated, and that this correlation might be stronger for certain types of tangible assets, such as land and buildings. Naturally, the evidence in Table 3 does not allow us to see whether this relation is confounded with other sources of firm heterogeneity. Moreover, it does not allow us to assess the economic importance of asset tangibility relative to other determinants of leverage. The next section deals with these issues.

3.1.2 Leverage Regression: The Unrestricted Tangibility Model

The estimation of Eq. (1) restricts the coefficients on the different components of asset tangibility to a single estimate. We refer to that equation as the "restricted model." In this section, we re-estimate Eq. (1) under different econometric approaches. More importantly, we also allow different components of asset tangibility to attract individual coefficients. We call this alternative model the "unrestricted model." The unrestricted tangibility model of leverage can be written as:

$$\begin{aligned} Leverage_{i,t} \;=\; & c + \alpha_1 Land\&Building_{i,t} + \alpha_2 Machinery\&Equipment_{i,t} + \alpha_3 OtherTangibles_{i,t} \\ & + \boldsymbol{\beta}\mathbf{X}_{i,t} + \sum_i Firm_i + \sum_t Year_t + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where *Leverage*, c, and $\mathbf{X}$ are defined similarly to Eq. (1), with *Firm* and *Year* absorbing firm- and time-specific effects, respectively.

The standard approach to the estimation of leverage equations such as Eqs. (1) and (2) is the OLS model. However, one should be concerned with the potential for empirical biases in this estimation. While the tangibility of a firm's assets — the type and mix of assets it uses — might be determined by the line of business it operates, one can argue that the firm ultimately makes decisions about the proportion of inputs employed in its production process (e.g., different levels and combinations of land, machinery, labor, and intangibles), making observed asset tangibility an *endogenous* variable. This may bias the estimates of Eqs. (1) and (2) under the OLS.

It is difficult to argue away the biases that arise from OLS estimations in this context. A reverse-causality story, for example, could yield a positive association between leverage and tangibility if the firm raises debt to acquire tangible assets. Alternatively, an omitted variable story could be told in which good firm fundamentals may lead to both more external financing (in the form of debt) and fixed asset acquisition. In turn, we look for variation coming from the redeployability of different components of tangible assets using an instrumental variables approach that is helpful in dealing with potential endogeneity between leverage and tangibility.

3.2 An Instrumental Variables Approach

The remainder of our analysis will focus on inferences based on instrumental variables (IV) approaches to modeling the relation between a firm's leverage and the various components of its tangible assets.[8] The issue of endogeneity of tangibility has not been previously addressed in the empirical capital structure literature. This task is challenging due to the heterogeneity that is imbedded in the traditional measure of tangibility, which includes assets as diverse as vacant land and machines in progress. Econometrically, this implies finding valid instruments for each identifiable type of tangible assets. We experiment with multiple sets of instruments, which we describe in turn. Admittedly, any IV approach is subject to some degree of skepticism

[8] For completeness and comparability, however, we also report results from standard OLS models.

with respect to the instruments employed. Beyond standard checks of instrument validity and relevance, we make sure that our results do not hinge on any particular instrument choice and are robust to the exclusion of individual instruments. Although not bullet-proof, we believe the approach we propose is useful and robust to a number of concerns associated with leverage model estimations that use asset tangibility as an input.

3.2.1 Sets of Instruments

Our first set of instruments includes drivers of demand and supply conditions in the real estate markets where firms operate. Research shows that corporate demand for real estate increases with the volatility of rental rates (Rosen et al. (1984), Ben-Shahar (1998), Sinai and Souleles (2005)). This happens because ownership provides insurance against fluctuations in rental costs. We proxy for the volatility of rental rents in local real estate markets with the average income volatility of commercial real estate lessors operating in the firm's headquarters state. The data used to compute this proxy are taken from the SNL–Datasource. We expect this time-varying instrument (denoted *RentalVolatility*) to attract a positive sign in the first stage of our IV estimations.[9]

Land economics research also shows that firms operating in real estate markets where office buildings and production facilities are readily available do not hold as many of those facilities in their balance sheets (Malpezzi and Green (1996) and Ortalo-Magne and Rady (2002)). The presence of Real Estate Investment Trusts (REITs) in a local real estate market is indicative of the efficiency of the market for office buildings and other commercial properties used by firms. Indeed, REITs were introduced with the Real Estate Act of 1960 to enhance the liquidity of commercial real estate assets, and research shows they increase the supply of commercial real estate in local markets (see Chan et al. (2003) and Geltner et al. (2007)).[10] We proxy for the supply of local commercial real estate facilities using the log of the number of REITs operating in the firm's state (denoted *LogSuppliers*). We expect this instrument to enter our estimations with a negative sign.

To supplement our set of real estate markets instruments, we include a proxy for the sale of real estate by the Federal Government (*GovernmentDisposal*). The Federal Government is

[9] One concern is whether firms' major facilities and headquarters are located in the same area. Denis et al. (2002) find that 70% of non-financial firms in COMPUSTAT conduct their entire operations within one geographical area (largely, the same state). Gao et al. (2008) find that of those firms with operations residing outside of the headquarters' state, the median firm has operations in only one additional state. While relatively scant, the available evidence suggests that the bulk of operating facilities of most firms (headquarters and major plants) are located together in the same geographical area, consistent with our identification strategy.

[10] REITs hold property portfolios that are both highly focused on a specific property segment (e.g., office buildings or industrial facilities) and geographically concentrated.

the largest real estate "supplier" in the U.S., and disposals of land and buildings by the Government — which can be massive at times — are known to impact local commercial real estate markets.[11] The Federal Properties Disposition Act of 1949 regulates the process of disposal and management of U.S. Government properties. The purpose of the Act is to restrain federal spending and one can argue that the Federal Government's need to dispose of land is plausibly exogenous to the conditions of local real estate markets and firms operating in those markets. We conjecture that firms operating in state-years where the Government disposes of real estate assets will hold less land and buildings in their balance sheets due to the lower price volatility of those assets. We obtain state-year panel data on U.S. dealings in real estate assets by filing a request under the Freedom of Information Act.[12]

Our second set of instruments looks at the market for machinery and equipment. Our first instrument in this set considers the liquidity of machinery and equipment within the industry in which the firm operates. Firms operating in industries with an active secondary market for their equipment will be more likely to carry those assets at a lower cost in their balance sheets (Almeida and Campello (2007)). In particular, since those assets can be easily found in secondary markets, they need not be built (custom made) for the firm. Instead, they can be bought as used goods and integrated in the firm's production process at a lower user cost (see Gavazza (2010)). Following Schlingemann et al. (2002), we use the 4-digit SIC industry-year ratios of sales of PP&E to the sum of sales of PP&E and capital expenditures (COMPUSTAT's $sppe/(sppe + capx)$) as a proxy for the liquidity of machinery and equipment in the industry a firm operates (see also Sibilkov (2009)). This proxy is denoted *IndustryResale*.

Prior literature also shows that manufacture structure (machinery and equipment) and labor configuration are correlated decisions (see MacKay and Phillips (2005) and Garmaise (2008) for evidence). Following Garmaise, we use the 4-digit SIC industry-year ratios of the number of employees scaled by total assets as an additional instrument for fixed capital. The idea is that while different firms may use different levels of capital and labor in their production process, depending on considerations such as capital vintage and utilization, one might expect these two quantities to move together along the investment expansion path. We use industry-level measures of that relation (*IndustryLabor*) so as to capture variation that is not

[11] Land ownership by the Federal Government varies sharply across states. In the Northeastern states of New York and Connecticut, for example, the U.S. Government owns less than 1% of total state-land acreage, while land ownership is as high as 44% in California and 52% in Oregon. The origin of this variation dates back to the Northwest Territory Ordinance of 1787, by which new states (beyond the original 13 colonies) were obligated to transfer massive amounts of land to the fledgling U.S. Government.

[12] These data are compiled by the Real Property Disposal Division (General Services Administration (GSA)), under the U.S. Department of Commerce.

part of the individual firm's policy set.

We capture additional industry dynamics in our instruments with the inclusion of 4-digit SIC industry-year averages for *Land&Building*, *Machinery&Equipment*, and *OtherTangibles*. The argument that a firm's financial and real decisions are linked to the industry where it operates is grounded in the theoretical product-market literature (e.g., Maksimovic and Zechner (1991) and Williams (1995)). Theory prescribes an optimal, technology-driven level and mix of fixed assets that varies across industries. The collective decisions made by a firm's industry-rivals reflect these asset characteristics, yet they are exogenous to the individual firm's choice set. Evidence of these links is presented by MacKay and Phillips (2005) and Campello (2006).

3.2.2 First-Stage Results and Instrument Quality Assessment

It is important that we verify the validity and relevance of our proposed instruments. Test statistics that speak to these properties are reported in Table 4. The table displays the slope coefficients returned from four different first-stage regressions that feature, alternatively, *OverallTangibility*, *Land&Building*, *Machinery&Equipment*, and *OtherTangibles* as the endogenous variable. The instruments we consider deliver results that agree with common priors. For example, proxies for rental volatility and the supply of rentable real estate in a firm's location load, respectively, positively and negatively on the firm's propensity to acquire land and buildings. Likewise, liquidity in the market for machinery and equipment causes firms to carry less of those assets in their balance sheets, while the ratio of employees to assets is positively associated with the demand for capital. At the same time, some of the instruments we include based on our priors prove to have somewhat lower (individual) explanatory power. It is thus important that we examine the relevance of our instrumental set.

The first instrument relevance test statistic we consider is Shea's Partial R^2 (Shea (1997)). Shea's R^2 measures the overall relevance of the instruments for the case of multiple endogenous variables. Table 4 shows that the Shea's R^2s associated with our instruments are relatively large for panel tests of the type we conduct, in the range of 5.7% to 8.3%.[13] We also conduct first-stage exclusion F-tests for our set of instruments and the associated p-values for those tests are all much lower than 1% (confirming the explanatory power of our instruments). One potential concern with the first-stage F-test in the case of multiple endogenous regressors is that it might have associated low p-values for all first-stage regressions even if only

[13] The simple Partial R^2s are, respectively, 6.7% for the *Land&Building* model and 8.6% for *Machinery&Equipment*. Baum et al. (2003) recommend as a rule of thumb that if the Shea's Partial R^2 and the simple Partial R^2 are of similar magnitude, then one can infer that instruments used in the identification have adequate explanatory power. Our instruments perform well under that metric.

one instrument is valid (see Stock and Yogo (2005)). To address this issue, we conduct the *Kleibergen-Paap* test for weak identification (Kleibergen and Paap (2006)). In the case of multiple endogenous variables, this is a test of the maximal IV bias that is possibly caused by weak instruments. For the unrestricted model, the *Kleibergen-Paap* F-test statistic is 10.6. Since the corresponding Stock and Yogo critical value for a maximal IV bias of 10% is 9.4, the maximal bias of our IV estimations will be below 10%.[14] In all, these various checks imply that our results seem robust to concerns about weak instruments.

Finally, we examine the validity of the exclusion restrictions associated with our instruments. We do this using Hansen's (1982) J-test statistic for overidentifying restrictions. The p-values associated with Hansen's test statistic are reported in the last row of Table 4. The high p-values reported in the table imply the acceptance of the null hypothesis that the identification restrictions that justify the instruments chosen are met in the data. Specifically, these reported statistics suggest that we do not reject the joint null hypothesis that our instruments are uncorrelated with the error term in the leverage regression and the model is well-specified.

Table 4 About Here

3.2.3 Second-Stage Results

Restricted Tangibility Model Second-stage coefficients for the restricted model (which includes only *OverallTangibility*) are reported in Table 5. We first discuss the statistical properties of these estimates (economic magnitudes are discussed shortly). We start by noting that *OverallTangibility* enters both the *MarketLeverage* and *BookLeverage* regressions with a positive, highly statistically significant sign. Turning to the control variables, they also enter the regressions with the expected signs. *Size* enters the leverage regressions with a positive sign, although statistically weaker. *Profitability* has a strong negative effect on leverage, a result that is commonly associated with Myers's (1984) pecking order story. The coefficient on Q obtains the expected negative sign, a finding often seen as consistent with the argument that firms with significant growth opportunities use less debt to avoid underinvestment (cf. Myers (1977) and Hart (1993)). Cash flow volatility may increase the cost of financial distress. Accordingly, *EarningsVolatility* enters the leverage regressions with the expected negative sign, although statistically insignificant. Firms with a high marginal tax rate should increase leverage to shield their tax burden. Contrary to this prediction, *MarginalTaxRate* enters the leverage

[14] Following Stock and Yogo, for further robustness, we re-estimate our models using the Limited Information Maximum Likelihood (LIML) estimator and the Fuller's modified LIML estimator, which are both robust to weak instruments. Our results are invariant to the use of maximum likelihood estimators.

regressions with a negative coefficient, a finding that is similarly reported by Faulkender and Petersen (2006). Consistent with Faulkender and Petersen's argument that firms with access to the public debt market are less opaque and can borrow more, we find that our bond market access indicator (*RatingDummy*) enters all regressions with a positively significant coefficient.

Table 5 About Here

The economic effects of *OverallTangibility* and the other regressors are reported in square brackets in Table 5. These effects are displayed in terms of percentage change in leverage relative to its sample mean as each continuous regressor increases from the 25^{th} to the 75^{th} percentile (one interquartile range (IQR) change), while all other variables are kept at their sample mean. The existing literature has paid little attention to the relative economic importance of the various forces driving observed capital structure, focusing instead on their statistical significance. This makes our exercise particularly interesting. At the same time, we are cautious about the interpretation of these results since the estimates are derived from reduced-form-type equations.

Despite concerns about the precision of estimates from capital structure regressions, the results in Table 5 highlight the importance of asset redeployability as a driver of leverage. The results in the table suggest that *OverallTangibility* is the most important determinant of *MarketLeverage*. For example, a one-IQR change in *OverallTangibility* causes *MarketLeverage* to increase by 0.066, which is a 32.4% increase relative to the sample mean leverage of 0.202. In this regression, the coefficient for Q also implies a sizeable effect, but it is only half of that of tangibility under the experimental design we consider.[15] Other important variables such as *Size* and *Profitability* have only limited economic impact on *MarketLeverage*. *OverallTangibility* is also the most important driver of *BookLeverage*.

Because *OverallTangibility* aggregates very different types of assets, it is important that we better identify the connection between asset structure and capital structure. This is the goal of the next set of tests.

Unrestricted Tangibility Model Our empirical analysis allows for the fact that corporate assets differ in their degree of redeployability. Assets such as land and buildings are generally more easily redeployable than machinery and equipment because they have a lower degree of

[15] We also considered experiments where we perturb the variable of interest with shifts measured in terms of standard deviations. Because some variables are highly skewed (such as Q), this purely parametric approach could lead us to conclude that those variables have disproportionately larger economic effects. As it turns out, however, our conclusions also hold when we consider standard deviation shifts in our experimental design.

firm specificity. Accordingly, we expect that among those assets that might be seen as tangible, land and buildings should be particularly helpful in easing contracting frictions between lenders and borrowers. This dimension has not been examined in the existing empirical literature. We are able to do so by decomposing the standard measure of asset tangibility (*OverallTangibility*) into various components: *Land&Building*, *Machinery&Equipment*, and *OtherTangibles*. With this decomposition, we can re-estimate the models of Table 5 and then assess the significance of individual components of a firm's tangible assets.

The results from our asset decomposition analysis are in Table 6, where we report estimates of economic significance.[16] To highlight the role played by redeployability, we present estimates that are obtained from ordinary least squares (OLS), least squares with fixed effects (FE), and instrumental variables with fixed effects (IV). Focusing on the IV specification, *Land&Building* stands out as the single most important economic determinant of leverage (either book- or market-based measures). In the *MarketLeverage* model, a one-IQR change in *Land&Building* is associated with an increase of 27.7% in the firm's leverage. This is almost twice as high as the effect of Q (which is 17.0%) and multiple times larger than any other traditional determinant of leverage. These contrasts are even sharper in the *BookLeverage* specification. In that model, a one-IQR change in *Land&Building* causes leverage to increase by 19.9%. This is about six-fold the economic effect of traditional drivers of capital structure, such as *Profitability* and Q. The only regressor in the *BookLeverage* model that has comparable economic magnitude is *Size*, which is not statistically significant.[17]

<u>TABLE 6 ABOUT HERE</u>

To sum up our results, for either definition of leverage (market or book leverage) and under alternative estimation approaches (OLS, FE, or IV), we find evidence pointing to land and buildings — presumably, the least firm-specific, most redeployable assets — as a first-order driver of leverage. Estimates for the other components of tangibility imply smaller, weaker effects. Importantly, as highlighted in the comparisons between the IV model and the other least square-based approaches, it is the component of land and buildings that responds to redeployability in secondary markets that explains the observed dispersion in corporate leverage. Differently put, our results show that tangible assets enable firms to sustain higher borrowing capac-

[16] One can readily recover the original regression coefficients from the estimations in Table 6 with the use of Table 1. For example, the original slope coefficient for *Land&Buildings* is 0.207 in the OLS model, which can be backed out by multiplying 13.0% from Table 6 by the average leverage of 0.202, divided by the interquartile range of 0.127 from Table 1. The tabulated regression coefficients are also available from the authors.

[17] The results we report are robust to the inclusion of operating leases in our models. In particular, our conclusions remain unchanged if we capitalize operating leases as in Rampini and Viswanathan (2010) and add this value to leverage and tangibility in our regressions.

ity, but *only to the extent* that those assets are redeployable. This evidence is new to the literature and is consistent with theories suggesting that contracting frictions such as limited enforceability condition firms' borrowing on their ability to offer collateral with high liquidation value.

4 Credit Frictions and Macroeconomic Movements

The evidence thus far is consistent with the argument that the redeployability of tangible assets affect leverage ratios because it relaxes financing frictions (provides liquid collateral to creditors). Taking this argument to its next logical steps, in this section we first contrast firms that are more likely to face financing frictions — for which collateral should be particularly important in raising debt finance — with firms that are less likely to face those problems. In a second set of experiments, we examine whether asset redeployability becomes a stronger driver of leverage in times when financing frictions are likely to be heightened, such as periods of aggregate credit contractions. These tests are described in turn.

4.1 Cross-Sectional Variation in Financing Constraints and Leverage

We investigate whether asset tangibility is a particularly important driver of leverage for firms that are more likely to face financing constraints. The first step in this analysis is to sort firms into "financially constrained" and "financially unconstrained" categories. The literature offers a number of plausible approaches to this sorting and we consider three alternative schemes:

- Scheme #1: We rank firms based on their asset size over the sample period, and assign to the financially constrained (unconstrained) group those firms in the bottom (top) three deciles of the size distribution. The rankings are performed on an annual basis. This approach resembles that of Gilchrist and Himmelberg (1995), who also distinguish between groups of financially constrained and unconstrained firms on the basis of size. Fama and French (2002) and Frank and Goyal (2003) also associate firm size with the degree of external financing frictions. The argument for size as a good observable measure of financing constraints is that small firms are typically young, less well known, and thus more vulnerable to credit imperfections.

- Scheme #2: We retrieve data on firms' bond ratings and classify those firms without a rating for their public debt as financially constrained. Given that unconstrained firms may choose not to use debt financing and hence not obtain a debt rating, we only assign to the constrained subsample those firm-years that both lack a rating and report positive long-term debt (see Faulkender and Petersen (2006)).[18] Financially unconstrained firms are those whose bonds have been rated. Related approaches for characterizing financing constraints are used by Gilchrist and Himmelberg (1995) and Almeida et al. (2004).

- Scheme #3: In every year over the sample period, we rank firms based on their payout ratio and assign to the financially constrained (unconstrained) group those firms in the bottom (top) three deciles of the annual payout distribution. We compute the payout ratio as the ratio of total distributions (dividends and repurchases) to operating income. The intuition that financially constrained firms have significantly lower payout ratios follows early work by Fazzari et al. (1988). In the capital structure literature, Fama and French (2002) use payout ratios as a measure of difficulties firms face in assessing the financial markets.

Table 7 reports second-stage IV estimation results for our three financing friction partition schemes. For ease of exposition and comparability, we report estimates for *OverallTangibility*, *Land&Building*, *Machinery&Equipment*, and *OtherTangibles* in terms of their marginal economic effects.

For the three subsamples of constrained firms (small, unrated, and low dividend payout firms), *Land&Building* appears as the main driver of capital structure. Panel A, for example, shows that a one-IQR change in *Land&Building* is associated with a 39% increase in *MarketLeverage* for the small-firm partition. This is equivalent to a shift in market leverage from its mean of about 22% to nearly 31%. Other categories of tangible assets (*Machinery&Equipment* and *OtherTangibles*), in contrast, allow for less debt financing. Their economic effect is smaller and statistically insignificant. Alternative leverage determinants (untabulated estimates) also have small economic effects when compared to *Land&Building*. For example, within the same small-firm partition, a one-IQR change in Q is associated with a 12% change in *MarketLeverage*. A similar experiment using *Size* yields a change of 11.5% in *MarketLeverage*. Notably, the economic effects of both Q and *Size* are less than one-third of the effect of *Land&Building*. We reach very similar conclusions when we examine the other constrained firm partitions; see results for unrated and low dividend payout firms.

In contrast to the above findings, asset tangibility does not affect leverage across unconstrained firms (large, rated, and high payout firms). The tangibility proxies enter the market leverage regressions with generally negative, statistically insignificant coefficients. These contrasting results imply that *only* constrained firms have their capital structures explained by

[18]Firms with no bond rating and no debt are excluded, but our results are not affected if we treat these firms as either constrained or unconstrained. In robustness checks, we restrict the sample to the period where firms' bond ratings are observed every year, allowing firms to migrate across constraint categories.

credit supply-side considerations (creditworthiness based on redeployable collateral).

Panel B reports regressions featuring *BookLeverage* as the dependent variable. In these regressions, *Land&Building* more sharply dominates other categories of asset tangibility (*Machinery&Equipment* is now always small and insignificant) as well as competing drivers of leverage (the economic effects of *Q*, *Size*, and *Profitability* are also much smaller). For the small-firm partition, for example, a one-IQR change in *Land&Building* causes *BookLeverage* to increase by 28% from its mean, compared to an effect of only 3% for *Machinery&Equipment* and 1% for *Q*. One reaches similar conclusions by examining the unrated and low payout firm partitions.

Table 7 About Here

It is worthwhile discussing the results of Table 7 in further detail. The estimates in the table suggest that *Land&Building* is the most important economic determinant of leverage, with its effect concentrated among firms that are likely to face greater credit frictions (firms that are small, unrated, and pay low dividends). These results are interesting in their own right and also add context to tests commonly conducted in the capital structure literature. In particular, standard capital structure models tend to consider asset tangibility as a "general driver" of leverage, presumably affecting all companies in a homogenous way (Rajan and Zingales (1995) is a classical example). Our evidence suggests, instead, that the channel through which asset tangibility affects leverage might be concentrated within particular categories of firms (e.g., small and unrated firms).[19]

The estimates in Table 7 also imply that the types of tangible assets that are less suitable to resolve financing frictions (e.g., machinery and equipment) are also economically and statistically less relevant in explaining leverage. These results are consistent with the notion that the effect of asset tangibility on capital structure operates through its ability to ameliorate contracting frictions between lenders and borrowers: tangible assets allow for more credit conditional on their redeployability.

4.2 Macroeconomic Movements and Leverage

We now focus on the role of asset tangibility in explaining capital structure when credit conditions shift as a result of macroeconomic shocks. According to Bernanke and Gertler (1995), ex-

[19] We took the additional step of running standard leverage regressions (similar to Eq. (1)) across partitions of small and large firms, as well as rated and unrated firms. Our simple OLS-FE estimations of Eq. (1) show that the traditional proxy for asset tangibility — the ratio of PP&E over total assets, which is labeled *OverallTangibility* in our paper — is only significant across small and unrated firm partitions. This basic check might invite more careful conceptualization of models that are meant to be all-encompassing in describing corporate leverage using asset tangibility as an input.

amining firm financing patterns over the business cycle is important because during those times credit frictions become more acute (e.g., agency problems are heightened). During contractions, tangibility should more significantly affect the availability of credit for firms that are most affected by financing constraints. If, as we argue, tangible assets are first-order drivers of leverage because they facilitate borrowing through a collateral channel, then the redeployability–leverage relation should strengthen during credit contractions. We test this hypothesis in turn.

A number of empirical studies have used economy-wide shocks to study firms' leverage decisions (e.g., Korajczyk and Levy (2003)), liquidity management (Almeida et al. (2004)), and inventory behavior (Carpenter et al. (1994)). While these papers have not examined the role of tangible assets in driving capital structure over the business cycle, we build on their approach to examine that association. Here, we follow the two-step procedure used by Almeida et al., which borrow this testing strategy from Kashyap and Stein (2000). The Kashyap-Stein two-step approach essentially provides validation for micro-level relations — in our case, between corporate asset structure and capital structure — using plausibly exogenous macroeconomic variation.

The first step of the procedure consists of estimating the baseline regression model (Eq. (2)) every year for our sample period. From the sequence of cross-sectional regressions, we collect the coefficients returned for *Land&Building* (i.e., α_1) and 'stack' them into the vector Ψ_t, which is then used as the dependent variable in the following (second-stage) time-series regression:

$$\Psi_t = \eta + \sum_{j=1}^{3} \phi_j \Delta Credit_{t-j} + \rho Trend_t + u_t, \tag{3}$$

The term $\Delta Credit$ represents innovations to the supply of credit, which is proxied by changes in the Fed funds rate (*Fed Funds*). The impact of shocks to credit supply on the sensitivity of *MarketLeverage* to *Land&Building* is gauged from the sum of the coefficients ϕ's on the lags of *Fed Funds*. A time trend ($Trend$) is included to capture secular changes in capital structure. To control for changes in the demand for credit, in multivariate versions of Eq. (3) we include the log of GDP and the log of consumer expenditures.[20] These regressions are estimated with Newey-West heteroskedasticity-consistent standard errors (Newey and West (1987)).

The results from the second-step estimation are reported in Table 8. The estimates in the table suggest that the role of land and buildings as a first-order determinant of leverage becomes noticeably more important during credit contractions. Using the univariate model from the full sample as an example (Panel A), the positive estimate for *Fed Funds* (i.e., the sum of the coefficients for the three lags of the Fed funds) implies that the coefficient on *Land&Building* increases by 0.187 when the Fed funds rate increases by 100 basis points. This is a significant

[20] These series are obtained from the Bureau of Labor Statistics.

shift given that the *Land&Building* coefficient equals 0.442 in the first-stage IV. The estimates in Panels B and C show that our conclusions hold after we control for shifts in the demand for credit using GDP (Panel B) and both GDP and consumer expenditures (Panel C).

The results in Table 8 also show that the increased sensitivity of *MarketLeverage* to *Land&Building* is especially strong for firms in the high financing friction partitions. In particular, the coefficient on *Fed Funds* is positive and highly statistically significant for the small, unrated, and low payout firms. In contrast, the same macroeconomic variable attracts coefficients that are very small in magnitude and generally statistically insignificant for unconstrained firms.

TABLE 8 ABOUT HERE

The results of this section suggest that asset redeployability facilitates borrowing by firms that are likely to be credit constrained (small, unrated, and low payout firms) during times when credit constraints bind the most (monetary tightenings). In all, they substantiate the argument that credit supply effects play a key role in the time-series and cross-sectional variation of corporate leverage ratios.

5 Comparisons with Recent Studies

Our analysis thus far uses standard leverage models to facilitate comparisons with the broader capital structure literature. Our arguments, however, are not model-specific and our results should hold under specifications used in papers that are closely related to ours. We experiment with this idea in turn. We first build on Faulkender and Petersen's (2006) credit-supply study, introducing our asset tangibility decomposition in their empirical model. Within their framework, we assess the economic effect of asset tangibility. We then consider Lemmon et al.'s (2008) leverage model. Lemmon et al. find that traditional drivers of leverage become virtually irrelevant when one accounts for firm-specific, time-invariant effects. We subject our tangibility proxies to a similar experiment, using those authors' approach.

5.1 Asset Tangibility and Credit Ratings

Faulkender and Petersen (2006) hypothesize that access to the public debt markets mitigates credit rationing, allowing firms to increase their borrowings. Using credit ratings as a proxy for access to those markets, the authors find a significant impact of ratings on leverage. In particular, estimates in Table 5 of their paper show that a ratings dummy increases a firm's market leverage ratio by 0.051 (see column 3). Relative to the average ratio of 0.222 that the authors report in their Table 1, this corresponds to an increase in leverage of 22.9%. The authors report that leverage increases range from 0.057 to 0.063 in instrumental variable models that tackle the endogeneity of ratings (see their Table 8). These numbers correspond to an increase in leverage in the order of 25.7% to 28.4% relative to the sample average leverage.

We use our sample to replicate the tests of Faulkender and Petersen (2006); see, e.g., Table 4 in their paper. In columns 1 and 2 of Table 9 below, we report OLS and IV results for our restricted model. In column 3, we report IV results for the unrestricted model. Notably, the results reported in Table 9 are very similar to those in Faulkender and Petersen. Focusing on the rating dummy (their key variable), column 3 shows that access to the public debt market increases leverage by 0.045. Relative to the average of 0.203, this corresponds to a 22.3% increase in leverage relative to the sample mean, which closely resembles the 22.9% estimate of Faulkender and Petersen.

<u>TABLE 9 ABOUT HERE</u>

Once we replicate Faulkender and Petersen's findings, our main task is to gauge the relative economic importance of our measures of tangibility. Table 9 reports, in square brackets, the percentage change in leverage relative to its sample mean as each variable increases from the 10^{th} to the 90^{th} percentile while all the other variables are kept at their mean.[21] The only exception is the rating dummy, which should be interpreted as the percentage change in leverage relative to its sample mean for firms with a credit rating relative to those without one.

The estimates of Table 9 imply that asset tangibility remains as a key driver of leverage in Faulkender and Petersen's specification. One finds, for example, that as *Land&Building* increases from the 10^{th} to the 90^{th} percentile, leverage increases by 0.106. Relative to the sample mean of 0.203, this corresponds to a 52.0% increase in leverage. This is more than twice as large as the increase that is associated with the rating dummy (i.e., 22.3%). We draw similar inferences for the more standard measure of asset tangibility, *OverallTangibility* (see column 2). This is an interesting finding since both our main arguments and Faulkender and Petersen's central theory revolve around supply-side determinants of capital structure. The more substantive contribution of our findings is that, rather than using a broadly-defined measure of access to credit, we identify a specific channel through which creditworthiness affects capital structure. Our results add to those of Faulkender and Petersen in further characterizing the supply-side determinants of observed leverage dispersion.

[21] We use the $10^{\text{th}}-90^{\text{th}}$ percentile change for continuous variables in the tests of this section so as to resemble the impact of a dummy variable (similar to Faulkender and Petersen's credit rating dummy).

5.2 Asset Tangibility and Firm Effects in Leverage Regressions

Lemmon et al. (2008) show that most of the empirical variation in corporate leverage can be explained by unobserved, time-invariant firm effects. On this basis, the authors argue that capital structure models estimated via OLS might overestimate the marginal effects of the traditional determinants of leverage. Consistent with this argument, they report that coefficient estimates for the traditional determinants of market leverage drop on average by about 60% after accounting for firm-fixed effects. Their paper gives a "dim picture" (p. 1605) of existing models' ability to explain capital structure.

We replicate the tests reported in Table V of Lemmon et al. using our sample. The results are shown in Table 10. Comparing OLS estimates (columns 1 and 3) with those of the firm-fixed effects IV specifications (columns 2 and 4), we find a clear pattern of decline in the size of the coefficients attracted by traditional determinants of leverage, similar to the pattern reported by Lemmon et al.[22] The coefficients associated with our main tangibility proxies are notable exceptions, however. For *OverallTangibility*, a comparison of results across columns 1 and 2 shows an *increase* in the magnitude of the coefficient from 0.164 to 0.260. In economic terms, this implies that a one-standard deviation increase in *OverallTangibility* makes leverage increase by 21.2% from its mean, compared to 13.4% in the OLS specification. Remarkably, we find a much sharper increase if we compare the coefficient estimates for *Land&Building* across columns 3 and 4 (unrestricted model). In this case, the tangibility coefficient increases by a factor of almost 3 (from 0.171 in the OLS to 0.437 in the IV specification).

Table 10 About Here

We also compare the economic effects of *Land&Building* and "initial leverage" (the firm's leverage at the time it first appears in COMPUSTAT). This is an interesting comparison since Lemmon et al. argue that initial leverage is one of the key predictors of capital structure. We do so by replicating Table II (full model) of Lemmon et al. In this test, we emulate the impact of firm-fixed effects by subtracting firm-centered averages of all variables except initial leverage (which is fixed within firm). Results are reported in column 5 of Table 10. Our estimates imply that a one-standard deviation increase in initial leverage causes leverage to increase by 0.07. Relative to our sample mean, this change corresponds to an increase of about 36%. This result is consistent with the evidence in Lemmon et al., who report in Table II (column 6) of their paper that a one-standard deviation increase in initial leverage causes leverage to increase by 0.07. More importantly, a comparison of the results across column 4 and 5 shows that the coefficient

[22] As in Lemon et al., one exception to this pattern is the estimate for *Log(Sales)*.

of *Land&Building* becomes stronger in the model with initial leverage. As it turns out, the impact of *Land&Building* is sizable and comparable to the impact of initial leverage. In particular, we find that a one-standard deviation increase in *Land&Building* causes leverage to increase by about 0.06. Relative to the sample mean, this figure implies an increase in leverage of 31%.

The tests of this section show that, unlike traditional determinants of leverage, our measures of asset tangibility *strengthen* after one controls for firm idiosyncratic characteristics, such as initial leverage and standard fixed effects. Simply put, they pass the "firm-effects stress tests" proposed by Lemmon et al. (2008). These results highlight the importance and robustness of the redeployability–leverage channel we propose. More generally, they imply that one potential problem with traditional leverage determinants is that their proxies might be too crude. Our findings provide a "brighter picture" of leverage models in suggesting that the statistical properties of other traditional leverage determinants might also improve upon better empirical characterization.

6 Conclusions

Understanding the role of collateral in borrowing is important because of its implications for corporate financing. In the presence of contracting frictions, assets that are tangible are more desirable from the point of view of creditors because they are easier to repossess in bankruptcy states. Tangible assets, however, often lose value in liquidation. It is thus unclear whether and how they affect a firm's debt capacity.

The results of this paper suggest that the redeployable component of tangible assets drives observed leverage ratios. Furthermore, across the various categories of tangible assets, it is land and buildings — presumably, the least firm-specific assets — that have the most explanatory power over leverage. The evidence we present implies that financing frictions are key determinants of capital structure. While prior literature has considered the notion that these credit imperfections are potentially relevant, we show that they have first-order effects on leverage.

Our analysis sheds additional light on the effect of credit market imperfections on leverage by comparing firms that are more likely to face financing frictions (small, unrated, and low dividend firms) and firms that are less likely to face those frictions (large, rated, and high payout firms). We find that our redeployability–leverage results are pronounced across the first set of firms. In contrast, for unconstrained firms, redeployability does not explain leverage. These firm-type contrasts are consistent with the financing friction argument: variation in asset redeployability only affects the credit access of those firms that are credit-constrained. Further tests show that redeployability eases borrowing the most when the supply of credit is tightened.

Our paper uniquely identifies a well-defined channel — the redeployability of tangible assets — to characterize the impact of credit frictions on leverage. We believe future research should more carefully consider trade-offs between credit constraints, credit supply, and firms' demand for debt financing. It should do so emphasizing concrete aspects (and frictions) of real-world financial contracts. More generally, this strategy can also be useful for research focusing on the interplay between access to collateral, corporate financing, and investment.

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Table 1 - Sample Descriptive Statistics

This table reports summary statistics for the main variables used in the paper's empirical estimations. All firm level data, with the exception of the marginal tax rate, are obtained from COMPUSTAT industrial tapes over the sample period 1984-1996. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. $MarketLeverage$ is the ratio of total debt (COMPUSTAT's items $dltt + dlc$) to market value of total assets, or $(at - ceq + prcc\_fcshpri)$. $BookLeverage$ is the ratio of total debt to book value of total assets (at). $OverallTangibility$ is the ratio of total tangible assets ($ppent$) to book value of total assets. $Land\&Building$ is the ratio of net book value of land and building ($ppenli+ppenb$) to the book value of total assets. $Machinery\&Equipment$ is the ratio of net book value of machinery and equipment ($ppenme$) to book value of total assets. $OtherTangibles$ is the ratio of plant and equipment in progress and miscellaneous tangible assets ($ppenc + ppeno$) to book value of total assets. $Size$ is the natural logarithm of the market value of total assets (measured in millions of 1996 dollars using the Producer Price Index (PPI) published by the U.S. Department of Labor as the deflator). $Profitability$ is the ratio of earnings before interest, taxes, depreciation and amortization ($oibdp$) to book value of total assets. Q is the ratio of market value of total assets to book value of total assets. $EarningsVolatility$ is the ratio of the standard deviation of earnings before interest, taxes, depreciation and amortization using four years of consecutive observations to the average book value of total assets estimated over the same time horizon. $MarginalTaxRate$ is Graham's (2000) marginal tax rate. $RatingDummy$ is a dummy variable that takes a value of 1 if the firm has either a bond rating ($splticrm$) or a commercial paper rating ($spsticrm$) and zero otherwise.

Variables	Sample Statistics					
	Mean	Median	St. Dev.	25th Pct.	75th Pct.	Obs.
$MarketLeverage$	0.202	0.163	0.175	0.056	0.307	10,128
$BookLeverage$	0.256	0.227	0.222	0.095	0.367	10,128
$OverallTangibility(PP\&E)$	0.356	0.327	0.175	0.244	0.452	10,015
$Land\&Building$	0.118	0.103	0.113	0.035	0.162	10,015
$Machinery\&Equipment$	0.189	0.161	0.129	0.104	0.237	10,015
$OtherTangibles$	0.015	0.000	0.043	0.000	0.014	10,014
$Size$	5.038	4.860	1.945	3.620	6.253	10,128
$Profitability$	0.107	0.133	0.169	0.068	0.187	10,128
Q	1.621	1.298	1.054	1.026	1.808	10,128
$EarningsVolatility$	0.091	0.067	0.089	0.042	0.110	10,078
$MarginalTaxRate$	0.321	0.340	0.104	0.298	0.360	10,128
$RatingDummy$	0.164	0.000	0.370	0.000	0.000	10,128

Table 2 - Standard Leverage Regressions

This table reports regression results for OLS with firm-fixed effects estimations of the restricted model (Eq. (1) in the text) for both our sample and an extended COMPUSTAT sample (ranging from 1971-2006). Estimations also include year dummies. All firm level data are from COMPUSTAT industrial tapes. Refer to Table 1 for detailed variable definitions. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. Standard errors reported in parentheses are based on heteroskedastic consistent errors adjusted for clustering across observations of a given firm (Petersen, 2009).

	Market Leverage		Book Leverage	
	1984-1996	1971-2006	1984-1996	1971-2006
$OverallTangibility$	0.212***	0.220***	0.231***	0.245***
	(0.028)	(0.010)	(0.038)	(0.014)
$Size$	0.005	0.018***	0.016	0.021***
	(0.006)	(0.002)	(0.014)	(0.003)
$Profitability$	-0.115***	-0.141***	-0.121***	-0.179***
	(0.019)	(0.007)	(0.039)	(0.014)
Q	-0.048***	-0.044***	-0.013*	-0.001
	(0.004)	(0.001)	(0.007)	(0.003)
$EarningsVolatility$	-0.028	-0.009	-0.203	0.004
	(0.064)	(0.016)	(0.279)	(0.030)
$MarginalTaxRate$	-0.169***	-0.189***	-0.218***	-0.224***
	(0.026)	(0.010)	(0.035)	(0.015)
$RatingDummy$	0.042***	0.039***	0.068***	0.059***
	(0.008)	(0.003)	(0.013)	(0.004)
Obs.	9,748	97,154	9,748	97,154
Adj.-R^2	0.213	0.203	0.090	0.085

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 3 - Leverage by Tangibility Quartiles

This table reports mean comparisons of the leverage ratio for sub-sample of firms in the top and bottom quartiles of *OverallTangibility*, *Land&Building*, *Machinery&Equipment*, and *OtherTangibles*. Refer to Table 1 for detailed variable definitions. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms.

Panel A: Market Leverage	Top Quartile	Bottom Quartile	Difference Top - Bottom
By *OverallTangibility*	0.240	0.160	0.080***
By *Land&Building*	0.233	0.175	0.058***
By *Machinery&Equipment*	0.227	0.189	0.038***
By *OtherTangibles*	0.188	0.202	-0.014***

Panel B: Book Leverage	Top Quartile	Bottom Quartile	Difference Top - Bottom
By *OverallTangibility*	0.300	0.214	0.086***
By *Land&Building*	0.290	0.246	0.044***
By *Machinery&Equipment*	0.287	0.239	0.048***
By *OtherTangibles*	0.250	0.256	-0.006

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 4 - First Stage of IV Regressions

This table reports the first stage of instrumental variable regressions. For the Restricted Model the dependent variable is *OverallTangibility*. For the Unrestricted Model the dependent variables are *Land&Building*, *Machinery&Equipment*, and *OtherTangibles*. We only tabulate coefficients on excluded instruments in the interest of space. Estimations also include firm- and year-fixed effects. All firm level data are from COMPUSTAT industrial tapes. Instrumental variables are obtained from several sources and are described in detail in the text. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. Standard errors reported in parentheses are based on heteroskedastic consistent errors adjusted for clustering within firm.

	Restricted Model	Unrestricted Model		
	Overall Tangibility	Land & Building	Machinery & Equipment	Other
Panel A: Real Estate Markets				
RentalVolatility	0.019***	0.039**	0.160**	-0.001
	(0.005)	(0.017)	(0.065)	(0.006)
LogSuppliers	-0.013***	-0.006**	-0.006*	-0.001
	(0.005)	(0.003)	(0.003)	(0.001)
GovernmentDisposal	0.002	-0.003*	0.003*	0.001
	(0.003)	(0.002)	(0.002)	(0.001)
Panel B: Machinery&Equipment Market				
IndustryResale	-0.039***	-0.008	-0.019**	-0.001
	(0.011)	(0.006)	(0.007)	(0.003)
IndustryLabor	0.484**	0.124	0.408***	-0.009
	(0.230)	(0.165)	(0.143)	(0.049)
IndustryTangibiltyIntensity	0.510***	0.372***	0.445***	0.696***
	(0.053)	(0.075)	(0.049)	(0.152)
Obs.	8,887	8,887	8,887	8,887
Shea's Partial R^2 (Excluded Instruments)	0.054	0.057	0.083	0.071
Standard F-test (Excluded Instruments)	23.28***	10.08***	16.47***	5.19***
Kleibergen-Paap's Statistic	23.28		10.59	
Hansen's J-Statistic - P-Value	0.19		0.57	

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 5 - Second Stage Regression Estimates - Restricted Model

This table reports second stage regression results for fixed effects instrumental variables (IV) estimations of the restricted model (Eq. (1) in the text). Estimations also include year dummies. The figures in square brackets reported under the standard errors represent the percentage changes [%] in leverage relative to its sample mean as each continuous regressor increases from the 25^{th} to the 75^{th} percentile, while all other regressors are kept at their sample mean. The exception is *RatingDummy*, for which we report the raw regression coefficient. For example, as *OverallTangibility* increases from its 25^{th} to its 75^{th} percentile, market leverage increases by 0.066, which is a 32.42% increase relative to the sample mean leverage of 0.202. All firm level data are from COMPUSTAT industrial tapes. Refer to Table 1 for detailed variable definitions. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. Standard errors reported in parentheses are based on heteroskedastic consistent errors adjusted for clustering across observations of a given firm (Petersen, 2009).

	Market Leverage	Book Leverage
OverallTangibility	0.321*** (0.082) [32.42%]	0.260*** (0.101) [20.76%]
Size	0.004 (0.006) [5.11%]	0.015 (0.014) [15.39%]
Profitability	-0.108*** (0.020) [-6.23%]	-0.110*** (0.039) [-5.03%]
Q	-0.046*** (0.004) [-17.43%]	-0.014** (0.007) [-4.15%]
EarningsVolatility	-0.026 (0.065) [-0.87%]	-0.215 (0.284) [-5.61%]
MarginalTaxRate	-0.156*** (0.026) [-4.24%]	-0.209*** (0.036) [-4.50%]
RatingDummy	0.045*** (0.009) [0.05]	0.071*** (0.013) [0.07]
Obs.	8,887	8,887
Adj.-R^2	0.205	0.088

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 6 - Economic Significance (Unrestricted Model) - Interquartile Change

This table reports regression results for ordinary least squares (OLS), firm effects least squares (FE), and fixed effects instrumental variables (IV) estimations of the unrestricted model (Eq. (2) in the text). Estimations also include year dummies. Results are displayed in terms of percentage changes in leverage relative to its sample mean as each continuous regressor increases from the 25th to the 75th percentile, while all other regressors are kept at their mean. The exception is the *RatingDummy*, for which we report the raw regression coefficient. All firm level data are from COMPUSTAT industrial tapes. Refer to Table 1 for detailed variable definitions. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms.

	Market Leverage % Change in Response to IQR Shock			Book Leverage % Change in Response to IQR Shock		
	OLS (1)	FE (2)	IV (3)	OLS (4)	FE (5)	IV (6)
Land&Building	13.00***	19.24***	27.65***	13.05***	17.26***	19.85**
Machinery&Equipment	12.07***	9.10***	9.43	11.99***	5.51*	1.68
OtherTangibles	0.55	1.04**	2.68**	0.56	0.79**	0.95
Size	-11.53***	6.04***	4.05	-6.13**	15.29	15.64
Profitability	-6.54***	-7.04***	-6.61***	-8.03***	-5.91***	-5.44***
Q	-22.94***	-18.36***	-16.97***	-3.53*	-3.80*	-3.80*
EarningsVolatility	-5.30**	-0.87	-0.91	-2.72*	-5.38	-5.58
MarginalTaxRate	-6.58***	-5.14***	-4.33***	-7.68***	-5.21***	-4.57***
RatingDummy	0.06***	0.04***	0.04***	0.09***	0.07***	0.06***
Obs.	9,748	9,748	8,887	9,748	9,748	8,887
Adj.-R^2	0.231	0.213	0.203	0.102	0.089	0.086

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 7 - Economic Significance: Low/High Credit Market Frictions - Interquartile Change

This table reports second stage regression results for fixed effects instrumental variables (IV) estimations of the unrestricted model (Eq. (2) in the text). Estimations also include control variables and year dummies (omitted). Results are displayed in terms of percentage changes in leverage relative to its sample mean as each continuous regressor increases from the 25^{th} to the 75^{th} percentile, while all other regressors are kept at their mean. The exception is the *RatingDummy*, for which we report the raw regression coefficient. All firm level data are from COMPUSTAT industrial tapes. Refer to Table 1 for detailed variable definitions. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. Small (Large) Firms are firms in the bottom (top) 3 deciles of the annual sample size distribution. Unrated (Rated) Firms are firms without (with) a debt rating and positive leverage. Low (High) DivPayout firms are firms in the bottom (top) 3 deciles of the annual sample payout distribution.

Panel A: Market Leverage % Change in Response to IQR Shock	Full Sample	Size		Ratings		Div. Payout	
		Small Firms	Large Firms	Unrated Firms	Rated Firms	Low DivPayout	High DivPayout
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Land&Building	27.65***	38.66***	0.83	39.32***	-6.26	31.55***	-27.92
Machinery&Equipment	9.43	12.04	-4.45	12.49*	1.57	12.98	2.86
OtherTangibles	2.68**	3.69	-3.21	2.50**	-4.07	1.35***	-10.57*

Panel B: Book Leverage % Change in Response to IQR Shock	Full Sample	Size		Ratings		Div. Payout	
		Small Firms	Large Firms	Unrated Firms	Rated Firms	Low DivPayout	High DivPayout
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Land&Building	19.85**	27.87**	-21.43	28.54***	-13.2	24.52*	-35.11
Machinery&Equipment	1.68	3.10	-8.21	1.92	0.70	0.37	-5.55
OtherTangibles	0.95	-1.40	-1.18	0.89	2.00	0.61	-9.67

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 8 - Macroeconomic Effects: The Impact of Land&Building on Leverage during Credit Contractions

The dependent variable is the annual series of the estimated coefficients on *Land&Building* from the fixed effects instrumental variable regression (IV) with market leverage (Eq. (3) in the text). In Panel A, the dependent variable is regressed on the 3 lags of the *FedFunds* (only sum of coefficients tabulated). In Panel B, the dependent variable is regressed on the 3 lags of the *FedFunds* (only sum of coefficients tabulated) and *GDP* (omitted). In Panel C, the dependent variable is regressed on the 3 lags of the *FedFunds* (only sum of coefficients tabulated) *GDP* (omitted), and *ConsumerExpenditures* (omitted). All regressions include a constant and a trend variable (omitted). The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. Newey-West consistent standard errors with 4 lags and robust to heteroskedasticity are reported in parentheses.

	Full Sample	Size		Ratings		Div. Payout	
		Small Firms	Large Firms	Unrated Firms	Rated Firms	Low DivPayout	High DivPayout
ΔCredit							
Panel A: Univariate							
Fed Funds	0.187*	0.402*	0.051	0.251**	0.056	0.195*	0.125**
	(0.080)	(0.165)	(0.027)	(0.063)	(0.109)	(0.079)	(0.031)
Panel B: Bivariate							
Fed Funds	0.182*	0.392**	0.052	0.201**	0.135	0.240**	0.064
	(0.066)	(0.119)	(0.026)	(0.061)	(0.061)	(0.046)	(0.065)
Panel C: Multivariate							
Fed Funds	0.161*	0.364*	0.047	0.182*	0.119	0.234**	0.075
	(0.047)	(0.123)	(0.038)	(0.047)	(0.053)	(0.046)	(0.076)

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 9 - Asset Tangibility and the Credit Ratings

This table reports results from replicating the basic regression model in Faulkender and Petersen (2006) for our sample based on OLS and fixed effects instrumental variable estimations (IV) for both our restricted and unrestricted models. Estimations also include year dummies. The dependent variable is market leverage. We follow Faulkender and Petersen (2006) in defining variables and model specifications but in Column 3 we use our *Land&Building*, *Machinery&Equipment* and *OtherTangibles* instead of the traditional tangibility proxy. All firm level data are from COMPUSTAT industrial tapes. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. Standard errors reported in parentheses are based on heteroskedastic consistent errors adjusted for clustering across observations of a given firm (Petersen, 2009). To resemble closely the impact of a dummy variable, the figures in square brackets reported under the standard errors represent the percentage changes in leverage relative to its sample mean as each continuous regressor increases from the 10^{th} to the 90^{th} percentile, while all other regressors are kept at their sample mean.

	Restricted Model		Unrestricted Model
	OLS	IV	IV
	(1)	(2)	(3)
OverallTangibility	0.190***	0.271***	
	(0.024)	(0.069)	
	[40.85%]	[58.25%]	
Land&Building			0.423***
			(0.130)
			[52.04%]
Machinery&Equipment			0.198**
			(0.097)
			[26.63%]
OtherTangibles			0.384**
			(0.184)
			[7.78%]
Firm has a debt rating	0.067***	0.047***	0.045***
	(0.010)	(0.009)	(0.009)
	[33.24%]	[23.21%]	[22.26%]
Ln(market assets)	-0.007***	0.002	0.000
	(0.002)	(0.006)	(0.006)
	[-18.28%]	[4.77%]	[1.07%]
Ln(1 + firm age)	-0.007	0.063**	0.057**
	(0.007)	(0.025)	(0.025)
	[-2.81%]	[25.62%]	[22.98%]
Market-to-book	-0.064***	-0.048***	-0.046***
	(0.003)	(0.004)	(0.004)
	[-56.65%]	[-42.59%]	[-41.23%]
R&D/sales	-0.080***	-0.019	-0.017
	(0.025)	(0.026)	(0.026)
	[-3.66%]	[-0.86%]	[-0.78%]
Advertising/sales	-0.133*	-0.200	-0.185
	(0.076)	(0.167)	(0.169)
	[-2.83%]	[-4.24%]	[-3.93%]
Profits/sales	-0.026*	-0.008	-0.007
	(0.014)	(0.010)	(0.010)
	[-3.02%]	[-0.88%]	[-0.80%]
Marginal Tax Rate	-0.296***	-0.218***	-0.220***
	(0.036)	(0.026)	(0.026)
	[-42.21%]	[-31.12%]	[-31.29%]
Obs.	8,719	8,719	8,719
Adj.-R^2	0.236	0.201	0.195

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table 10 - Asset Tangibility and Firm Fixed-Effects

This table reports results from replicating Table V in Lemmon et al. (2008) for our sample based on OLS and fixed effects instrumental variable estimations (IV) for both our restricted and unrestricted models. Estimations also include year dummies. The dependent variable is market leverage. We follow Lemmon, Roberts, and Zender (2008) in defining variables and model specifications but in Columns 3, 4 and 5 we use our *Land&Building*, *Machinery&Equipment* and *OtherTangibles* instead of the traditional tangibility proxy. All firm level data are from COMPUSTAT industrial tapes. The sample includes all firms except, financial, lease, REIT and real estate-related, non-profit, and governmental firms. Standard errors reported in parentheses are based on heteroskedastic consistent errors adjusted for clustering across observations of a given firm (Petersen, 2009). The figures in square brackets reported under the standard errors represent the percentage changes in leverage relative to its sample mean as each continuous regressor increases 1 standard deviation, while all other regressors are kept at their sample mean.

	Restricted Model		Unrestricted Model		
	OLS (1)	IV (2)	OLS (3)	IV (4)	IV (5)
OverallTangibility	0.164***	0.260**			
	(0.030)	(0.104)			
	[13.38%]	[21.21%]			
Land&Building			0.171***	0.437**	0.559***
			(0.044)	(0.185)	(0.172)
			[9.46%]	[24.12%]	[30.85%]
Machinery&Equipment			0.136***	0.127	-0.090
			(0.044)	(0.145)	(0.159)
			[8.03%]	[7.49%]	[-5.29%]
OtherTangibles			0.152	0.690***	0.587**
			(0.094)	(0.231)	(0.244)
			[2.70%]	[12.20%]	[10.39%]
InitialLeverage					0.482***
					(0.033)
					[36.13%]
Log(Sales)	0.003	0.026***	0.004	0.026***	0.041***
	(0.003)	(0.008)	(0.003)	(0.008)	(0.009)
	[2.93%]	[23.85%]	[3.49%]	[23.65%]	[37.91%]
Market-to-book	-0.059***	-0.026***	-0.058***	-0.025***	-0.025***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
	[-26.14%]	[-11.29%]	[-25.70%]	[-10.94%]	[-11.14%]
Profitability	-0.058**	-0.036*	-0.058**	-0.037*	-0.048**
	(0.027)	(0.021)	(0.027)	(0.022)	(0.024)
	[-5.71%]	[-3.58%]	[-5.76%]	[-3.67%]	[-4.72%]
Indus. med. lev.	0.224***	0.045*	0.235***	0.051*	0.044
	(0.042)	(0.027)	(0.042)	(0.028)	(0.030)
	[10.88%]	[2.19%]	[11.38%]	[2.49%]	[2.12%]
Cash flow vol.	-0.121*	0.053	-0.109	0.058	0.085
	(0.072)	(0.074)	(0.074)	(0.074)	(0.079)
	[-4.08%]	[1.79%]	[-3.70%]	[1.97%]	[2.88%]
Dividend payer	-0.078***	-0.012	-0.083***	-0.011	-0.015*
	(0.010)	(0.008)	(0.010)	(0.008)	(0.008)
	[-37.56%]	[-5.87%]	[-39.94%]	[-5.52%]	[-3.51%]
Obs.	6,073	6,073	6,073	6,073	6,073
Adj.-R^2	0.219	0.107	0.213	0.103	0.105

Note: ***, ** and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.