Asymmetries in the Firm's use of debt to changing market values

Stephen P. Ferris, Jan Hanousek, Anastasiya Shamshur, Jiri Tresl

PII: S0929-1199(17)30407-8
DOI: doi:10.1016/j.jcorpfin.2017.12.006
Reference: CORFIN 1314

To appear in: *Journal of Corporate Finance*

Received date: 4 July 2017
Revised date: 22 November 2017
Accepted date: 8 December 2017

Please cite this article as: Stephen P. Ferris, Jan Hanousek, Anastasiya Shamshur, Jiri Tresl , Asymmetries in the Firm's use of debt to changing market values. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Corfin(2017), doi:10.1016/j.jcorpfin.2017.12.006

Asymmetries in the Firm's Use of Debt to Changing Market Values

by

Stephen P. Ferris
University of Missouri
ferriss@missouri.edu

Jan Hanousek
CERGE-EI
Charles University and the Academy of Sciences, Prague
CEPR, London
jan.hanousek@cerge-ei.cz

Anastasiya Shamshur
Norwich Business School, University of East Anglia
CERGE-EI, Charles University and the Academy of Sciences, Prague
a.shamshur@uea.ac.uk

Jiri Tresl
Central Michigan University
CERGE-EI, Charles University and the Academy of Sciences, Prague
tresl1j@cmich.edu

We would like to thank Jan Bena, Demian Berchtold, Andrea Patacconi, Jack Rader. Stepan Jurajda, and participants of the various conferences including NOeG-SEA, CEA, MFS, Midwest AAA, and seminars held at the Copenhagen Business School, University of Nebraska-Lincoln for valuable insights. The research was supported by GAČR grant No. 15-15927S. The usual disclaimer applies. All mistakes remain our own.

Asymmetries in the Firm's Use of Debt to Changing Market Values

Abstract

Using a sample of U.S. firms over the period, 1984 to 2013, this study examines the relation between market and book leverage ratios. Unlike Welch (2004) who contends that changes in market leverage do not induce adjustments in book leverage, we find an asymmetric effect. That is, firms adjust their book leverage only when the changes in market leverage are due to increases in equity values. No adjustment is observed when firm equity values decrease. Our results are consistent with Myers (1977) and Barclay, Morellec and Smith (2006) who argue that optimal debt levels decrease with corporate growth opportunities.

Keywords: market leverage; book leverage; capital structure; adjustment speed

JEL classification: G32; C23

.

Asymmetries in the Firm's Use of Debt to Changing Market Values

1. Introduction

Corporate finance scholars as well as practitioners employ two measures to assess the extent to which firms make use of leverage.[1] Many researchers use market leverage ratios (e.g., Hovakimian et al., 2001; Fama and French, 2002; Welch, 2004; Leary and Roberts, 2005) while others elect to estimate book leverage ratios (e.g., Roberts and Sufi, 2009; Cai and Zhang, 2011; DeAngelo, DeAngelo, and Whited, 2011; DeAngelo and Roll, 2015). Although these measures do track each other closely, stock returns through their effect on the value of equity, introduces divergence between these values over the life of a firm. Welch (2004) reports, however, that firms do little to respond to the effect of these stock price changes on their market measured capital structures. That is, managers do not take measurable efforts to align market and book leverage ratios, resulting in corporate debt-equity ratios varying closely with fluctuations in a firm's stock price.

This study provides a deeper examination of this relation between market and book leverage ratios. More specifically, we investigate under what conditions changes in market leverage are accompanied by changes in book leverage. We investigate if there might exist circumstances that trigger managers to balance market and book leverage ratios. We also model and estimate the speed of capital structure adjustments when they occur.

We use quarterly data for U.S. firms from 1984 to 2013 to undertake our analysis. We find, unlike Welch (2004), that there is a corporate response to equity market driven changes in capital

[1] Market leverage is defined as the value of debt divided by the market value of the firm's assets; book leverage is measured as total debt divided by the book value of assets.

structure. Contrary to his conclusion that stock returns are the primary component in explaining capital structure and capital structure changes, we find that firms do readjust to stock market prices rather than simply let their debt ratios fluctuate. Importantly, we determine that this response is asymmetric. That is, firms adjust their book leverage only when the change in market leverage is due to an increase in the value of a firm's equity. Rising equity prices have the effect of lowering market leverage relative to its book counterpart. Further, we estimate the speed of adjustment of the firm's book leverage to its corresponding market ratio to be 31% per quarter. This is considerably higher than the speed of adjustment to the target leverage (26.5%).[2,3] By contrast, there is no significant adjustment to book leverage when the market leverage increases due to a decline in corporate equity values. This behavior is most consistent with Myers (1977) and Barclay, Morellec and Smith (2006) who contend that debt decreases when the firm enjoys more growth opportunities.

Since the observed adjustment in book leverage is asymmetric, it is difficult to reconcile such actions with mechanical mean reversion (Shyam-Sunder and Myers, 1999; Chen and Zhao, 2007) or other predictable effects that arise when firms do not follow target behavior (Chang and Dasgupta, 2009; Faulkender et al., 2012). This asymmetry in adjustment implies a systematic behavior that cannot be explained by random changes in book leverage ratios.

We also consider firm financing choices as suggested by Chang and Dasgupta (2009) and Faulkender et al (2012) to better understand the process by which book leverage ratios are adjusted. We sort our sample based on the relative position of market to book leverage and then analyze the

[2] Target leverage is often referred to as the 'optimal debt ratio' and denotes the target ratio a firm is trying to reach.
[3] The estimated speed of adjustment between actual and target leverage ratios for the typical firm in our sample is about 26.5% per quarter for market leverage and 26.6% for book leverage. The similarity between book and market leverage partial adjustment speed is well documented in the literature (see Flannery and Rangan, 2006; Flannery and Hankins, 2013). This quarterly speed of adjustment is lower than the annual speed of adjustment (36.6–40.5%) reported by Flannery and Rangan (2006). This might be due to the use of quarterly data that are more volatile, resulting in more frequent adjustments.

firm's subsequent financing choices. We find that firms are more likely to issue equity over the subsequent period if their market leverage is lower than their book leverage.

We further examine the changes in leverage ratio components to identify an active mechanism through which firms manage their book leverage. We show that the observed reduction in book leverage for firms whose market leverage is smaller than the book leverage is mostly driven by the increase in the book value of their assets. This increase in their book value comes from an active management of working capital, equity, and other liabilities.

Our study makes an important contribution to our understanding of capital structure choices and their dynamics over time. We determine that Welch's (2004) conclusion that firms do little to counteract the influence of stock price changes on their capital structure is only partially supported by the data. We find from a thirty-year analysis of corporate debt usage, that book leverage ratios follow an asymmetric adjustment process when responding to share price movement. We discover that increases in a firm's equity value flow through to its market leverage ratio and then ultimately into its book leverage. Decreases in firm equity values, however, trigger no significant adjustment in book leverage ratios. These results provide support for the view that when stock market fluctuations are high, book leverage is a more conservative measure of corporate debt utilization. We also establish that a firm's market and book leverage ratios demonstrate very similar evolution patterns and track each other quite closely.

We organize our study into the following sections. In section 2 we describe how firms manage their book leverage when it diverges from their market-based leverage. In section 3 we discuss our data and sample construction process. In section 4 we briefly describe the co-evolution of book and market leverage. Section 5 contains our most important analysis and examines how market and book leverage ratios differ in response to changes in the firm's equity values. We

present a comparative analysis of financial and accounting characteristics between high and low adjustment firms in Section 6. Section 7 describes our matching analysis that allows us to determine the actual channels used to manage book leverage. Section 8 presents a set of robustness checks where we examine the possibility of mechanical adjustments to changes in the value of market leverage and test alternative definitions of market leverage. Section 9 contains a brief summary of our results and a discussion of how these findings contribute to a fuller understanding of the dynamics of corporate capital structures.

2. Corporate Management of Book Leverage

The adjustment in book leverage due to a deviation between market and book leverage in the preceding period can be understood with reference to Myers (1977). In that study, Myers separates the value of the firm into: (1) the value of assets in place and (2) the present value of future growth opportunities. He clarifies that the present value of future growth opportunities is actually the "present value of the firms' options to make future investments."

We now apply Myer's (1977) model of firm value to our analysis of corporate leverage management. Consider the book value of assets as reported on the corporate balance sheet as a proxy for assets in place. Then consider the market value of assets as a proxy for the value of assets in place and the present value of the firms' options to make future investments. As the range of possible future firm values increase, the option value increases. The corresponding market leverage ratio consequently decreases when it is calculated as debt divided by the market value of assets. This variation in future firm values reduces the amount of debt supported by these growth options. Firms thus decrease their book leverage in the following period to lower the underinvestment problem produced by the debt overhang.

Our empirical results presented later in this study indicate that firms decreasing their book leverage tend to be small and have volatile cash flows. When assets in place are larger than assets in place and the firm's growth options, then we do not see an adjustment. Such firms are relatively large with stable cash flows, making the underinvestment problem less of a concern. This is consistent with the stylized fact that larger firms borrow relatively more (e.g. Titman and Wessels, 1988; Rajan and Zingales, 1995; and Fama and French, 2002).

3. Data and Sample Description

We construct our sample using Compustat North America and the St. Louis Federal Research Economic Data (FRED) over the period 1984Q1 to 2013Q4. The resulting dataset contains 419,713 firm-quarter observations. Consistent with much of the literature, we require each firm to have a fully consolidated accounting statement and be incorporated in the U.S. To avoid distortions due to regulation, financial firms (SICs 6000–6999) and regulated utilities (SICs 4900–4999) are excluded from the sample.

We analyze fiscal quarters because quarterly financial statements are an important communication mechanism between managers and the capital markets. The quarterly statements are reviewed, and corporate officers must attest to the quality of these statements since the adoption of the Sarbanes-Oxley Act. These quarterly statements are widely studied by investors in the capital markets to assess a firm's prospects for growth or value appreciation. Further, CEOs tend to emphasize quarterly results since their bonus payments are often linked to them (Matsunaga and Park, 2001). Therefore, we focus on the firm's quarterly results to observe the timing of a leverage adjustment.

We follow Lemmon, Roberts, and Zender (2008), Leary and Roberts (2014), and DeAngelo and Roll (2015) for the identification and construction of our major regressors. *Book Leverage*$_t$ is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the book value of total assets (ATq), all at time *t*. *Market Leverage*$_t$ is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of total assets. The market value of total assets is the stock price (PRCCq) times the number of shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and the investment tax credit (TXDITCq). *Firm Size* is calculated as the log of sales (SALEq) deflated by the GDP deflator, where the deflated index is base lined to 100 for the year 2009. The GDP deflator is collected from the St. Louis FRED.

We calculate several performance and value variables. *Profitability* is calculated as operating income before depreciation (OIBDPq) divided by the book value of total assets (ATq). *Cash Flow Volatility* is the standard deviation of historical operating income before depreciation (OIBDPq), scaled by total assets over the past 12 quarters. The *Market-to-Book* ratio is calculated as market equity plus total debt plus preferred stock redeemable (PSTKRQ), or (PSTKQ) if missing, minus deferred taxes and investment tax credits (TXDITCQ), and then scaled by the book value of total assets (ATq). *Tangibility* is net PPE (PPENTq) scaled by the book value of total assets (ATq).

Industry Median Book Leverage is the median book leverage estimated for the 2-digit SIC code each quarter. We require at least 5 companies in that industry and quarter. Lastly, the variable *Recession* indicates a recession in the economy as defined by NBER's Business Cycle Dating Committee.

Panel A of Table 1 provides summary descriptive statistics for our variables. We observe that the representative firm from our sample has an average book leverage ratio of 22.3%, which is almost identical to the market leverage ratio of 22%. The medians of these ratios indicate some differences, with the corresponding book leverage ratio being 19.1%, while the market leverage ratio is 14.3%. The standard deviation and various percentiles indicate comparable distributions for both ratios. The average quarterly firm sales are approximately 28.5 million USD, a profitability ratio of 1.4%, with 29.3% of the book value of its assets backed by tangible property, plant and equipment. A *Market-to-Book* ratio for the representative firm is 1.776. These descriptive statistics are comparable to those reported in prior studies such as Flannery and Rangan (2006) and Lemmon, Roberts, and Zender (2008).

Panel B contains the time-series distribution of our sample. We have the greatest coverage, with 18,892 observations in 1997. The narrowest coverage occurs in 2013 with 8,977 observations. On average, there are 13,990 observations annually.

4. The Co-Evolution of Market and Book Leverage

To begin our analysis of the relation and adjustment pattern between book and market leverage ratios we present Figure 1. This figure plots the mean book and market leverage ratios over our sample period, 1984 to 2013. An immediate observation is that the leverage ratios move together and closely track each other. Market leverage, however, is slightly more volatile than its book counterpart. Our analysis clearly supports the findings of Bowman (1980) and Bessler, Drobetz and Kazemieh (2011) that there is a strong correlation between the market and book measures of financial leverage.

In Figure 2 we plot the median difference between the market and book leverage ratios. We find that, on average, market leverage is greater than book leverage around recessions due to

the effect of depressed equity values. Book leverage, however, is on average, greater than market leverage during the non-recessionary periods. At the same time, the median of the difference between market and book leverage ratios tends to fluctuate around zero.[4] Figure 2 also shows that the difference between market and book leverage moves in waves and peaks during recessions.

5. The Connection Between Book and Market Leverage

5.1 A Partial Adjustment Methodology

In this section we examine the extent to which market and book leverage ratios are linked. That is, we investigate whether a firm adjusts its book leverage following changes in its market leverage. The obvious link between these ratios is the market value of the firm's equity. If the value of the firm's equity changes, then the market leverage ratio should adjust immediately. Book leverage adjustment is likely to occur later with the issuance of new securities.

To determine whether there is any relation between changes in market leverage and subsequent book leverage, we reformulate the partial adjustment model which is developed in the Appendix. We accomplish this by modelling the difference between market and book leverage as specified below:

$$d_{it}^{B} - d_{it-1}^{B} = \lambda(d_{it-1}^{M} - d_{it-1}^{B}) + \delta X_{it-1} + v_{it}, \qquad (1)$$

where $d_{it}^{B} - d_{it-1}^{B}$ is the difference between book leverage at time *t* and *t-1* for a firm *i*, $d_{it-1}^{M} - d_{it-1}^{B}$ represents the difference between market and book leverage ratios at time *t*-1 for firm *i*, and λ is the speed of the adjustment coefficient. Vector X_{it-1} contains firm-specific control variables. The full model also accounts for the potential differences in the speed of adjustment in recession periods, different fiscal quarters, and for cyclical companies.

[4] Note that zero leverage firms are excluded from the sample.

$$d_{it}^{B} - d_{it-1}^{B} = \lambda(d_{it-1}^{M} - d_{it-1}^{B}) + \lambda_{recession}(d_{it-1}^{M} - d_{it-1}^{B}) * recession_{D} + \lambda_{cyclical}(d_{it-1}^{M} - d_{it-1}^{B}) * cyclical_{D} + \lambda_{quarter}(d_{it-1}^{M} - d_{it-1}^{B}) * quarter_{D} + \delta X_{it-1} + v_{it} \quad (2)$$

Further, we investigate whether firms exhibit different adjustment behavior depending on the difference between market and book leverage. We calculate the difference between market and book leverage for each of our sample firms. A negative difference, when the market leverage ratio is lower than the corresponding book-based ratio, suggests that the market value of the firm is higher than its book value. A positive difference, when the market leverage is higher than its corresponding book leverage, implies the opposite. Our resulting model is as follows:

$$d_{it}^{B} - d_{it-1}^{B} = \lambda_{up}(d_{it-1}^{M} - d_{it-1}^{B}) \times D(MLev > BLev)_{t-1} + + \lambda_{down}(d_{it-1}^{M} - d_{it-1}^{B}) \times D(MLev < BLev)_{t-1} + + \delta X_{it-1} + v_{it} \quad (3)$$

In equation (3), $D(MLev > BLev)_{t-1}$ is equal to 1 if the firm's market leverage is greater than its book leverage and 0 otherwise. Similarly, $D(MLev < BLev)_{t-1}$ is equal to 1 when the firm's market leverage is lower than its book leverage and 0 otherwise. These relationships are measured at time *t-1*. The vector of firm-specific control variables (X_{it-1}) includes firm size, profitability, cash flow volatility, market-to-book, and asset tangibility. We also control for industry median book leverage. To address potential endogeneity and dependent variable persistence problems, we estimate the model by GMM (see e.g., Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998; Flannery and Hankins, 2013).

5.2 Empirical Findings

Table 2 presents our empirical findings of whether changes in a firm's market leverage ratio are accompanied by changes in its book leverage. If this is true, then λ (equation 1), the coefficient of interest, should be statistically significant. Model 1 contains the estimation results when all the dummy variables are set to zero. The estimated partial adjustment speed is 12.6% per quarter. This means that the discrepancy between the market and book leverage ratios in the current period is associated with an adjustment in book leverage during the following period. Model 2 tests for potential differences in adjustment speed during a recession. During economic downturns, we observe that the estimated adjustment speed decreases to about 9% per quarter. Interestingly, the leverage adjustment behavior of cyclical companies differs significantly from the rest of the sample (Model 3). The book and market leverage for these firms move in different directions since the estimated adjustment speed is –29%.

One possible explanation for this observed pattern is that cyclical firms enjoy higher revenues during periods of economic prosperity, but suffer reduced sales levels during economic downturns or contraction. The equity value of these firms is likely to drop significantly during a recession, resulting in a mechanical increase in their market leverage. To reduce the costs of financial distress, cyclical firms might focus on repaying their debt to reduce their book leverage.

Models 4 through 6 focus on quarterly, cyclical, and economic downturn effects. Model 4 accounts for this quarterly variation in the speed of adjustment. The difference between the market and book leverage in the fourth quarter has a slightly reduced effect on book leverage during the upcoming (first) quarter. Model 5 controls for economic recession and cyclical firms, while Model 6 is the fully specified model and includes controls for recession, cyclical firms, and individual

quarter effects. The results for this comprehensive specification are similar to those of the more limited models.

The capital structure strategies of a firm can differ depending on the market perception of a firm's value and risk. For example, an increase in the value of the firm's equity can lead to a decrease in market leverage. It then becomes interesting to examine whether there is a corresponding change in the firm's book leverage. We examine this issue under two different conditions: (1) when the market leverage ratio of a firm exceeds its book leverage ratio (denoted as *UP*) and (2) when the market leverage ratio is less than its book leverage ratio (denoted as *DOWN*).

Table 3 summarizes our results from this analysis, incorporating relative differences in the leverage ratios. Model 1 demonstrates that the speed of adjustment is dependent on the relative position of the market to the book leverage ratio. When the market leverage is greater than the book leverage (*UP*) very little adjustment is observed. While the coefficient is statistically significant, this result becomes statistically weaker in subsequent specifications and disappears when all relevant factors are included (see Model 6).

When the market leverage is lower than the book leverage (*DOWN*), the estimated partial adjustment speed varies between 31.3% and 32.1% per quarter. The coefficients are uniformly positive and highly significant. Their magnitude is about ten times larger than those observed for the opposite case (i.e., *UP*).

In aggregate, Models 1 through 6 show that the adjustment in leverage is asymmetric. When the market leverage is greater than the book leverage (*UP*), the estimated coefficient is, about a tenth the size of the coefficients for those observations when the market leverage is less

than its book counterpart (i.e., *DOWN*). We conclude that firms adjust their book leverage ratios only when their market leverage is lower than its book counterpart.

This pattern might be explained with a discussion of how changing equity prices influence both market and book leverage ratios. Decreasing equity values mechanically increase the market leverage ratio. But decreasing share prices are generally accompanied by negative earnings, which reduce retained earnings and consequently book equity. Book leverage will correspondingly increase. Increasing equity values are driven more by expectations of future positive earnings that are not yet reflected in the book value of equity. Therefore, adjustments in book leverage occur in subsequent periods through the firm's financing activity.

We further test these results by examining a subsample of firms that are over-leveraged compared to their industry median leverage.[5] We expect over-leveraged firms to have lower debt capacity and be more eager to adjust their book leverage in response to a change in their market leverage.

Table 4 presents our results. Overall, they are similar to those reported for the full sample in the preceeding table. That is, firms adjust their book leverage ratios only when their market leverage is lower than its book counterpart. We do observe, however, that this asymmetric adjustment in leverage is more pronounced for these over-leveraged firms. The estimated partial adjustment speed is 39.7% per quarter in the full model compared to 32.1% for the entire sample reported in Table 3.

[5] The results for under-leveraged companies are not reported, but are available upon request.

6. Characteristics of Asymmetrically Responding Firms

In this section we examine more critically the characteristics of those firms that elect to asymmetrically adjust their capital structure in response to equity price changes. We focus on the characteristics of those firms which exhibit the highest and lowest degree of asymmetric leverage adjustment behavior. We measure this asymmetric response as the residuals from the partial adjustment model of book leverage estimated in model 6 of Table 3. Those firms with the most positive residuals are the ones which exhibit the highest degree of asymmetric leverage adjustments. Firms with the most negative residuals respond the least to changes in market equity values. We examine the upper and lower quartile of residuals as well as the top and bottom decile. Results from this analysis are contained in Table 5.[6]

We observe a number of interesting differences between those firms that make large and small capital structure adjustments in response to changing equity prices. We find that firms making the largest adjustments are significantly smaller based on GDP deflated sales and total assets. They also report lower profitability, perhaps due to their higher selling expenses. These firms, however, have significantly higher levels of cash and hold more tangible assets in the form of property, plant and equipment as well as inventory. These firms also have higher cash flow volatility and market-to-book ratios. This suggests that these firms are unwilling to finance their growth with debt when their market leverage drops below their book leverage. This finding is consistent with the predictions of Barclay, Morellec and Smith (2006). We conclude that the asymmetric leverage adjustments of firms are not random and firms making such adjustments exhibit distinctive characteristics.

[6] Results from other percentile-based subsamples show comparable results.

7. Active Management of Leverage

In this section we seek to identify the active mechanism by which corporate managers make changes in their book leverage. We aim to distinguish whether the change in book leverage is due to asymmetric adjustments or to firm characteristics such as size or industry membership. Our results suggest the active management of book leverage, especially when it diverges from its corresponding market value. In particular, we observe firms whose market leverage is lower than their book leverage elect to reduce their book leverage over the following period. Consequently, we examine how the specific components of book leverage change in the next period.

We perform a matching analysis using *p*-score and nearest neighbor matching. To begin our analysis, we split our sample into quartiles based on the difference between market and book leverage. The firms in the top quartile, whose book leverage is substantially higher than their market leverage, form the treated sample and firms in the bottom quartile, whose market leverage is substantially higher than book leverage, are the control sample. Then, we use a matching algorithm to find similar pairs of firms in top and bottom quartiles to estimate the so-called treatment effect. We combine the exact matching on two-digit industry codes and time (fiscal year and quarter) with a propensity score matching on firm-specific characteristics used in our leverage regression model. These characteristics are firm size, profitability, cash flow volatility, market to book ratio, and industry median book leverage.

The match is performed at time *t*. We employ the Abadie and Imbens (2006, 2011) matching procedure which derives the rate of convergence of the nearest neighbor matching estimator and the bias-corrected estimator. We use the same caliper of 0.05 which determines the weighted distance of the covariates for each observation and we retain only those observations which are on common support. Based on the matched firms, we calculate an average treatment

effect on treated (ATET) firms for specific book leverage components at time *t+1*. This estimated ATET measures the difference in mean outcomes between the firms in the 1st quartile (with BL>ML) and the firm in the 4th quartile (BL<ML).

Our study uses quarterly data, we therefore focus on mechanisms that managers can influence in the short-term. Since raising debt and issuing equity entails additional costs, we analyze how firms manage non-interest-bearing liabilities on the liabilities side and treasury stock (share repurchases) on the equity side. The equation below shows the disaggregation of the book leverage ratio into its components.

$$Book\ Leverage = \frac{Debt}{Book\ Value\ of\ Assets} \quad (4)$$

$$= \frac{Debt}{Liabilities + Book\ Value\ of\ Equity\ Equity} \quad (5)$$

$$= \frac{Debt}{(NonInterestBearing\ Liabilities + Debt) + (Remaining\ Equity - Treasury\ Stock)} \quad (6)$$

The empirical results are presented in Table 6. In Panel A, we calculate the difference in book leverage between the treated and control groups at time *t+1*. Our results indicate that firms whose market leverage is below book leverage at time *t* significantly decrease their book leverage in the following period even when compared to the matched firms whose market leverage is greater than book leverage at time *t*.

In Panel B, we further decompose book leverage (Equation 4) into individual components (Equation 5 and 6) and calculate the percentage change. The treatment firms in equation (5), increase debt by an average of 3.95% compared to the control group. A decrease in book leverage occurs only if the denominator increases more. When examining the components of the denominator (Equation 5), we find that the treated firms increase their liabilities by 3.42% and

their equity by 4.75%. Thus the denominator increases more than the numerator. Therefore, the treated group decreases book leverage more than the control group.

Next, we examine the components in equation (6) where we separate liabilities into non-interest-bearing liabilities and debt. Also, we separate treasury stock from the equity account. The rationale is that in the short-run it might be easier for firms to manage non-interest-bearing liabilities and treasury stock (share repurchases) than issuing or retiring debt and raising equity. Our results indicate that the treated firms increase non-interest-bearing liabilities by 4.76%. This is consistent with the active management of working capital and other liabilities. Working capital adjustments are considered an inexpensive source of financing. When looking at treasury stock, we do not find any significant differences in treasury stock management between treated and control groups. Though we observe an increase in the remaining equity for treated firms.

To summarize, when we match firms whose market leverage is lower than their book leverage at time *t* (treated) to similar firms whose market leverage is higher than their book leverage (control), we find that the treated group reduces book leverage at time *t+1* by increasing the book value of assets. This increase in book value is driven by the non-interest-bearing component of the liabilities section, which suggests the active management of working capital, equity, and other liabilities. Even though managers might have more control over share repurchases, we do not observe that the increase in equity is driven by that component, at least in the short-run.

8. Robustness of the Empirical Findings

8.1. Mechanical Adjustment

Chang and Dasgupta (2009) argue that the existing models of target leverage behavior cannot distinguish deliberate from random financing. They suggest that researchers should look at financing choices to test their theories. We undertake such an analysis in this section.

We begin by sorting firms into two groups at time *t-1*: (1) firms whose market leverage is greater than its book leverage; (2) firms whose market leverage is lower than its book leverage. Then at time *t* we examine the financing behavior of the firm. We expect that when market leverage is less than book leverage, a firm should decrease its book leverage by: (1) decreasing net debt issuance, (2) increasing net equity issuance or, (3) a combination of both.[7] Since our focus is on leverage adjustments, we exclude observations where the market and book leverage ratios are equal to each other within a 2.5%, 5%, or 10% band.

Table 7 presents our empirical findings. Using a 2.5% exclusion band, 83.6% of our sample firms decrease net debt issuance, increase net equity issuance, or some combination of both when market leverage is lower than its corresponding book value. The difference is statistically significant when compared to the opposite group. Among our sample firms, 36.7% simultaneously reduce net debt issuance and increase net equity issuance when their market leverage is less than their book leverage. Again, the difference is statistically significant. As shown in Table 5, using our alternative exclusion bands of 5% and 10% yields comparative results.

[7] Consistent with Lemmon, Roberts, and Zender (2008), we define Net Debt Issuance as the change in total debt from *t−1* to quarter *t* divided by the *t−1* book value of total assets. Net Equity Issuance is similarly defined as the split-adjusted change in shares outstanding ($CSHOq_t - CSHOq_{t-1} * (ajexq_{t-1}/ ajexq_t)$) times the split-adjusted average stock price ($PRCCQ_t + PRCCQ_{t-1} * (ajexq_t/ajexq_{t-1})$) divided by the *t−1* book value of total assets.

8.2. Alternative Definitions for Market Leverage

In this section, we test the robustness of our results to an alternative measure of leverage. Therefore, we redefine market leverage according to that used by Lemmon, Roberts, and Zender (2008) and DeAngelo and Roll (2015). Specifically, we estimate Market Leverage ($Market^{ALT}$) as total debt divided by total debt plus the market value of equity all at time *t*. Market Equity is estimated as the stock price (PRCCQ) times the number of shares outstanding (CSHPRQ). We re-estimate our major findings using this alternative definition and present our results in Table 8.

Panel A of Table 8 contains our findings that align with those reported in Table 2. The estimated coefficients and levels of statistical significance are comparable to those originally reported. The partial adjustment speed approximates 17% per quarter, indicating that book leverage convergences towards its market leverage counterpart.

Panel B corresponds to results we report in Table 3. These findings are consistent across the tables. Models 1 through 6 show that the book leverage adjustment is dependent on the difference between market and book leverage in the previous period. The asymmetry in the book leverage adjustment continues to hold. Very little or no adjustment in book leverage is observed if the market leverage exceeds book leverage ratio. The partial adjustment speed in book leverage, however, is about 30% if market leverage is lower than book leverage.

In Panel C, we present the results for the subsample of firms that are over-leveraged compared to the industry median book leverage. This analysis parallels that reported in Table 4. Again, our original findings are confirmed. That is, firms adjust their book leverage ratios only when their market leverage is lower than their book counterpart. This asymmetric adjustment in leverage, however, is even more pronounced when firms are over-leveraged.

9. Conclusion and Discussion

Using a large sample of U.S. firms over the period from 1984 to 2013, we find, contrary to Welch (2004), that firms do adjust their book leverage ratios in response to changes in market leverage that are driven by share price appreciation. Interestingly, these observed adjustments in the book leverage are asymmetric. That is, firms adjust their book leverage relative to market leverage only when the changes in market leverage are due to increases in firm value. No adjustment is observed when firm values decrease.

We find a number of significant differences between firms making large and small capital structure adjustments in response to changing equity prices. We find that firms making the largest adjustments are significantly smaller, report lower profitability, and experience higher selling expenses. These firms, however, have significantly higher levels of cash and hold more tangible assets. These firms also have higher cash flow volatility and market-to-book ratios. We conclude that the asymmetric leverage adjustments of firms are not random and firms making such adjustments exhibit distinctive characteristics.

One potential explanation for these results is that book and market leverage ratios are connected through the value of a firm (assets in place versus growth opportunities) as discussed by Myers (1977) and Barclay, Morellec and Smith (2006). The equity value of a firm increases with additional growth options even if there is no change in the value of assets in place. This increase in equity value leads to a mechanical decrease in market leverage. This results in the firm's market leverage being lower than its book leverage. We find that firms narrow the difference between these two ratios over subsequent periods by decreasing the book leverage. They can accomplish this by managing their working capital, equity and other liabilities. No adjustment in

book leverage is observed, however, when the change in market leverage is due to a decrease in equity value.

The importance of these findings is that they challenge the notion that stock returns are the only determinant or the major determinant of leverage dynamics. We show that share price movements explain capital structure patterns only when corporate equity values are declining. When share prices increase and decrease market leverage ratios, firms actively seek to readjust their book leverage. Thus, managers actively manage their capital structures with stock price movements explaining only a portion of the corporate leverage dynamic.

Appendix: Leverage Partial Adjustment Model

A standard partial adjustment model is defined as follows:

$$\Delta d_{it} = \lambda\left(d_{it}^{*} - d_{i,t-1}\right) + v_{it} \tag{1}$$

where d_{it} stands for the leverage of company *i* in the period *t*, Δd_{it} denotes an actual change in leverage between period *t* and period *t*-1, and d_{it}^{*} represents firm target leverage. Assuming that target leverage is a function of industry- and firm-level characteristics, denoted as x_{it}, we obtain the following specification:

$$d_{it}^{*} = \beta x_{it} + \mu_i \,. \tag{2}$$

We can estimate the model in a one-step approach. Following Flannery and Rangan (2006) and substituting equation (2) into (1), we obtain the following (FE) model:

$$\begin{aligned} d_{it} - d_{it-1} &= -\lambda d_{i,t-1} + \lambda d_{it}^{*} + v_{it} \\ d_{it} &= (1-\lambda) d_{i,t-1} + \lambda d_{it}^{*} + v_{it} \\ d_{it} &= \varphi d_{i,t-1} + \beta^{*} x_{it} + v_{it}, \end{aligned} \tag{3}$$

where the speed of adjustment is $\lambda = 1 - \varphi$ and $\beta^{*} = \lambda\beta$. To allow for the differences in the speed of adjustment during a recession period, for cyclical industries, or for different financial reporting quarters, we modify the model as below:

$$\Delta d_{it} = \lambda\left(d_{it}^{*} - d_{i,t-1}\right) + \lambda_{change_D}\left(d_{it}^{*} - d_{i,t-1}\right) * change_D + v_{it}, \tag{4}$$

where $change_D$ is a dummy variable equal to one for the specific period or subsample with a potentially different speed of adjustment $(\lambda + \lambda_{change_D})$, such as a recession or for a cyclical firm.

Therefore, a specific model that allows us to estimate the adjustment speed during a recession is defined as follows:

$$d_{it} = d_{it-1} + \lambda d_{it}^{*} - \lambda d_{i,t-1} + \lambda_{change_D} d_{it}^{*} change_D - \lambda_{change_D} d_{i,t-1} change_D + v_{it}$$

$$d_{it} = (1-\lambda) d_{i,t-1} - \lambda_{change_D} d_{i,t-1} change_D + \lambda \beta x_{it} + \lambda_{change_D} \beta x_{it} change_D + v_{it}$$

$$d_{it} = \varphi d_{i,t-1} + \varphi_1 d_{i,t-1} change_D + \beta^{*} x_{it} + \beta^{*}_{change_D} x_{it} change_D + v_{it} \quad (5)$$

As before, the partial speed of adjustment is equal to $\lambda = 1 - \varphi$, while the partial speed of adjustment in the recession period or for cyclical firms is $\lambda_{change_D} = 1 - \varphi - \varphi_{change_D}$, $\beta^{*} = \lambda\beta$ and $\beta^{*}_{change_D} = \lambda_{change_D}\beta$.

The final model accounts for potential differences in the speed of adjustment in the recession period (denoted as $recession_D$), for cyclical firms ($cyclical_D$) and in different reporting quarters (a set of three quarterly dummies, which for simplicity we denote as $quarter_D$). The model is specified as follows:

$$\begin{aligned} d_{it} = \varphi d_{i,t-1} &+ \varphi_{recession} d_{i,t-1} * recession_D + \varphi_{cyclical} d_{i,t-1} * cyclical_D \\ &+ \varphi_{quarter} d_{i,t-1} * quarter_D + \beta^{*} x_{it} + \beta^{*}_{recession} x_{it} \\ &* recession_D + \beta^{*}_{cyclical} x_{i,t} * cyclical_D \\ &+ \beta^{*}_{quarter} x_{i,t} * quarter_{D+} v_{it} \end{aligned} \quad (6)$$

Where d_{it} and d_{it-1} stand for the leverage of company *i* in the period *t* and *t-1*, respectively. Similarly to (), we get $\lambda = 1 - \varphi$, $\lambda_{recession} = 1 - \varphi - \varphi_{recession}$, $\lambda_{cyclical} = 1 - \varphi - \varphi_{cyclical}$, $\lambda_{quarter} = 1 - \varphi - \varphi_{quarter}$. Finally, x_{it} is a vector of firm-specific control variables that are *Firm Size*, *Profitability*, *Cash Flow Volatility*, *Market-to-Book*, and *Tangibility*. We also control for an *Industry Median Book Leverage*.

References

Abadie, A., & Imbens, G. W. (2006). Large sample properties of matching estimators for average treatment effects. *Econometrica*, 74(1), 235-267.

Abadie, A., & Imbens, G. W. (2011). Bias-corrected matching estimators for average treatment effects. *Journal of Business & Economic Statistics*, 29(1), 1-11.

Arellano, M., & Bond, R. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies, 58* (2), 277–297.

Arellano, M., & Bover. O. (1995). Another look at the instrumental variable estimation of error components models. *Journal of Econometrics*, 68, 29–51.

Barclay, M. J., Morellec, E., & Smith, C. W. (2006). On the Debt Capacity of Growth Options. *Journal of Business*, *79*(1), 37-59.

Bessler, W., Drobetz, W., & Kazemieh, R. (2011). Factors affecting capital structure decisions. In Baker, H. K., & Martin, G. S. (Eds.), *Capital structure and corporate financing decisions: Theory, evidence, and practice*. John Wiley: New Jersey.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115-143.

Bowman, R. G. (1980). The importance of a market-value measurement of debt in assessing leverage. *Journal of Accounting Research*, *18*(1), 242-254.

Cai, J., & Zhang, Z. (2011). Leverage change, debt overhang, and stock prices. *Journal of Corporate Finance, 17*(3), 391-402.

Chang. X, & S. Dasgupta (2009). Target Behavior and Financing: How Conclusive is the Evidence? *Journal of Finance*, *64*(4), 1767-1796.

Chen, L., & Zhao, X. (2007). Mechanical mean reversion of leverage ratios. *Economics Letters*, 95(2), 223-229.

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

DeAngelo, H., & R. Roll (2015). How stable are corporate capital structures? *Journal of Finance, 70*(1), 373-418.

Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. *Review of Financial Studies*, *15*(1), 1-33.

Faulkender, M., Flannery, M., Hankins, K. and Smith, J., (2012), Cash flows and leverage adjustments, *Journal of Financial Economics* 103, 632-646.

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

Flannery, M. J., & Hankins, K. W. (2013). Estimating dynamic panel models in corporate finance. *Journal of Corporate Finance, 19*, 1-19.

Hovakimian, A., Opler, T., & Titman, S. (2001). The debt-equity choice. *Journal of Financial and Quantitative Analysis*, *36*(1), 1-24.

Leary, M. T., & Roberts, M. R. (2005). Do firms rebalance their capital structures?. *The Journal of Finance*, 60(6), 2575-2619.

Leary, M. T., & Roberts, M. R. (2014). Do peer firms affect corporate financial policy? *The Journal of Finance*, *69*(1), 139-178.

Lemmon, M. L., Roberts, M. R., & Zender, J. F. (2008). Back to the beginning: persistence and the cross-section of corporate capital structure. *The Journal of Finance*, *63*(4), 1575-1608.

Matsunaga, S. R., & Park, C. W. (2001). The effect of missing a quarterly earnings benchmark on the CEO's annual bonus. *The Accounting Review*, 76(3), 313-332.

Myers, S. C. (1977). Determinants of Corporate Borrowing. *Journal of Financial Economics* 5(2), 147-175.

Rajan, R. G., & Zingales, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data. *Journal of Finance*, 50, 1421–1460.

Roberts, M. R., & Sufi, A. (2009). Control rights and capital structure: An empirical investigation. *The Journal of Finance*, *64*(4), 1657-1695.

Shyam-Sunder, L., & Myers, S. C. (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics*, 51(2), 219-244.

Titman, S., & Wessels, R. (1988). The Determinants of Capital Structure. *Journal of Finance*, 43, 1–19.

Welch, I. (2004). Capital structure and stock returns. *Journal of Political Economy*, *112*(1), 106-132.

Figure 1: Evolution of Market and Book Leverage

This figure shows the evolution of average book and market leverage ratios from 1984 quarter 1 to 2013 quarter 4. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by book assets (ATq), all at time t *Market Leverage* is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of assets. Market value of assets is stock price (PRCCq) times shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and investment tax credit (TXDITCq). We exclude zero-leverage firms. The shaded area represents recessions as defined by the NBER.

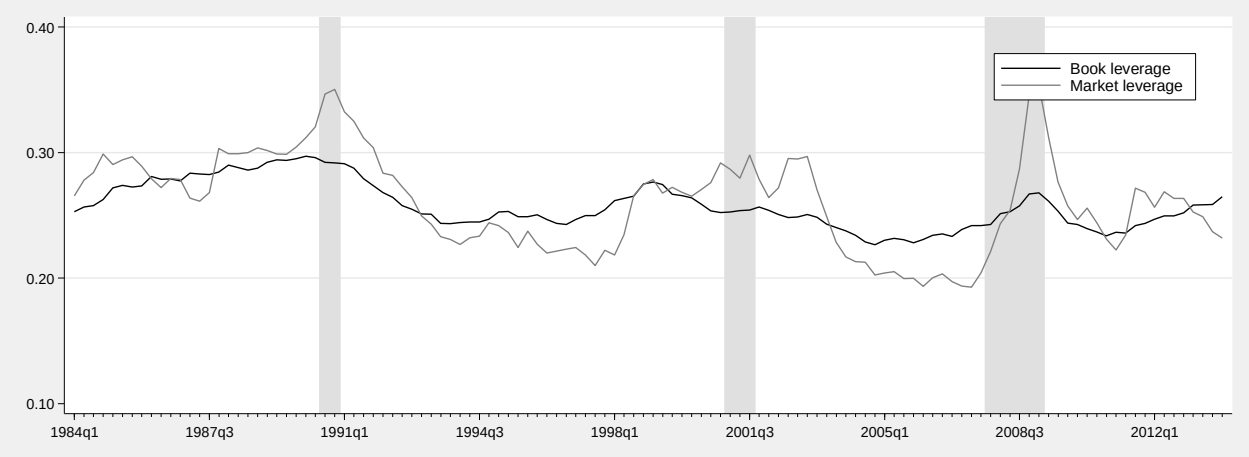

Figure 2: Mean and Median Differences between Market and Book Leverage

This figure plots the difference (mean and median) between market and book leverage from 1984 quarter 1 to 2013 quarter 4. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the book value of total assets (ATq), all at time t. *Market Leverage* is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of total assets. The market value of total assets is the stock price (PRCCq) times the number of shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and the investment tax credit (TXDITCq). We exclude zero-leverage firms. The shaded area represents recessions as defined by the NBER.

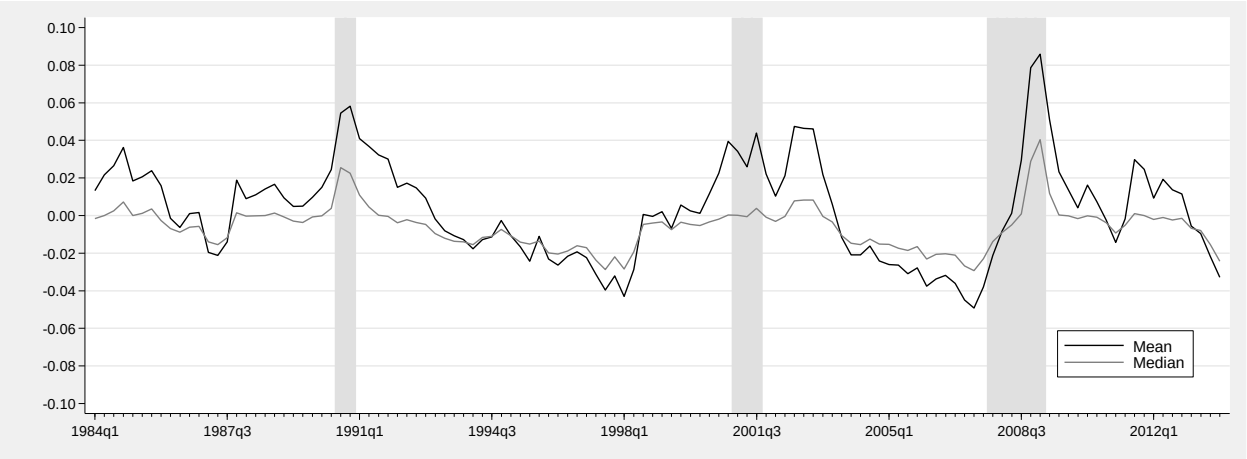

Table 1: Sample Summary Statistics and Annual Distribution

This table presents the summary statistics for the entire sample, which spans the first quarter of 1984 through the last quarter of 2013. Panel A shows the descriptive statistics. Panel B shows the number of observations by year. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by book assets (ATq), all at time t. *Market Leverage* is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of assets. Market value of assets is stock price (PRCCq) times shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and investment tax credit (TXDITCq). *Firm Size* is calculated as the log of sales (SALEq) deflated by the GDP deflator with a base value of 100 for the year 2009. *Profitability* is calculated as operating income before depreciation (OIBDPq) divided by the book value of total assets (ATq). *Cash Flow (CF) Volatility* is calculated as the standard deviation of historical operating income before depreciation (OIBDPq) scaled by total assets over the past 12 quarters, *Market-to-Book* is calculated as the market value of equity plus total debt plus preferred stock redeemable (PSTKRQ), or (PSTKQ) if missing, minus deferred taxes and investment tax credits (TXDITCQ). Everything is then scaled by the book value of total assets (ATq). *Tangibility* is calculated as net PPE (PPENTq) scaled by the book value of total assets (ATq).

Panel A: Summary statistics

Variable	*N*	Mean	Median	Std. Dev	5th	10th	90th	95th
Book Leverage	419,713	0.223	0.191	0.203	0.000	0.000	0.509	0.610
Market Leverage	419,713	0.220	0.143	0.235	0.000	0.000	0.586	0.712
Firm Size	419,713	3.349	3.366	2.533	-0.855	0.208	6.535	7.445
Profitability	419,713	0.014	0.028	0.087	-0.105	-0.048	0.066	0.082
CF Volatility	419,713	0.027	0.016	0.063	0.004	0.005	0.056	0.084
Market-to-Book	419,713	1.776	1.159	2.426	0.480	0.585	3.379	4.892
Tangibility	419,713	0.293	0.225	0.237	0.028	0.046	0.677	0.792

Panel B: Observations by year

Year	*N*	Year	*N*
1984	10,839	1999	17,424
1985	11,141	2000	17,600
1986	11,344	2001	16,670
1987	12,516	2002	15,596
1988	13,231	2003	14,756
1989	13,264	2004	14,460
1990	13,069	2005	14,374
1991	13,089	2006	14,216
1992	13,596	2007	13,836
1993	14,499	2008	13,527
1994	15,892	2009	12,222
1995	16,471	2010	11,405
1996	17,653	2011	10,550

1997	18,892	2012	9,922
1998	18,682	2013	8,977
Total	*419,713*		

Table 2: Partial Adjustment of Book Leverage to Market Leverage

This table presents the GMM regression results for equations (2) estimating the partial adjustment models for changes in book leverage with respect to the book-market leverage position. We control for a possible correlation between fixed effects and the lagged dependent variable (Baltagi, 2008). We correct any biases using a GMM system estimation procedure, introduced by Blundell and Bond (1998). Interactions with recession, cyclical industries, and different quarters provide estimates of the respective speed of adjustment. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the book value of total assets (ATq), all at time t. *Market Leverage* is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of assets. The market value of assets is stock price (PRCCq) times the number of shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and the investment tax credit (TXDITCq). *Firm Size* is calculated as the log of sales (SALEq) deflated by the GDP deflator, where the deflated index is baselined to 100 for the year 2009. Profitability is calculated as operating income before depreciation (OIBDPq) divided by the book value of total assets (ATq). *Cash Flow (CF) Volatility* is calculated as the standard deviation of historical operating income before depreciation (OIBDPq) scaled by the value of total assets over the past 12 quarters. *Market-to-Book* is calculated as the market value of equity plus total debt plus preferred stock redeemable (PSTKRq), or (PSTKq) if missing, minus deferred taxes and investment tax credits (TXDITCq). Everything is then scaled by the book value of total assets (ATq). *Tangibility* is calculated as net PPE (PPENTq) scaled by the book value of total assets (ATq). *Industry Median Book* Leverage is the median book leverage at 2 digit SIC industry level in the respective quarter. Estimated coefficients for firm controls are not reported but are available upon request. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

	$\Delta Book\ Leverage_t$					
Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Diff $_{t-1}$ (Market-Book)	0.126***	0.139***	0.164***	0.128***	0.177***	0.177***
	(0.009)	(0.010)	(0.013)	(0.009)	(0.014)	(0.014)
Leverage Diff $_{t-1}$ × Recession$_{t-1}$		-0.051***			-0.051***	-0.046***
		(0.010)			(0.010)	(0.010)
Leverage Diff $_{t-1}$ × Cyclical$_{t-1}$			-0.460***		-0.469***	-0.439***
			(0.146)		(0.146)	(0.150)
Leverage Diff $_{t-1}$ × q1$_{t-1}$				-0.007*		-0.007*
				(0.004)		(0.004)
Leverage Diff $_{t-1}$ × q2$_{t-1}$				0.001		-0.000
				(0.004)		(0.004)
Leverage Diff $_{t-1}$ × q4$_{t-1}$				-0.012***		-0.012***
				(0.004)		(0.004)
Firm Controls $_{t-1}$	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Interacted with Recession$_{t-1}$		Incl.			Incl.	Incl.
Interacted with Cyclical$_{t-1}$			Incl.		Incl.	Incl.
Interacted with Quarters$_{t-1}$				Incl.		Incl.
Firm and time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	374,036	374,036	374,036	374,036	374,036	374,036

Table 3: **Partial Adjustment of Book Leverage to Market Leverage Given Book-Market Difference**

This table presents the GMM regression results for equation (3) which estimates the partial adjustment models for changes in the book value of leverage with respect to the difference in book-market leverage ratios. We control for a possible correlation between fixed effects and the lagged dependent variable (Baltagi, 2008) with a GMM system estimation procedure (Blundell and Bond, 1998). *UP(DOWN)* is a dummy variable equal to 1 when *MrktLev > BookLev (MrktLev < BookLev)*. Interactions with recession, cyclical industries and different quarters provide estimates of the respective speed of adjustment. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the book value of total assets (ATq), all at time t. *Market Leverage* is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of total assets. The market value of total assets is stock price (PRCCq) times shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and investment tax credit (TXDITCq). *Firm Size* is calculated as the log of sales (SALEq) deflated by the GDP deflator where the deflated index is baselined to 100 in 2009. *Profitability* is calculated as operating income before depreciation (OIBDPq) divided by the book value of total assets (ATq). *Cash Flow (CF) Volatility* is calculated as the standard deviation of historical operating income before depreciation (OIBDPq) scaled by total assets over the past 12 quarters. *Market-to-Book* is calculated as the market value of equity plus total debt plus preferred stock redeemable (PSTKRq), or (PSTKq) if missing, minus deferred taxes and the investment tax credits (TXDITCQq). All are then scaled by the book value of total assets (ATq). *Tangibility* is calculated as net PPE (PPENTq) scaled by the book valure of total assets (ATq). *Industry Median Book Leverage* is the median book leverage at 2 digit SIC industry level in the respective quarter. The estimated coefficients for firm controls are not reported, but are available upon request. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

	$\Delta Book\ Leverage_t$					
Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage $Diff_{t-1}$ (Market -Book) × UP	-0.036***	-0.045***	-0.030*	-0.028**	-0.039*	-0.033
	(0.012)	(0.015)	(0.018)	(0.013)	(0.020)	(0.021)
Leverage $Diff_{t-1}$ (Market -Book) × DOWN	0.313***	0.318***	0.315***	0.314***	0.319***	0.321***
	(0.018)	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)
Leverage $Diff_{t-1}$ × $Recession_{t-1}$		0.009			0.008	0.013
		(0.011)			(0.011)	(0.011)
Leverage $Diff_{t-1}$ × $Cyclical_{t-1}$			0.058		0.064	0.087
			(0.153)		(0.153)	(0.157)
Leverage $Diff_{t-1}$ × $q1_{t-1}$				-0.013***		-0.014***
				(0.004)		(0.004)
Leverage $Diff_{t-1}$ × $q2_{t-1}$				-0.006		-0.006
				(0.004)		(0.004)
Leverage $Diff_{t-1}$ × $q4_{t-1}$				-0.011***		-0.012***
				(0.004)		(0.004)
Firm Controls $_{t-1}$	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Interacted with $Recession_{t-1}$		Incl.			Incl.	Incl.
Interacted with $Cyclical_{t-1}$			Incl.		Incl.	Incl.
Interacted with $Quarters_{t-1}$				Incl.		Incl.
Firm and time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	374,036	374,036	374,036	374,036	374,036	374,036

Table 4: Partial Adjustment of Book to Market Leverage for Overleveraged Firms

This table presents the GMM regression results for equation (3) which esitmates the speed of adjustment models for changes in book leverage with respect to book-market leverage position. The sample contains firms which are overleveraged in comparison to the median industry level. We control for a possible correlation between fixed effects and the lagged dependent variable (Baltagi, 2008) by using a GMM system estimation procedure (Blundell and Bond, 1998). *UP(DOWN)* is a dummy variable equal to 1 when *MrktLev > BookLev (MrktLev < BookLev)*. Interactions with recession, cyclical industries and different quarters provide estimates of the respective speed of adjustment. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the book value of total assets (ATq), all at time t. *Market Leverage* is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of total assets. The market value of total assets is the stock price (PRCCq) times the number of shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and the investment tax credit (TXDITCq). *Firm Size* is calculated as the log of sales (SALEq) deflated by the GDP deflator where the deflated index is based lined to 100 for 2009. *Profitability* is calculated as operating income before depreciation (OIBDPq) divided by the book valure of total assets (ATq). *Cash Flow (CF) Volatility* is calculated as the standard deviation of historical operating income before depreciation (OIBDPq) scaled by total assets over the past 12 quarters. *Market-to-Book* is calculated as the market value of equity plus total debt plus preferred stock redeemable (PSTKRq), or (PSTKq) if missing, minus deferred taxes and investment tax credits (TXDITCq). All are then scaled by the book value of total assets (ATq). *Tangibility* is calculated as net PPE (PPENTq) scaled by the book value of total assets (ATq). *Industry Median Book Leverage* is the median book value of leverage at 2 digit SIC industry level in the respective quarter. The estimated coefficients for firm controls are not reported, but are available upon request. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

	$\Delta Book\ Leverage_t$					
Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage $Diff_{t-1}$ (Market -Book) × UP	-0.024	-0.052**	-0.000	-0.017	-0.035	-0.036
	(0.018)	(0.021)	(0.022)	(0.019)	(0.026)	(0.027)
Leverage $Diff_{t-1}$ (Market -Book) × DOWN	0.350***	0.363***	0.367***	0.367***	0.377***	0.397***
	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)	(0.031)
Leverage $Diff_{t-1}$ × $Recession_{t-1}$		0.044**			0.044**	0.061***
		(0.019)			(0.019)	(0.020)
Leverage $Diff_{t-1}$ × $Cyclical_{t-1}$			-0.214		-0.129	-0.128
			(0.210)		(0.210)	(0.209)
Leverage $Diff_{t-1}$ × $q1_{t-1}$				-0.020***		-0.021***
				(0.006)		(0.006)
Leverage $Diff_{t-1}$ × $q2_{t-1}$				-0.011**		-0.012**
				(0.005)		(0.005)
Leverage $Diff_{t-1}$ × $q4_{t-1}$				-0.018***		-0.021***
				(0.006)		(0.006)
Firm Controls $_{t-1}$	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Interacted with $Recession_{t-1}$		Incl.			Incl.	Incl.
Interacted with $Cyclical_{t-1}$			Incl.		Incl.	Incl.
Interacted with $Quarters_{t-1}$				Incl.		Incl.
Firm and time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	173,329	173,329	173,329	173,329	173,329	173,329

Table 5: Comparative Characteristics for Asymmetrically Responding Firms

This table presents the summary sample statistics for firms who exhibit the highest and lowest degree of asymmetric leverage adjustment behavior. Specifically, we save the residuals from Model 6 in Table 3, equation 3 in text, and analyze the biggest positive and negative residuals. The cutoffs are 25% and 10%. *Firm Size* is calculated as the log of sales (SALEq) deflated by the GDP deflator with a base value of 100 for the year 2009. *Profitability* is calculated as operating income before depreciation (OIBDPq) divided by the book value of total assets (ATq). *Cash* is calculated as Cash and Short-Term Investments (CHEq) scaled by book assets (ATq). *Tangibility* is calculated as net PPE (PPENTq) scaled by the book value of total assets (ATq). *Cash Flow (CF) Volatility* is calculated as the standard deviation of historical operating income before depreciation (OIBDPq) scaled by total assets over the past 12 quarters. *Market-to-Book* is calculated as the market value of equity plus total debt plus preferred stock redeemable (PSTKRQ), or (PSTKQ) if missing, minus deferred taxes and investment tax credits (TXDITCQ). Everything is then scaled by the book value of total assets (ATq). *Log (Book Assets)* is the log of book assets which are deflated by the GDP deflator (from FRED), deflated index 100=2009. *Collateral* is calculated as inventory (INVTq) plus net PPE (PPENTq)) scaled by book assets. *Selling Expense* is calculated as Selling, General and Administrative Expenses (XSGAq) scaled by sales (SALEq). *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by book assets (ATq), all at time t. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

Variable	Top Quartile	Bottom Quartile	Difference of Means	Top Decile	Bottom Decile	Difference of Means
Firm Size	2.213	4.294	-2.081***	2.960	4.166	-1.206***
Profitability	-0.008	0.026	-0.034***	0.001	0.020	-0.019***
Cash	0.204	0.080	0.124***	0.126	0.073	0.053***
Tangibility	0.212	0.481	-0.269***	0.262	0.531	-0.269***
CF Volatility	0.040	0.021	0.019***	0.035	0.023	0.012***
Market-to-Book	2.321	1.189	1.132***	1.911	1.165	0.746***
Log (Book Assets)	3.887	5.822	-1.935***	4.304	5.826	-1.522***
Collateral	0.374	0.606	-0.232***	0.437	0.644	-0.207***
Selling Expense	1.962	0.393	1.569***	2.266	0.551	1.715***

Table 6

Active Management of Leverage

This table shows the results for the nearest neighbor matching procedures (Abadie and Imbens, 2006, 2011). We assign the difference between market and book leverage at time *t-1* to quartiles. We then compare the firms whose market leverage is substantially lower than their book leverage (quartile 1; treated group) to firms whose market leverage is substantially higher than book leverage (quartile 4; control group). The firms from each quartile are matched using the nearest neighbor procedure to find similar pairs. In Panel A, we analyze the difference in book leverage between the quartile 1 and quartile 4 firms at time t. This is the average treatment effect of the treated firm. In Panel B, we analyze the percentage change in the respective variable between the treated and control groups. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

Panel A: Difference in Book Leverage

Variable	N	Average treatment effect on treated (ATET)	Robust Standard Errors	*t*-stat	*P>|t|*
Difference Book Leverage$_t$ (Treated - Control)	191,646	-0.002***	0.00	-7.30	0.00

Panel B: Components of Book Leverage

Variable (Percentage Change in Mean Effects)	N	Average treatment effect on treated (ATET)	Robust Standard Errors	*t*-stat	*P>|t|*
Percentage Change Book Value of Assets$_t$	190,860	3.95% ***	0.08	51.97	0.00
Percentage Change Debt$_t$	181,944	3.20% ***	0.19	17.22	0.00
Percentage Change Liabilities$_t$	190,786	3.42%***	0.11	30.53	0.00
Percentage Change Book Value of Equity$_t$	190,448	4.75% ***	0.17	28.30	0.00
Percentage Change Non-Interest-Bearing Liabilities$_t$	190,943	4.76% ***	0.14	33.72	0.00
Percentage Change Remaining Equity$_t$	180,964	4.97% ***	0.20	24.43	0.00
Percentage Change Treasury Stock$_t$	65,547	0.13%	0.44	0.29	0.77

Table 7: Financing Choices

The table presents financing choices for two groups of firms at time *t.* The first group are those firms whose market leverage is lower than the book leverage at time *t-1*; The second group are those firms whose market leverage is greater than the book leverage at time *t-1*. We exclude observations where market leverage and book leverage are equal to each other within a 2.5%, 5%, and 10% band. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the book value of total assets (ATq), all at time *t. Market Leverage* is total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the market value of total assets. The market value of total assets is the stock price (PRCCq) times the number of shares outstanding (CSHPRq) plus total debt plus preferred stock (PSTKq or PSTKRq if missing) minus deferred taxes and the investment tax credit (TXDITCq). Net Debt Issuance is calculated as the change in total debt from quarter $t-1$ to quarter t divided by the $t-1$ book value of total assets. Net Equity Issuance is calculated as the split-adjusted change in the number of shares outstanding ($CSHOq_t - CSHOq_{t-1} * (AJEXq_{t-1}/ AJEXq_t)$) times the split-adjusted average stock price ($PRCCq_t + PRCCq_{t-1} * (AJEXq_t/AJEXq_{t-1})$) dividend by the book value of total assets at t-1.

	2.5% Exclusion Band			5% Exclusion Band			10% Exclusion Band		
Variable	BL > ML	BL < ML	Z-statistic for difference	BL > ML	BL < ML	Z-statistic for difference	BL > ML	BL < ML	Z-statistic for difference
(-) Debt Issuance	120,096	89,825		116,583	85,917		110,116	77,605	
	53.6%	55.8%		53.6%	55.9%		53.7%	56.1%	
(+) Equity Issuance	149,552	79,070		145,784	74,898		138,445	66,383	
	66.8%	49.2%		67.0%	48.8%		67.5%	48.0%	
Either	187,348	124,771		182,145	119,001		172,251	106,876	
	83.6%	77.6%	*47.3*	83.8%	77.5%	*48.0*	84.0%	77.3%	*49.3*
Both	82,300	44,124		80,222	41,814		76,310	37,112	
	36.7%	27.4%	*60.6*	36.9%	27.2%	*61.7*	37.2%	26.8%	*63.3*
TOTAL number	224,046	160,861		217,481	153,562		205,173	138,324	
	100.0%	100.0%		100.0%	100.0%		100.0%	100.0%	

Table 8: Alternative Definition of Market Leverage and Partial Adjustment Analysis

This table presents the GMM regression results using the market leverage definition from Leary and Michaely (2014). We control for a possible correlation between fixed effects and the lagged dependent variable (Baltagi, 2008) by uisng a GMM system estimation procedure (Blundell and Bond, 1998). The interactions with recession, cyclical industries, and different quarters provide estimates of the respective speed of adjustment. *Book Leverage* is calculated as total debt (short-term debt (DLCq) + long-term debt (DLTTq)) divided by the book value of total assets (ATq), all at time *t*. *Market Leverage(*$Market^{ALT}$*)* is calculated as total debt divided by total debt plus the market value of equity, all at time t. The market value of equity is the stock price (PRCCQ) times the number of shares outstanding (CSHPRQ). *UP(DOWN)* is a dummy variable that equals 1 when *MrktLev > BookLev (MrktLev < BookLev)*. *Firm Size* is calculated as the log of sales (SALEq) deflated by the GDP deflator, where the deflated index 100 is base lined to 100 for the year 2009. *Profitability* is calculated as operating income before depreciation (OIBDPq) divided by the book value ot total assets (ATq). *Cash Flow (CF) Volatility* is calculated as the standard deviation of historical operating income before depreciation (OIBDPq) scaled by total assets over the past 12 quarters. *Market-to-Book* is calculated as the market value of equity plus total debt plus preferred stock redeemable (PSTKRq), or (PSTKq) if missing, minus deferred taxes and investment tax credits (TXDITCq). Everything is then scaled by book value of total assets (ATq). *Tangibility* is calculated as net PPE (PPENTq) scaled by the book value of total assets (ATq). *Industry Median Book Leverage* is the median book leverage at 2 digit SIC industry level in quarter *t-1*. Panel A contains GMM regression results for equation (2) and relates to Table 3. Panel B presents the GMM regression results for equation (3) and relates to Table 4. Panel C is analogous to Table 5. The sample in Panel C contains firms which are overleveraged relative to the median industry (book) leverage. The estimated coefficients for firm controls are not reported, but are available upon request. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

Panel A: Partial Adjustment of Book Leverage to Market Leverage

	$\Delta Book\ Leverage_t$					
Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage Diff $_{t-1}$ ($Market^{ALT}$ -Book)	0.132***	0.146***	0.169***	0.135***	0.184***	0.183***
	(0.010)	(0.011)	(0.014)	(0.010)	(0.015)	(0.015)
Leverage Diff $_{t-1}$ × Recession$_{t-1}$		-0.053***			-0.056***	-0.049***
		(0.011)			(0.011)	(0.010)
Leverage Diff $_{t-1}$ × Cyclical$_{t-1}$			-0.430***		-0.456***	-0.424***
			(0.150)		(0.151)	(0.154)
Leverage Diff $_{t-1}$ × q1$_{t-1}$				-0.008*		-0.008*
				(0.004)		(0.004)
Leverage Diff $_{t-1}$ × q2$_{t-1}$				0.002		0.000
				(0.004)		(0.004)
Leverage Diff $_{t-1}$ × q4$_{t-1}$				-0.014***		-0.013***
				(0.004)		(0.005)
Firm Controls $_{t-1}$	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Interacted with Recession$_{t-1}$		Incl.			Incl.	Incl.
Interacted with Cyclical$_{t-1}$			Incl.		Incl.	Incl.
Interacted with Quarters$_{t-1}$				Incl.		Incl.
Firm and time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	374,745	374,745	374,745	374,745	374,745	374,745

Panel B: Partial Adjustment of Book Leverage to Market Leverage Given Book-Market Difference

	$\Delta Book\ Leverage_t$					
Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage $Diff_{t-1}$ ($Market^{ALT}$ -Book) × UP	-0.036***	-0.045***	-0.031*	-0.025*	-0.040*	-0.033
	(0.013)	(0.016)	(0.019)	(0.013)	(0.022)	(0.022)
Leverage $Diff_{t-1}$ ($Market^{ALT}$ -Book) × DOWN	0.301***	0.306***	0.304***	0.302***	0.308***	0.310***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.019)	(0.020)
Leverage $Diff_{t-1}$ × $Recession_{t-1}$		0.007			0.005	0.011
		(0.011)			(0.011)	(0.011)
Leverage $Diff_{t-1}$ × $Cyclical_{t-1}$			0.080		0.087	0.105
			(0.158)		(0.160)	(0.163)
Leverage $Diff_{t-1}$ × $q1_{t-1}$				-0.014***		-0.015***
				(0.004)		(0.004)
Leverage $Diff_{t-1}$ × $q2_{t-1}$				-0.005		-0.005
				(0.004)		(0.004)
Leverage $Diff_{t-1}$ × $q4_{t-1}$				-0.013***		-0.014***
				(0.004)		(0.004)
Firm Controls $_{t-1}$	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Interacted with $Recession_{t-1}$		Incl.			Incl.	Incl.
Interacted with $Cyclical_{t-1}$			Incl.		Incl.	Incl.
Interacted with $Quarters_{t-1}$				Incl.		Incl.
Firm and time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	374,745	374,745	374,745	374,745	374,745	374,745

Panel C: Partial Adjustment of Book Leverage to Market Leverage for Overleveraged Firms Given Book-Market Difference

	$\Delta Book\ Leverage_t$					
Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Leverage $Diff_{t-1}$ ($Market^{ALT}$ -Book) × UP	-0.012	-0.043*	0.006	-0.003	-0.033	-0.035
	(0.020)	(0.023)	(0.024)	(0.020)	(0.028)	(0.029)
Leverage $Diff_{t-1}$ ($Market^{ALT}$ -Book) × DOWN	0.336***	0.349***	0.355***	0.352***	0.365***	0.383***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.030)	(0.031)
Leverage $Diff_{t-1}$ × $Recession_{t-1}$		0.043**			0.041**	0.059***
		(0.020)			(0.019)	(0.020)
Leverage $Diff_{t-1}$ × $Cyclical_{t-1}$			-0.140		-0.048	-0.031
			(0.216)		(0.217)	(0.215)
Leverage $Diff_{t-1}$ × $q1_{t-1}$				-0.020***		-0.022***
				(0.006)		(0.006)
Leverage $Diff_{t-1}$ × $q2_{t-1}$				-0.010*		-0.011**
				(0.005)		(0.005)
Leverage $Diff_{t-1}$ × $q4_{t-1}$				-0.021***		-0.023***
				(0.006)		(0.006)
Firm Controls $_{t-1}$	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
Interacted with $Recession_{t-1}$		Incl.			Incl.	Incl.
Interacted with $Cyclical_{t-1}$			Incl.		Incl.	Incl.
Interacted with $Quarters_{t-1}$				Incl.		Incl.
Firm and time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	17,3927	17,3927	17,3927	17,3927	17,3927	17,3927

Highlights

- Firms asymmetrically adjust book leverage in response to changes in market leverage
- Adjustments in book leverage are observed only when firm value increase
- Book and market leverage ratios are connected through the value of a firm
- Results are consistent with Myers (1977): Assets in place vs. growth opportunities