

Dissertation Chapter 1

How important is “target leverage?” A study of
determinants of firms’ capital structure adjustments

by

Doruk Ilgaz*

G32

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* Ilgaz, D. (dilgaz@uh.edu), Department of Economics, University of Houston, 204 McElhinney Hall, Houston, TX 77204. I wish to acknowledge John Graham for kindly sharing his marginal tax rates dataset.

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Abstract

Both theory and practice seem to agree that firms adjust their capital structure to stay in close proximity to a target leverage ratio. However, this target leverage ratio is not accounted for as a determinant of leverage in existing empirical work. Recent findings in the leverage adjustment speed literature yield a practical way to calculate these target leverage ratios. In this paper, I calculate the deviation of actual leverage from target leverage and use it as a determinant of firm’s leverage along with a set of other control variables that are traditionally used in the literature. I find that the addition of deviations from target leverage more than doubles the explanatory power compared to existing empirical specifications. Using standardized regression coefficients I show that the deviation from target leverage ratios is the most important determinant of firms’ capital structure.

I. Introduction

Graham and Harvey's (2001) survey of managers points out that firms choose to operate at a firm-specific level of leverage. Lemmon, Roberts and Zender (2008) show that capital structures are remarkably stable over time; and that firms with high (low) leverage maintain relatively high (low) leverage for over twenty years, independent of being public or private. Flannery and Rangan (2006), Leary and Roberts (2005), Huang and Ritter (2009), and Frank and Goyal (2009) confirm that firms have target leverage ratios and adjust their leverage to keep in close proximity to their target level of leverage over many years.¹ Specifically, Lemmon, Roberts and Zender (2008) mention that firms use security issuances to maintain leverage ratios in a relatively confined region around a long-run mean, consistent with a dynamic rebalancing of capital structure. If the target leverage ratio is such an essential factor then it should have predictive power for future leverage adjustments. If so, how important is that relative to other factors? Particularly, how much of observed leverage adjustments can be attributed to the target leverage concept?

Although the above studies well document a firm's motive to stay near its target leverage ratio, the capital structure literature fails to include it as a factor in explaining leverage adjustments. In a panel setting, I study the relative importance of the target leverage ratio versus other traditional determinants of a firm's leverage decisions. I show that the deviations from the target leverage ratio are the most important factor

¹ In addition, Kayhan and Titman (2007), Hennessy, Livdan, and Miranda (2010), Mehrotra, Mikkelsen, and Partch (2003), and Jalilvand and Harris (1984).

behind leverage adjustments. Inclusion of this factor in the empirical specification increases the explanatory power by a factor two. The estimates are similar for subsamples of investment grade, speculative grade as well as non-rated firms.

Historically, capital structure theory is dominated by two models: the trade-off model (Scott (1976)), and the pecking order model (Myers and Majluf (1984)). Pecking order theory argues that due to information asymmetry firms prefer internal funds over external funds and equity financing is a last resort. This suggests that firms do not aim at any target leverage ratio; instead, the leverage ratio is just the cumulative result of hierarchical financing over time (Shyam-Sunder, Myers (1999)). The trade-off model, on the other hand, says that firms trade-off costs (cost of borrowing) and benefits (tax shield) of debt and operate at their optimal level of leverage. There is vast empirical literature arguing the relative merits of each model. It is well-documented that firms do operate at some particular level of leverage,² but it is not certain whether taxes matter.³ Firms also seem to follow some sort of modified pecking order model (Lemmon and Zender (2004)) but their choice of funding does not seem to be driven by information asymmetry (Jung, Kim, Stulz (1996), Leary and Roberts (2010)). More recent empirical studies, such as Lemmon, Roberts and Zender (2008), model leverage in a dynamic rebalancing setting and show that capital structures persist over time around some

² Taggart (1977), Marsh (1982), Auerbach (1985), Jalilvand and Harris (1984) and Howakimian, Opler and Titman (2001) find mean reversion in debt ratios and evidence that firms appear to adjust toward debt targets.

³ Titman and Wessels (1988) and Gaver, and Gaver (1993) do not find any relation between corporate debt and taxes. MacKie, Mason (1990), Givoly et al. (1992), Rajan, Zingales (1995), Graham(1996a) and Graham, Lemmon, Schalleim (1998), on the other hand, find a positive association. However, Barclay and Smith (1995a), Sharpe and Nguyen (1995) find a negative association.

firm-specific target level. The literature that studies determinants of a firm's leverage has yet to account for the target leverage ratios as a factor in a panel setting.

In this paper I follow the leverage adjustment literature to calculate target levels of leverage.⁴ Then, I subtract it from the current leverage ratio to calculate the deviation from the target level of leverage. I then test for the significance of this deviation in determining subsequent changes in leverage ratios.

Specifically, I regress the leverage ratio on the deviation from the target ratios as well as growth options, profitability, income volatility, asset tangibility, product uniqueness, size, and marginal tax rate. I also run estimations for different rating groups as well as for firms classified by changes in their leverage ratios. In both cases, the addition of deviation from target leverage as a control variable doubles the explanatory power of the model. Using standardized coefficients, I compare the relative importance of these factors. My main finding is that deviations from the target leverage seem to be the most important as any other control variable in most cases. The results are robust to estimation using leverage levels or changes in leverage as the dependent variable.

The rest of this article is organized as follows. Section II describes the data. Section III explains the variables employed in my model. Section IV presents the empirical findings for the proposed econometric implementation. Finally, Section V concludes.

⁴ Such as in Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Huang and Ritter (2009), and Faulkender, Flannery Hankins and Smith (2010). Following leverage adjustment literature, I use a standard partial-adjustment model of firm's capital structure to estimate target leverages. I calculate the deviation from the target leverage as the difference between target leverage and current leverage.

II. Data

I calculate the variables using the data in the COMPUSTAT annual industrial files. The variable definitions are given in the Appendix. Table 2 displays the descriptive statistics of the variables.

[Table 1]

A. Data Selection

All firm-year observations are obtained from COMPUSTAT for the 1985-2010 period. Following Fama and French (1997) I exclude the firms from the financial sector (SICs 6000-6999), from non-classifiable establishments (SICs 9995-9999), and from the regulated sector or utilities (SICs 4900-4999). I discard any observations with missing values for total assets, long-term debt, total liabilities, fiscal year end share price, fiscal year end shares outstanding, operating income, property, plant and equipment and double entries from the dataset. I discard firm-year observations that yield negative book value of equity. To avoid outliers, I trim the observations that correspond to the top and bottom 0.5% values of the variables. In calculating standard deviations for variables, I eliminate the firms with less than five years of frequency from the dataset. I did not restrict the dataset to be balanced. Firms may exit and reappear in the sample. I

also use Standard and Poor's issuer rating (data280)⁵ as reported in COMPUSTAT. Firms that are rated below (above) BBB- are referred to as speculative (investment) grade, and firms without a debt rating at all are referred to as non-rated. Sample consists of 2,585 public and private firms and 15,860 firm-year observations. 3,820 of the observations, about a quarter of my sample have an assigned debt rating.

B. Data Manipulation

I use variables in three forms: levels, changes and standardized changes. Level form of a variable is as calculated using COMPUSTAT values. The change in a variable is the difference between its current level and its lagged level.⁶ Thirdly, the standardized changes in variables are the changes in variables demeaned and divided by the standard deviation of that variable in the sample period for each firm. In calculating standard deviation, I require the firms to have at least five years of frequency in the sample period.

⁵ Standard and Poor's issuer rating (data280) is decoded to an ordinal scale that starts with a numerical code of nine for the best rating possible, AAA, and ends with a numerical code of one for the worst rating considered, C. The rest of the numerical codes (eight to two) are assigned, in order, to ratings AA, A, BBB, BB, B, CCC and CC. Rating modifiers, which show relative standing within the major rating categories, are excluded as the case in other studies in literature.

⁶ The observations in 1984 are lagged and only used to calculate the change in explanatory variables for 1985 then discarded.

III. Model Variables

This section explains the variables used in estimating firms' leverage ratios. First, it explains the dependent variable, the leverage ratio, then follows by the independent variables, deviation from the target leverage, market to book ratio as a proxy for growth options, operating income to total assets as proxy for profitability, coefficient of variation of quarterly operating income as proxy for income volatility, plant, property and equipment over total assets (fixed ratio) as proxy for asset tangibility, sales expenses over sales as proxy for product uniqueness, logarithm of total assets for firms' size and finally marginal tax rate.

A. Dependent Variable: Firm's Leverage Ratio

I calculate leverage ($Lev_{i,t}$) as long term debt over total assets. I also calculate other alternative measures of leverage such as, book-value leverage (i.e. total debt / total assets), and market-value leverage (i.e. total debt / (total assets + market value of equity - book value of equity)).

B. Independent Variable: Deviations from Target Leverage

Studies show that firms determine an optimal leverage ratio and follow this ratio over long years. Lemmon, Roberts and Zender (2008) specifically focus on the persistence in the leverage ratios and show that the capital structures are remarkably stable over time. Their empirical results point out to that firms with high (low) leverage

remain relatively high (low) leverage for over twenty years, independent of being public or private or going to public decisions. Lemmon, Roberts and Zender (2008) note that firm fixed effects (including industry effects) only account for 10% of the variation, whereas an unobserved firm specific effect is responsible for 90% of the explained variation in leverage. They find that firms use security issuances to maintain their leverage ratios in relatively confined regions around their long-run means, consistent with a dynamic rebalancing of capital structure.

According to the trade-off model, a firm has an incentive to correct the deviation from its target level of leverage. A leverage change (at a year t) would ideally correct the previous distance (at year $t-1$) from the target level.

Following several studies in the leverage adjustment literature, such as Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Huang and Ritter (2009) and Faulkender, Flannery, Hankins, and Smith (2010) (FFHS hereafter), I start with a standard partial-adjustment model of firm capital structure to estimate a regression of the form:

$$Lev_{i,t} - Lev_{i,t-1} = \gamma(Lev_{i,t}^* - Lev_{i,t-1}) + \varepsilon_{i,t} \quad (1)$$

where $Lev_{i,t}$ is leverage, $Lev_{i,t-1}$ is lagged leverage and $Lev_{i,t}^*$ is the estimated target leverage, given firm characteristics at $t-1$. According to this model, the typical firm adjusts its leverage annually and at each adjustment closes γ percent (per time period) of the gap between its target leverage and its beginning of period leverage. In the

leverage adjustment literature, this “gamma” value is commonly called the firm’s speed of “adjustment” toward target.

The regression in (1) relies on an estimated target leverage, $Lev_{i,t}^*$. The most challenging aspect of estimating either regression is constructing an estimate of the firm’s target leverage. Following the same procedure as FFHS, I rearrange (1) with the restriction $Lev_{i,t-1}^* = \beta X_{i,t-1}$ into:

$$Lev_{i,t} = \gamma\beta X_{i,t-1} + (1 - \gamma)Lev_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

where β is a coefficient vector to be estimated concurrently with γ and $X_{i,t-1}$ includes:

a *constant*,

$EbitTA = (\text{Income before Extraord. Items} + \text{Interest Exp.} + \text{Income Taxes}) / \text{Tot. Assets}$,

$MBTA = ((\text{Book Liabilities} + \text{Market Value of Equity}) / \text{Total Assets})$,

$DEPTA = \text{Depreciation and Amortization} / \text{Total Assets}$,

$LogA = \log(\text{Total Assets adjusted by the consumer price index to 2010 US dollars})$,

$PPATA = \text{Net property, plant and equipment} / \text{Total Assets}$,

$XRDTA = \text{Research and Development Expense} / \text{Total Assets}$,

$XRDDummy = 1$ if Research and Development Expense > 0, else zero, and

$IndLev = \text{Median Debt Ratio for the firm’s Fama and French (1997) industry}$.

This sort of dynamic panel model entails some important estimation issues (Nickell (1981), Baltagi (2008)). Flannery and Hankins (2010) review and conclude that

among others the Blundell and Bond's (1998) system GMM estimation method generally provides adequate estimates.

Table 2 presents the results of this system GMM estimation for my sample.

[Table 2]

Estimation yields the coefficient vector β (as in Table 2), which I use to construct the firms' annual target leverage ratios. Then I calculate the deviation from the target leverage:

$$Dev_{i,t} = Lev_{i,t}^* - Lev_{i,t-1} \quad (3)$$

$$\alpha + \beta_1 DevTLev_{i,t-1} + \beta_2 DefLev_{i,t+1} + \beta_3 VWLev_i + \beta_4 VWMtB_i$$

Deviation from the target leverage ratio ($Dev_{i,t-1}$) should be one determinant of next year's leverage change. The greater (less) the deviation, the greater (less) should be the leverage change in order to get back to the target level of leverage.

C. Firm-Specific Control Variables

Graham and Harvey's (2001) field study shows that managers value financial flexibility and firms prioritize internal funds to external funds.⁷ Firms adjust their capital structure in the most cost efficient way. When considering changes in leverage, changes in firm dynamics should be taken into account.

Changes in profitability or other firm dynamics would affect availability of or need for funds, and leverage for that matter. Capital structure literature uses a set of

⁷ Though, Graham and Harvey (2001) point out that this is different what original pecking order theory (Myers and Majluf, 1984) says, thus refer to this finding as financial flexibility

variables commonly accepted to affect firm's leverage ratios. Following the literature I include proxies for growth options, profitability, income volatility, asset tangibility, product uniqueness, size and tax rates.

For firm's growth options ($MB/TA_{i,t-1}$) I use the market-to-book ratio (= (market value + book liabilities) / total assets). If firm's market-to-book ratio is high enough then raising capital through equity issues is more advantageous than raising capital through debt issues. Leary and Roberts (2005) find that firms respond to equity issuances and equity price shocks by appropriately rebalancing their leverage.

I measure profitability ($OI/TA_{i,t-1}$) by the return on assets (= operating income / total assets). Standard and Poor's state that firms with higher operating margins have a greater ability to generate equity capital internally, to attract capital externally, and to withstand business adversity.

As a proxy for income volatility ($cv(OI)_{i,t-1}$), I calculate the coefficient of variation of the quarterly income. For each firm, I compute the time-series standard deviation of its quarterly operating income divided by the time-series average of the operating income absolute values, so that I obtain its coefficient of variation. For each year in my sample, I calculate $cv(OI)_{i,t}$ for the 3-year period preceding the year in question. Including this variable controls for the observable part of the firm's past income volatility.

I measure firm's asset tangibility ($PPE/TA_{i,t-1}$) by the fixed asset ratio (net plant, property and equipment / total assets).

Following Titman and Wessels (1988), I use selling expenses over sales as a proxy for uniqueness ($SE/S_{i,t-1}$). Firms with higher levels of product uniqueness have more resources allocated to researching, advertising, and selling their products, as well as a more rigid cost structure. It is considered as a risk factor.

For firm's size ($LogA_{i,t-1}$) I use the logarithm of its total assets adjusted for inflation (prices at 2010). Big firms are likely to be more diversified, less concentrated geographically, and more financially flexible. Smaller firms are apt to be riskier and are seen as having less staying power or survival probability and as being more exposed to expensive bank debt.

As the final control for leverage, I use the marginal tax rates ($MTaxR_{i,t-1}$). The marginal tax rate dataset is the extended version of that used in Graham's (1996a, 1996b) study.⁸ Tax advantage of using debt creates an incentive for increasing leverage. Following Graham, Lemmon, and Schallheim (1998), and Molina (2005) I use the marginal tax rates before interest (i.e., based on the income before interest is deducted) to avoid endogeneity with leverage. Graham's marginal tax rates are built by simulating future profits, accounting for net operating losses, investment tax credits, and the alternative minimum tax.

This is the most practical way of considering the tax effects on leverage ratios. Having said that, when marginal tax rate data is plotted, the first thing to notice is clustering (bunching) around the values of 0%, 34% and 40%. This is the main motivation to also use first differenced data in my estimations. Some literature finds the

⁸ The data for the marginal tax rate was kindly provided by John Graham.

effect of tax rates to be significant on leverage in a levels regression setup.⁹ However, when the marginal tax rate data is first differenced all the clustering is then around 0.

IV. Results

In this section, I present the findings of the empirical analysis. Section A presents the main findings and compares levels and changes regression results. Section B presents the results for different rating groups, and Section C analyzes the case for different sizes of leverage adjustments.

A. Leverage Estimations: Levels and Changes

Traditionally, capital structure literature regresses firm's leverage ratio on a set variables. Similarly, I begin my analysis by regressing leverage on the proposed determinants, deviation from target leverage and the traditional set of control variables. In the level regression, again following literature, all the independent variables are lagged. Table 3 presents the results for the three types of estimation methods: Ordinary Least Squares (OLS), Fixed Effects (FE) and Standardized Variables Regression (Standardized OLS). In order to emphasize the effect of deviation variable, I run the regressions both with and without including $Dev_{i,t-1}$.

⁹ For example Molina (2005) finds the effect of marginal tax rates on level of leverage to be significant, and even uses it as an instrument for leverage in a system of equations. And in another case, along with marginal tax rates Molina (2005) also considers external financing weighted average market-to-book ratio as an additional instrument. Molina (2005) does not report a joint F-test. When I run a joint F-test, I find that these two instruments together are insignificant also.

[Table 3]

In each regression technique, it is seen that $Dev_{i,t-1}$ increases the explanatory power of the model, the most in FE regression. In the Standardized OLS, the magnitude of the coefficients is comparable. $Dev_{i,t-1}$ has the highest absolute value coefficient, which tells that it is the most important factor among other determinants of leverage. About half as important as $Dev_{i,t-1}$ are $PPE/TA_{i,t-1}$, asset tangibility, and $LogA_{i,t-1}$, firm's size. And they are followed by $OI/TA_{i,t-1}$, profitability, $MB/TA_{i,t-1}$, growth options, and $SE/S_{i,t-1}$, product uniqueness.

Another interesting result emerging from Table 3 is regarding taxes ($MTaxR_{i,t-1}$). Similar to some findings in the literature, the OLS estimation shows that taxes matter for leverage. However, I find that this is contrary to the results of the other estimation techniques. This probably related to the high level of clustering problem in marginal tax rates data (particularly at the values 0%, 35% and 40%). For profitable terms the marginal tax rate would be greater than zero, whereas for firms at loss the tax rate would be zero and these firms will have low or high leverage independent of their tax rate. Wooldridge (2002) recommends that in families, groups of observations there may be various correlations and the most practical way of eliminating such relationship effects is simply first differencing the data. I present the estimations using the first differenced data as changes regression results in Table 4.

[Table 4]

The explanatory power of the OLS results without $Dev_{i,t-1}$ decreases from 22% in (Table 3) to 4% (Table 4). However, the explanatory power of FE regression is unchanged, and that for Standardized OLS actually increases slightly. Mainly $Dev_{i,t-1}$ is the most significant variable and adds greatly to the explanatory power of the model; even more in changes regression than it does in levels. Inclusion of $Dev_{i,t-1}$ triples the power in OLS regression, more than quadruples in FE regression, and more than doubles in standardized OLS. Among all cases, the model has the highest explanatory power in the standardized changes regression ($R^2 = 19\%$) with the inclusion of $Dev_{i,t-1}$.

I will start by looking at individual variables with taxes. $MTaxR_{i,t-1}$ seems to be insignificant in all analysis, which tells taxes actually do not matter for leverage changes. This proves against trade-off theory that says firms trade-off between costs (default risk) and benefits of debt (taxes) and eventually operate at some target optimal level of leverage.

Similar to $MTaxR_{i,t-1}$, also $cv(OI)_{i,t-1}$, income volatility, is insignificant. Firm's having a high or low income volatility implies it is a high or low risk of income generation and it is assumed as a risk factor by the credit rating agencies. However, this indirect effect does not seem to at least directly matter for firm's leverage choice. $MB/TA_{i,t-1}$, growth options, gains significance only in the standardized OLS regression.

In the standardized OLS analysis, the coefficient of $Dev_{i,t-1}$ is greatest among other leverage determinants (after the constant). Comparing the magnitudes of the coefficients in the standardized OLS, profitability ($OI/TA_{i,t-1}$), asset tangibility ($PPE/$

$TA_{i,t-1}$) and size ($LogA_{i,t-1}$) seem to be among the other important factors affecting the leverages. Along with the taxes, income volatility seems not to affect leverages.

The constant term in the standardized OLS has the greatest absolute value and tells a firm-specific factor that is not included in the model seem to matter a lot for leverages. Although this is beyond the scope of this study, it may be the reason why the explanatory power of the model is limited around 20%'s and requires further research.

[Table 5]

Next, for robustness I compare the estimation results for different measures of leverage as dependent variable. Table 5 shows that $Dev_{i,t-1}$ is the most important determinant of leverage, book-value leverage or the market value leverage. The situation is different for the other variables, however. When market-value leverage is considered taxes become significant for the first time, though, with a small coefficient. Similarly, income volatility becomes significant with a small coefficient. This may be due to that equity market may be pricing income volatility and this is captured by the market-value leverage. These additional significances increase the explanatory power of the model for the market-value leverage. On the other hand, in the case of changes regression for book-value leverage explanatory power decreases sharply, driven by insignificant control variables. Having said that this does not affect the main finding; $Dev_{i,t-1}$ has the largest coefficient and still is the single most important factor for leverage. The book-value leverage, different from the leverage, takes short-term debt (debt in current liabilities) into account, as well. Short-term debt would change the

dynamics of leverage beyond the factors in the model. This would make these factors insignificant and thus the model would have low explanatory power.

The results mentioned in this section show that deviations from target leverage ($Dev_{i,t-1}$) is the most important factor for capital structure choices of firms. What happens if the firm has a low debt rating? How does the model perform for large changes in leverage versus small leverage adjustments? The following sections seek answers to these questions.

B. Leverage Estimations by Ratings

The dynamics of leverage adjustments may be different for non-rated, rated, and speculative or investment grade firms. Table 6 presents the results for firms categorized by their ratings. The explanatory power of the model is roughly below 20% for non-rated firms, and above that for the rated firms. This shows there may be slight differences among firms with different ratings.

[Table 6]

The main finding, irrespective of the rating group or whether it is a levels or changes regression, is that $Dev_{i,t-1}$ has the largest coefficient, and comes out as the most important (also highest significance in all) leverage determinant. This is consistent with the rest of the results and the main goal of this study.

As for the other variables profitability ($OI/TA_{i,t-1}$), asset tangibility ($PPE/TA_{i,t-1}$) and size ($LogA_{i,t-1}$) seem to be among the other important factors in general (Due to

possible issues associated with levels regression, I focus on the findings of the changes regressions). Income volatility ($cv(OI)_{i,t-1}$) don't seem to matter for leverage adjustments. Growth options ($MB/TA_{i,t-1}$) seem to be about twice as important for rated firms (same level for speculative and investment grade firms) than non-rated firms. Asset tangibility ($PPE/TA_{i,t-1}$) on the other hand seem to matter more for non-rated firms, and actually lower the rating, the more important it becomes. This makes sense as low rating or no-rating would imply a risk and it becomes important whether the assets are tangible in case of a bankruptcy would serve as collateral.

There are also some differences between investment and speculative grade firms. Product uniqueness ($SE/S_{i,t-1}$) does not matter for leverage adjustments in speculative grade firms, but in investment grade firms it is even more important than growth options ($MB/TA_{i,t-1}$). Similarly, changes in firm size ($LogA_{i,t-1}$) is the least important factor for leverage changes in speculative grade firms, however in investment grade firms it is second important factor. On the other hand, changes in profitability is about the same importance for speculative and investment grade firms.

Lastly, one important result that comes out of analyzing leverage adjustments by rating groups is about the effect of taxes. Changes in marginal tax rate ($MTaxR_{i,t-1}$) seem to matter for changes in leverage in investment grade firms. Although, it is the least important factor, still the relationship is significant. According to the trade-off model a firm trades off costs of using debt (added default risk) to benefits of using debt (tax shield). However, I find that taxes only matter for leverage changes of investment

grade firms and with a relatively small coefficient. One possible explanation may be that leverage adjustment costs working as a threshold. It may be that it is still cost effective for an investment grade firm to adjust leverage for tax benefits in the face of relevant costs simply due to scale factor, whereas tax benefits does may not suffice the leverage adjustment costs for a speculative grade firm.

C. Leverage Estimations by Adjustment Size

I sort the sample by the absolute value of the standardized leverage changes. I form five bins with 3172 firm-year observations in each, and I run estimations for each bin separately to see whether there are any differences in the leverage adjustment determinants. Table 7 shows the results for each group of firms.

[Table 7]

Model seems to have twice as explanatory power for small leverage adjustments than the largest, most aggressive leverage changes. This makes sense, as the largest leverage changes may consist of special cases raising capital which may not be related to any of the independent variables in the model. However, the R-squared is even lower for the rest of the groups.

As for variables explaining leverage adjustments, the main finding that deviations from target ($Dev_{i,t-1}$) emerges as the most critical determinant. In the smallest leverage adjustments it is about four times as important as the other variables,

where growth options ($MB/TA_{i,t-1}$), income volatility ($cv(OI)_{i,t-1}$), product uniqueness ($SE/S_{i,t-1}$) and as in other results taxes ($MTaxR_{i,t-1}$) don't seem to matter. For the largest leverage adjustment group, the only variable that doesn't matter is income volatility ($cv(OI)_{i,t-1}$).

V. Conclusion

In this paper, I investigate determinants of firms' capital structure choices. The factors that are included in the model are deviations from target leverage, growth options, profitability, income volatility, asset tangibility, product uniqueness, firm size and taxes.

I begin by comparing leverage levels OLS regression with fixed effects and standardized OLS. I find that the results in the OLS are inflated and hence OLS may not be the best way to estimate leverage models. Especially, high levels of clustering in the marginal tax rates data and benefits of changes regression over the levels regression suggests first differencing the variables would yield more meaningful analysis of the motivation behind firms' capital structure choice. After comparing the findings of a variety of techniques, here, in an effort, to rank the determinants in importance I choose standardized changes OLS as a method of analysis.

Target leverage has been mentioned in the literature. Also anecdotal surveys with managers (such as Harvey and Graham (2000)) show that firms do really have and care about their target level of leverages. However, it has never been studied as a determinant of leverage in a panel setting before. The recent relevant literature uses a partial adjustment model of leverage to calculate firm's target level of leverage. I use this variable along with the other traditional factors of leverage.

The main finding of the study is that getting back to the target level of leverage (deviations from the target leverage) is the most important factor in a firm's leverage adjustment. It is the most significant variable with the largest magnitude of absolute value coefficient and increases the explanatory power of the model the most in all types of level or changes regressions with all types of estimation techniques. The results are robust to other types of leverage measures. Main finding also do not change for non-rated (explanatory power slightly less), speculative grade or investment grade firms. I also control for small leverage changes (explanatory power doubles) versus large changes and in all cases the deviation factor emerges as the most critical determinant of leverage.

I contribute by showing that first-differenced variables is a better way of studying capital structure choices. And when compared to the traditional leverage determinants, getting back to the target leverage is the most important factor.

Appendix: Variable Definitions

This appendix details the variable construction for analysis of the sample. All numbers in parentheses refer to the annual Compustat item number.

Dependent Variables:

Leverage ($Lev_{i,t}$) = long-term debt / total assets = long-term debt (9) / book value of assets (6).

Book-value Leverage = total debt / total assets = [long-term debt (9) + debt in current liabilities (34)] / book value of assets (6).

Market-value Leverage = total debt / (total assets + market value of equity - book value of equity)).

Independent Variables:

Deviation from Target Leverage ($Dev_{i,t-1}$): is the lagged leverage less the historical mean level of leverage, divided by the standard deviation of the firms' leverages (at least five years of history).

Market Value of Equity = year end share price (199) * shares outstanding (25)

Book Value of Equity = total assets (6) - total liabilities (181) - preferred stocks (10) + deferred taxes (74) + convertible debt (79).

Market-to-book ratio ($MB/TA_{i,t-1}$) = market value of equity + book value of debt / total assets.

Profitability ($OI/TA_{i,t-1}$) = operating income (13) / total assets (6).

Income Volatility ($cv(OI)_{i,t-1}$) = for the preceding three year period, standard deviation of quarterly operating income / mean absolute value.

Tangibility ($PPE/TA_{i,t-1}$) = property, plant and equipment (8) / total assets (6).

Product Uniqueness ($SE/S_{i,t-1}$) = selling expenses / sales.

Size ($\log A_{i,t-1}$) = total assets (6) / inflation index for year t. Adjusted to 2004 prices.

Marginal tax rate ($MTaxR_{i,t-1}$): is the marginal tax rate before interest deductions as in Graham (1996a, 1996b) tax rate dataset.

Rating ($S\&PRat$): is the Standard and Poor's issuer rating as in COMPUSTAT (280) available from 1985. I decoded this data to an ordinal scale that starts with a numerical code of nine for the best rating possible, AAA, and ends with a numerical code of one for the worst rating considered, C. The rest of the numerical codes (eight to two) are assigned, in order, to ratings AA, A, BBB, BB, B, CCC and CC. Rating modifiers, which show relative standing within the major rating categories, are excluded as the case in other studies in literature.

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Table 1. Descriptive Statistics

The descriptive statistics for firms without a debt rating, with a rating, and whole sample are presented in Panels A, B and C, respectively. The first two columns show firms' leverage and target leverage ratios. The next two columns show firms' Standard and Poor's debt rating over a nine-point scale, and then S&P detailed rating (including rating modifiers) over a twenty-two-point scale in the fourth column. The rest are the control variables: market to book ratio, operating income over total assets, coefficient of variation for quarterly operating income, plant, property and equipment over total assets, sales expenses over total sales, assets in 2010 million dollars, and marginal tax rate, respectively.

Stats	<i>Lev</i>	<i>Lev*</i>	<i>SPRat</i>	<i>SPRatDet</i>	<i>MB/TA</i>	<i>OI/TA</i>	<i>cv(OI)</i>	<i>PPE/TA</i>	<i>SE/S</i>	<i>Assets</i>	<i>MTaxR</i>
A. Unrated											
N	12040	12040	0	0	12040	12040	12040	12040	12040	12040	12040
Mean	0.10	0.38			2.02	0.11	1.38	0.25	0.38	366	0.29
Median	0.05	0.37			1.47	0.13	0.49	0.21	0.28	120	0.34
SD	0.13	0.21			1.90	0.15	3.66	0.18	0.72	1315	0.12
Min	0.00	-2.40			0.20	-1.45	0.05	0.00	0.01	10	0.00
Max	0.86	1.80			52.47	0.51	57.45	0.95	24.14	66435	0.51
B. Rated											
N	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820
Mean	0.22	0.61	6.04	14.10	1.87	0.15	0.45	0.33	0.22	9718	0.33
Median	0.20	0.61	6.00	14.00	1.51	0.15	0.25	0.30	0.19	2985	0.35
SD	0.14	0.24	1.29	3.76	1.24	0.07	1.22	0.18	0.15	23548	0.08
Min	0.00	-0.47	0.00	1.00	0.45	0.43	0.05	0.01	0.02	16	0.00
Max	0.88	1.29	9.00	22.00	17.68	0.46	35.91	0.91	2.94	337824	0.46
C. All Sample											
N	15860	15860	3820	3820	15860	15860	15860	15860	15860	15860	15860
Mean	0.13	0.43	6.04	14.10	1.98	0.12	1.15	0.27	0.34	2619	0.30
Median	0.09	0.42	6.00	14.00	1.48	0.14	0.41	0.23	0.25	229	0.34
SD	0.14	0.24	1.29	3.76	1.76	0.14	3.27	0.18	0.63	12282	0.11
Min	0.00	-2.40	0.00	1.00	0.20	-1.45	0.05	0.00	0.01	10	0.00
Max	0.88	1.80	9.00	22.00	52.47	0.51	57.45	0.95	24.14	337824	0.51

Table 2. System GMM Estimation Results

Table 2 presents the results of estimation of firms' Leverage, Book-value Leverage, and Market-value Leverage in a partial adjustment model setting. The estimation method employed is Blundell, Bond (1998) system GMM. The estimation procedure is carried out using `xtabond2` STATA package by Roodman (2006). The coefficient matrix β will be used to construct Lev^* , firms' target leverage ratios. Constructing Lev^* in this manner is as in Faulkender, Flannery, Hankins, and Smith (2010). The variables employed in the model is Leverage (also book-value leverage and market-value leverage), earnings before interest and tax over total assets, market value over total assets, depreciation over total assets, logarithm of total assets (in 2010 USD), plant, property and equipment over total assets, research and development expenses over total assets, research and development dummy (=1 if R&D expense exists, 0 otherwise) and industry leverage. Year and industry dummies are included but not reported for brevity. The reported t-values represent robust errors. ***, **, * represent 1%, 5% and 10% significance levels, respectively. The sample is COMUSTAT firms in 1985-2010.

Dep. Var.:	Leverage			Book-value Leverage			Market-value Leverage		
	β		t	β		t	β		t
<i>Lev</i>	0.8564	***	40.61	0.6042	***	57.69	0.5635	***	54.24
<i>Ebit/TA</i>	-0.0292	***	-2.71	-0.2743	***	-3.85	-0.2738	***	-3.70
<i>MB/TA</i>	-0.0008		-1.51	-0.0190	***	-4.47	-0.0211	***	-4.80
<i>DP/TA</i>	-0.0768	*	-1.85	-0.9214	***	-3.30	-1.0212	***	-4.19
<i>LogA</i>	0.0102	***	3.37	0.0922	***	4.77	0.1660	***	9.07
<i>PPE/TA</i>	0.1480	*	5.60	1.2110	***	7.53	1.2504	***	7.73
<i>XRD/TA</i>	-0.0424	*	-2.05	-0.2996	*	-1.93	-0.3341	**	-2.12
<i>XRDDummy</i>	0.0008	***	0.21	0.0273		1.14	-0.0224		-0.84
<i>IndLev</i>	-0.2472		-6.33	-1.7125	***	-9.55	-2.9682	***	-11.76
<i>Constant</i>	-0.0201	**	-1.43	-0.3552	***	-3.89	-0.7173	***	-8.01
F	189.91			144.79			164.24		
N	50007			50007			50007		
Firms	7019			7019			7019		

***, **, * represent 1%, 5% and 10% robust significance levels, respectively. Year dummies are included but not reported for brevity.

Table 3. Leverage Levels-Regression Results

Table 3 presents the results for estimating level of leverage using ordinary least squares, fixed effects and using standardized variables. Dependent variable is the level of leverage, and all the rest of the variables are a year lagged levels of deviation, market value over total assets, operating income over total assets, coefficient of variation of operating income, plant, property and equipment over total assets, sales expenses over sales, logarithm of total assets (in 2010 USD) and marginal tax rate. For each method estimation results are presented with and without the *Dev* variable. Year and industry dummies are included but not reported for brevity. The reported t-values represent robust errors. ***, **, * represent 1%, 5% and 10% significance levels, respectively. The sample is COMUSTAT firms in 1985-2010.

Regression Type:	OLS		FE		Standardized OLS	
	Base Case	Including <i>Dev</i>	Base Case	Including <i>Dev</i>	Base Case	Including <i>Dev</i>
	β	β	β	β	β	β
<i>Dev</i>		-0.4382 ***		-0.2215 ***		-0.2690 ***
<i>MB/TA</i>	-0.0071 ***	-0.0046 ***	-0.0028	-0.0020 *	-0.0210 ***	-0.0222 ***
<i>OI/TA</i>	-0.1731 ***	-0.1199 ***	-0.0583 **	-0.0398 ***	-0.0572 ***	-0.0430 ***
<i>cv(OI)</i>	-0.0007 **	-0.0007 ***	0.0002	0.0001	-0.0026	-0.0026
<i>PPE/TA</i>	0.1790 ***	0.4689 ***	0.0925 ***	0.1973 ***	0.0671 ***	0.1152 ***
<i>SE/S</i>	-0.0161 ***	-0.0090 **	-0.0054 **	-0.0026	-0.0195 **	-0.0185 **
<i>LogA</i>	0.0123 ***	0.0357 ***	0.0176 ***	0.0278 ***	0.0730 ***	0.1126 ***
<i>MTaxR</i>	0.0494 ***	0.0247 **	-0.0056	-0.0007	0.0050	0.0068
<i>Constant</i>	0.0528 **	-0.0629 ***	0.0250	-0.0011 ***	-0.0515	-0.0658
N	15860	15860	15860	15860	15860	15860
Firms	2585	2585	2585	2585	2585	2585
Adj. R ²	0.22	0.49	0.04	0.18	0.10	0.16

***, **, * represent 1%, 5% and 10% robust significance levels, respectively. Year and industry dummies are included but not reported for brevity.

Table 4. Leverage Changes Regression Results

Table 4 presents the results for estimating change in leverage using ordinary least squares, fixed effects and using standardized variables. Dependent variable is the leverage change, and all the rest of the variables are changes in deviation, market value over total assets, operating income over total assets, coefficient of variation of operating income, plant, property and equipment over total assets, sales expenses over sales, logarithm of total assets (in 2010 USD) and marginal tax rate. For each method estimation results are presented with and without the *Dev* variable. Year and industry dummies are included but not reported for brevity. The reported t-values represent robust errors. ***, **, * represent 1%, 5% and 10% significance levels, respectively. The sample is COMUSTAT firms in 1985-2010.

Regression Type:	OLS		FE		Standardized OLS	
	Base Case	Including <i>Dev</i>	Base Case	Including <i>Dev</i>	Base Case	Including <i>Dev</i>
	β	β	β	β	β	β
<i>Dev</i>		0.1950 ***		0.2334 ***		0.2863 ***
<i>MB/TA</i>	-0.0001	-0.0001	0.0000	-0.0001	-0.0651 ***	-0.0646 ***
<i>OI/TA</i>	-0.0489 **	-0.0537 ***	-0.0546 ***	-0.0620 ***	-0.1273 ***	-0.1343 ***
<i>co(OI)</i>	0.0002	0.0001	0.0000	-0.0001	0.0009	-0.0004
<i>PPE/TA</i>	0.1229 ***	0.1937 ***	0.1261 ***	0.2209 ***	0.0903 ***	0.1573 ***
<i>SE/S</i>	-0.0087 ***	-0.0084 ***	-0.0088 ***	-0.0087 ***	-0.0911 ***	-0.0843 ***
<i>LogA</i>	0.0203 ***	0.0206 ***	0.0242 ***	0.0252 ***	0.1907 ***	0.1978 ***
<i>MTaxR</i>	-0.0073	-0.0105	-0.0038	-0.0043	-0.0044	-0.0018
<i>Constant</i>	-0.0098	-0.0089	-0.0124	-0.0175	-0.2785 **	-0.3591 ***
N	15860	15860	15860	15860	15860	15860
Firms	2585	2585	2585	2585	2585	2585
Adj. R ²	0.04	0.15	0.04	0.18	0.08	0.19

***, **, * represent 1%, 5% and 10% robust significance levels, respectively. Year and industry dummies are included but not reported for brevity.

Table 5. Estimations for Alternative Measures of Leverage

Table 5 presents the results for leverage change estimations for different measures of leverage. The dependent variable (and correspondingly derived *Dev*) is leverage, active leverage (= leverage - passive leverage = leverage - (debt / (total assets + next period net income))), book-value leverage (= total debt / total assets), and market-value leverage (= total debt / (total assets + market value of equity - book value of equity)). The independent variables are changes in deviation, market value over total assets, operating income over total assets, coefficient of variation of operating income, plant, property and equipment over total assets, sales expenses over sales, logarithm of total assets (in 2010 USD) and marginal tax rate. All variables are standardized. Year and industry dummies are included but not reported for brevity. The reported t-values represent robust errors. ***, **, * represent 1%, 5% and 10% significance levels, respectively. The sample is COMUSTAT firms in 1985-2010.

	Leverage				Active Leverage				Book-value Leverage				Market-value Leverage			
	Levels		Changes		Levels		Changes		Levels		Changes		Levels		Changes	
<i>Dev</i>	-0.2690	***	0.2860	***	-0.3381	***	-0.0285	***	-0.0530	***	0.0481	***	-0.0453	***	0.0353	***
<i>MB/TA</i>	-0.0222	***	-0.0647	***	0.0137	*	0.0516	***	-0.0085	***	0.0198		-0.0171	***	-0.0195	***
<i>OI/TA</i>	-0.0430	***	-0.1332	***	0.0610	***	-0.0737	***	-0.0062	***	-0.0365	***	-0.0084	***	-0.0185	***
<i>cv(OI)</i>	-0.0026		0.0067		0.0057		0.0288	***	0.0014		-0.0134		0.0003		0.0024	**
<i>PPE/TA</i>	0.1152	***	0.1573	***	-0.0015		-0.0082		0.0116	***	-0.0066		0.0103	***	0.0067	***
<i>SE/S</i>	-0.0185	**	-0.0843	***	-0.0065		-0.0069		-0.0009		0.0016		-0.0010		-0.0052	***
<i>LogA</i>	0.1126	***	0.1986	***	-0.1507	***	-0.0955	***	0.0252	***	0.0133		0.0333	***	0.0094	***
<i>MTaxR</i>	0.0068		-0.0013		-0.0174	**	-0.0156	*	-0.0005		0.0189		0.0003		-0.0024	**
<i>Const.</i>	-0.0658		-0.3552	***	-0.1314		-1.3127	**	0.1982	***	-0.4379	**	0.1579	***	-0.0436	**
N	15860		15860		15860		15329		15860		15860		15860		15860	
Adj. R ²	0.16		0.19		0.05		0.03		0.25		0.02		0.28		0.27	

***, **, * represent 1%, 5% and 10% robust significance levels, respectively. Year and industry dummies are included but not reported for brevity.

Table 6. Estimations by Firms' Ratings

Table 6 presents the results for estimating leverage and leverage changes within the specified rating group based on Standard and Poor's debt rating. Depending on the whether the estimation is a levels or changes regression, the dependent variable is either the level of leverage or change in leverage, and all the rest of the variables are deviation, market value over total assets, operating income over total assets, coefficient of variation of operating income, plant, property and equipment over total assets, sales expenses over sales, logarithm of total assets (in 2010 USD) and marginal tax rate, correspondingly. All variables are standardized. In levels regression all regressors are lagged by a year. Year and industry dummies are included but not reported for brevity. The reported t-values represent robust errors. ***, **, * represent 1%, 5% and 10% significance levels, respectively. The sample is COMUSTAT firms in 1985-2010. In all fairness for those firms below B rating (junk-rated) results are available but not presented due to small sample size.

	Non-Rated Firms				All Rated Firms				Speculative Grade Firms				Investment Grade Firms			
	Levels		Changes		Levels		Changes		Levels		Changes		Levels		Changes	
<i>Dev</i>	-0.2566	***	0.2821	***	-0.2868	***	0.2906	***	-0.2788	***	0.2521	***	-0.2808	***	0.3160	***
<i>MB/TA</i>	-0.0179	**	-0.0566	***	-0.0541	***	-0.0921	***	-0.0054		-0.1012	***	-0.0717	***	-0.0878	***
<i>OI/TA</i>	-0.0378	***	-0.1169	***	-0.0375	**	-0.1621	***	-0.0356		-0.1624	***	-0.0303		-0.1491	***
<i>cv(OI)</i>	-0.0033		0.0054		0.0046		0.0166		0.0385	*	0.0234		-0.0209		0.0051	
<i>PPE/TA</i>	0.1285	***	0.1742	***	0.0675	***	0.1010	***	0.1732	***	0.1320	***	0.1333	***	0.0960	**
<i>SE/S</i>	-0.0242	***	-0.0794	***	0.0085		-0.0779	**	-0.0168		-0.0361		0.0428	**	-0.0956	**
<i>LogA</i>	0.1063	***	0.1930	***	0.0977	***	0.1819	***	0.1675	***	0.0976	*	0.1065	***	0.2376	***
<i>MTaxR</i>	0.0063		0.0006		0.0071		-0.0179		-0.0001		0.0364		0.0182		-0.0613	*
<i>Const.</i>	-0.0658		-0.4260	***	-0.6766	***	-1.1642	***	0.5578	***	1.3797	***	-1.5984	***	-1.9475	***
N	12040		12040		3820		3820		1287		1287		1538		1538	
Adj. R ²	0.15		0.18		0.21		0.23		0.23		0.27		0.25		0.22	

***, **, * represent 1%, 5% and 10% robust significance levels, respectively. Year and industry dummies are included but not reported for brevity.

Table 7. Estimations by Size of Leverage Change

Table 7 presents the results for estimating leverage changes based on their size. The sample is ranked based on absolute value of leverage change and divided into five equal sized groups. Each column in Table 6 presents the results for the estimation run per group, from small leverage changes to larger. The independent variables are changes in deviation, market value over total assets, operating income over total assets, coefficient of variation of operating income, plant, property and equipment over total assets, sales expenses over sales, logarithm of total assets (in 2010 USD) and marginal tax rate. All variables are standardized. Year and industry dummies are included but not reported for brevity. The reported t-values represent robust errors. ***, **, * represent 1%, 5% and 10% significance levels, respectively. The sample is COMUSTAT firms in 1985-2010.

Leverage Change	Smallest	2	3	4	Largest
<i>Dev</i>	0.1223 ***	0.0082 ***	0.0004	0.0047 ***	0.1499 ***
<i>MB/TA</i>	-0.0109	-0.0045 **	-0.0005	0.0000	-0.0415 ***
<i>OI/TA</i>	-0.0307 *	-0.0069 **	-0.0030 **	-0.0039 *	-0.0510 ***
<i>cv(OI)</i>	0.0065	0.0012	-0.0005	-0.0003	-0.0085
<i>PPE/TA</i>	0.0464 **	0.0118 ***	0.0005	0.0005	0.0384 **
<i>SE/S</i>	0.0029	-0.0052 *	-0.0017	0.0020	-0.0499 ***
<i>LogA</i>	0.0147 **	0.0028	0.0000	0.0030	0.1181 ***
<i>MTaxR</i>	-0.0193	-0.0009	-0.0017	-0.0029 *	0.0422 ***
<i>Constant</i>	-2.1686 ***	-0.1966 ***	-0.0044	0.2924 ***	1.0081 ***
N	3172	3172	3172	3172	3172
Adj. R ²	0.29	0.04	0.04	0.07	0.16

***, **, * represent 1%, 5% and 10% robust significance levels, respectively. Year and industry dummies are included but not reported for brevity.