The Capital Structure: An Alternative Explanation

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Abstract

Prior studies on the capital structure have identified several capital structure determinants. However, the models that try to explain leverage often have only little explanatory power. In this study an alternative, more practically related manner of defining leverage is presented in order to obtain better models to explain differences in the capital structures of firms. I find that when leverage is defined by a debt-to-EBITDA measure instead of an often used debt-to-assets ratio, better capital structure models can be obtained. Furthermore, reexamination of previously identified capital structure determinants finds business risk, profitability, collateral value of assets, the non-debt tax shield and asset intensity to be related to long-term debt. Profitability, risk, collateral value of assets, the non-debt tax shield and growth are found to affect the amount of short-term debt in the capital structure.

1. Introduction

'When you combine ignorance and leverage, you get some pretty interesting results' – Warren Buffett. The statement relates to the current financial crisis resulting from the credit crunch in the financial markets. The collective opinion about the cause of the current downturn in the credit market is definitely that investment bankers, investors, top managers and other financial executives took too much risk in order to make as much money as they possibly could. Highly levered positions were taken in order to obtain incredible returns while ignoring risks. The financial system is a system based on trust and in their ignorance people were confident that taking immense risks would do no harm, because everyone thought that the financial system would work and keep itself up and running. However, as follows from basic finance theory, compensation is according to risk and there is no such thing as a free lunch. High expected returns exist for investments with high chances of turning out badly. What happened to the financial markets is that one burst in the system - one thing that turned out really badly - caused another burst and ultimately the entire financial system collapsed as a consequence of highly leveraged and risky positions and ignorance of those risks.

In the literature leverage has been a frontline topic for many years. What determines the amount of leverage that firms take on in their capital structure? This is a question that keeps researchers busy for already several decades. Since Modigliani and Miller (1958) an enormous amount of research has been done on what determines the capital structure choice in firms. At first Modigliani and Miller stated that the financing mix was irrelevant for the value of a company, but later on (1963) they corrected themselves by acknowledging that there exist some benefits from earnings shielded from tax by interest payments made. Thereafter, several theories have been developed in order to identify the factors that explain why firms have different leverage ratios.

The two most prominent explanations of the capital structure are the static tradeoff theory and the pecking order theory. Both have appealing features that sound credible, but unfortunately neither of them is able to give a full and definite explanation for the differences in the capital structures of firms.

Numerous studies tried to identify determinants of the capital structure and some important factors have been identified in the literature. Yet, the capital structure puzzle is still largely unsolved, because the explanatory power of the constructed models in prior research is often

very low. This raises doubts whether the models are complete or whether they are correctly defined. To go back to the discussion of leverage taken on in present times, how do we define leverage? What do practitioners use as their measure for debt capacity of firms? It turns out that practitioners do not use asset or market value of debt plus equity multiples to determine debt capacity, but multiples of a firm's earnings before interest, taxes, depreciation and amortization (EBITDA). For that reason this study examines whether a leverage measure of debt-to-EBITDA could be explained better by previously found capital structure determinants. If this would be the case, the constructed models should yield higher explanatory power than models that define leverage by means of a debt-to-assets measure.

The study analyzes the effects of several capital structure determinants on short- and long-term debt ratios by means of three samples of firms from Compustat North America over the period 2000 to 2006. It turns out that the capital structure can be better explained when short- and long-term leverage are defined as debt-to-EBITDA ratios than when measured by debt-to-assets.

With the new models, using debt-to-EBITDA ratios to define leverage, a reexamination of the effects of the most important capital structure determinants found in prior studies on leverage is done. Business risk, profitability and the non-debt tax shield are found to be negatively related to long-term debt in the capital structure. A positive relation is found for the collateral value of assets and asset intensity. Firm size and growth tend to be unrelated to long-term leverage.

Regarding short-term debt, a negative relation is found for profitability, the non-debt tax shield and growth. Business risk and the collateral value of assets seem to have a positive effect on short-term leverage and no relation is found for firm size and asset intensity.

This study contributes to the literature by presenting an alternative, more practically related manner of defining leverage. The result is that better models can be obtained, which gives a better insight in what determines the capital structure. Furthermore, the effect of asset intensity on leverage is examined here, which is not the case in previous studies on capital structure determinants.

The paper continues as follows. Section 2 presents the hypotheses. Section 3 describes the data and methods used in the study. Section 4 discusses the results and findings of the models. Section 5 summarizes and concludes. Section 6 gives suggestions for further research.

2. Hypotheses

2.1 Leverage Ratio

As Rajan and Zingales (1995) argue, there is not one single measure that defines the leverage ratio of a firm. It depends on the intent and objectives of the analysis conducted how the debt ratio should be defined appropriately. In prior studies on the capital structure determinants often a debt-to-assets or sometimes a 'debt-to-book value of debt plus market value of equity' measure is used as the dependent variable to be explained by the explanatory variables. Yet, the results from these studies are usually not very satisfactory since the models often have low explanatory power. This results in a search for more and more explaning variables that could possibly improve the existing models and solve the capital structure puzzle. However, the question is whether the problem really is one of missing variables. It could as well be the case that the common measure for the leverage ratio is just not the right one. This way of reasoning might deserve more credence if we look at the capital structure from a more practical view. In the end it are the practitioners who make the decisions about the financing structure. Following their line of reasoning could therefore give us a better insight in what really drives capital structure decisions. In practice a firm's net long-term net debt (NLTD) capacity is usually defined by lenders as a multiple of its earnings before interest, taxes, depreciation and amortization (EBITDA), because it indicates whether a firm is solvable or not. Hence the expectation is that a measure of long-term net debt-to-EBITDA might yield a model with higher explanatory power than the models with the usual measures. This gives us the first hypothesis:

Hypothesis 1a: A NLTD-to-EBTIDA model has higher explanatory power than a commonly used measure.

Regarding short-term debt (STD) it could also be expected that a STD-to-EBITDA can be better explained by firm characteristics than a commonly used measure and that it is therefore also expected to yield a better model, hence:

Hypothesis 1b: Short-term leverage can be better explained by firm characteristics when measured as STD-to-EBITDA than when defined as STD-to-Assets.

Table 1 gives an overview of leverage measures used in prior studies, most of them are NLTD or total debt proxies, but some also investigate the relationships between STD and the capital structure determinants separately.

Table 1: Leverage measures in prior studies

Article	Leverage Measure
Titman and Wessels (1988)	STD/BVE[1], STD/MVE[2], LTD/BVE, LTD/MVE, CD/BVE[3], CD/MVE
Bradley et al. (1984)	LTD/(LTD+MVE)
Rajan and Zingales (1995)	BVD/(BVD+BVE)[4]
Friend and Hasbrouck (1987)	BVD/BVA[5]
Friend and Lang (1988)	BVD/BVA
Kim and Sorensen (1986)	LTD/BVCAP[6]
Lakshmi (2009)	LTD/(LTD+MVE)
Miguel and Pindado (2001)	MVLTD/(MVLTD+MVE)[7]
Ferri and Jones (1979)	BVD/BVA

2.2 Business Risk

Higher uncertainty about future earnings of a firm increases the difficulty for financial planning. If earnings are not stable over time, the risk of inability to pay interest on the firm's borrowings is higher. Following this line of reasoning Bradley et al. (1984) stated that when there are significant costs of financial distress, debt and business risk are inversely related, because they both increase the possibility of bankruptcy. Friend and Hasbrouck (1987) argue in a similar way, according to them firms with higher business risk will have less leverage because of higher bankruptcy and agency costs. Still more studies find a negative relation between the amount of debt and the degree of business risk due to the possibility of the firm not being able to meet its periodic obligations.[8] Jensen et al. (1992) conclude that the supply of debt to firms with higher business risk is lower regardless of the interest rate.

On the contrary there are also some studies that find a positive relation between business risk and leverage, for example Lakshmi (2009), Kim and Sorensen (1986) and Bennet and Donnelly (1993). The theoretical explanation behind these findings is given by Myers (1977), who concludes that riskier firms have lower agency costs of debt, because the impact of a

[1] Book value of equity (BVE)
[2] Market value of equity (MVE)
[3] Convertible debt (CD)
[4] Book value of total debt (BVD)
[5] Book value of total assets (BVA)
[6] Book value of total capital (BVCAP)
[7] Market value of long term debt (MVLTD)
[8] Some other studies finding a negative relation are for example Ferri and Jones (1979), Marsh (1982), Friend and Lang (1988).

risky debt issue on the market value of a firm is less when the investment has higher risk relative to the assets in place. Myers' explanation is built on the fact that equity can be viewed as a call option. He argues that the exercise value of the investment option is higher for shareholders of a firm that issued risky debt, than for the bondholders. In this way, issuing risky debt will always lead a firm to forgo valuable investment opportunities according to Myers. Yet, this is the case if the investment is assumed not to change the variance in the market value of the firm. The outcome could be different if the investment option has higher risk relative to the assets in place, leading the variance in market value to increase. As Jensen and Meckling (1976) conclude, the increase in risk could be so large that the transfer of wealth from stockholders, who are the decision makers, to bondholders becomes negative. Since increased risk of the firm increases the value of the call option on the assets – the equity value – it turns out to be valuable to undertake negative net present value investment opportunities that increase the firm's risk. [9] So the unavoidable loss in value from issuing risky debt when changes in the market value variance are not taken into account, could be offset by an increase in value when the firm has risky investment opportunities. According to Myers (1977) the higher risk in the nature of the business leads to a smaller loss of total value, meaning a lower impact on the market value of the company, as compared to less risky companies. This leads riskier firms to issue more debt.

Lastly, there are also studies, like Titman and Wessels (1988), which find no significant relationship between the amount of debt in the capital structure and the volatility of earnings.

Despite the mixed evidence I think that the arguments for the negative relationship deserve more credence, especially considering the fact that the majority of prior studies supports this hypothesis. There is no difference hypothesized between the relationships of STD and NLTD to business risk.

Hypothesis 2: A firm's short- and long-term leverage are negatively related to business risk.

[9] This is when it is assumed that the debt matures after the investment decision has been made and stockholders decide on whether to exercise the investment option or not. If the investment has increased the risk of the firm, the possibility of a failure of the project has increased. When projects fail, a firm may default on its debt obligations and the bondholders bear the costs of the failure. Therefore, an increase in risk leads to lower total transfer of wealth to bondholders. A negative wealth transfer to bondholders makes negative present value projects attractive for shareholders as from the way their decision making is defined, since the difference between the initial investment and the future payoffs is compensated by the negative transfer to bondholders.

2.3 Profitability

There are two opposing views regarding the effect of a firm's profitability on the capital structure. One reasons from the demand and one from the supply side of debt. Lenders are more easily willing to supply debt to firms that seem healthy and generate steady profits. This makes them safer and increases the chance for the lender to be repaid, hence making them more willing to supply capital. Besides, Modigliani and Miller (1963) conclude that firms use debt to create a tax shield to enjoy tax deductibility of interest payments. Since high profitability firms are able to bear the higher risk from more debt, following the line of reasoning from Modigliani and Miller it could be expected that these firms have higher debt levels as to maximize the tax shield.

On the other hand the pecking order theory states that firms prefer the use of internal funds over external funds. Hence firms with higher profitability do not need to rely on external funds as much as firms with lower profitability and are therefore expected to maintain lower debt ratios. In addition to that, Titman and Wessels (1988) argue that they find a negative relationship between profitability and debt, because firms tend to repay their loans with excess cash flows. Rajan and Zingales (1995), Friend and Hasbrouck (1987), Friend and Lang (1988) and Lakshmi (2009) all find a significant negative relationship between debt and profitability as well. Relying on the pecking order theory and empirical evidence from earlier studies the third hypothesis is the following:

Hypothesis 3: There is a negative relation between a firm's short- and long-term debt ratio and its level of profitability.

2.4 Size

The findings on the relationship between the level of debt and the size of the firm in prior research are mixed. According to Fama and Jensen (1983) larger firms are more diversified, leading to a lower possibility of bankruptcy than is the case with smaller, undiversified firms. Hence larger firms can take on more debt causing the relation to be positive. Furthermore, Warner (1977) and Ang and McConnell (1982) find that the costs of financial distress are negatively related to firm size, leading larger firms to take on more debt.

Issuing costs could also have an impact on the relation between firm size and capital structure since the costs of issuing debt and equity decrease with size. These issuance costs seem to play a very important role in the capital structure decision for small companies. For that

reason small firms tend to make more use of short-term funds supplied by banks (Barclay and Smith, 1995) and large firms more of long-term public debt.

On the other hand Barclay and Smith argue that large firms often have foreign operations and therefore probably issue foreign debt. Since foreign debt markets are usually less liquid than the U.S. debt markets, they are more likely to make use of short-term debt.

Rajan and Zingales (1995) suggest that the information asymmetry between internal and external shareholders will be smaller for larger firms, leading to more use of equity in the capital structure. This supposes firm size to be inversely related to debt.

Marsh (1982), Friend and Lang (1988), Ferri and Jones (1979) and Lakshmi (2009) find a positive relation between firm size and long-term debt. Titman and Wessels (1988) find a negative relation and Remmers, Stonehill, Wright and Beekhuisen (1974) find firm size to be unrelated to the level of debt in the capital structure. So all in all it can be said that the evidence on the relation between leverage and firm size is mixed and that it depends on how debt is defined; short-term, long-term or both.

Hypothesis 4a: The relationship between the net long-term debt-ratio and firm size is positive.

Hypothesis 4b: The short-term debt-ratio and firm size are negatively related.

2.5 Collateral Value of Assets

The costs of issuing debt for a firm are lower when the risk for the lender is lower. The asymmetric information between management and lenders drives up the costs of borrowing. Yet, if the firm is able to issue debt that is secured by assets in place, this information asymmetry can be reduced and with that the costs of debt. Therefore it can be expected that firms with higher collateral value of assets have higher leverage ratios.[10]

Besides, as suggested by Jensen and Meckling (1976) and Myers (1977), stockholders in levered firms tend to invest sub-optimally as to shift wealth away from bondholders to increase their own. Collateralized debt can prevent this since the borrower is obliged to use the raised funds for a specified project which secures the debt. Therefore collateralized debt is more favorable to lenders. Because of the fact that debt cannot be secured with intangible assets it is expected that firms with more tangible assets have higher debt levels.

[10] See Titman and Wessels (1988) and Lakshmi (2009).

In contrast to these theories supporting a positive relation between the collateral value of assets and the debt level of a firm, agency costs can give an explanation of a possible negative relationship. Managers tend to take on a sub-optimal level of debt out of self interests. Firms with low collateral value of assets have lower capital expenditures to monitor and restrict management and therefore have higher agency costs. As an alternative, debt could be taken on to serve as a monitoring device in firms with little collateral assets leading to a negative relationship (Jensen, 1986).

Empirical evidence from Rajan and Zingales (1995), Friend and Hasbrouck (1987), Friend and Lang (1988), Marsh (1982) and Lakshmi (2009) gives support to a positive relationship. This leads to the fifth hypothesis:

Hypothesis 5: There is a positive relationship between the collateral value of assets and the level of short- and net long-term debt in a firm.

2.6 Non-debt Tax Shields

The theory of DeAngelo and Masulis (1980) that firms can establish other tax shields than those arising from debt, as described by Modigliani and Miller (1963), is somewhat contrasting to the theory of collateral value of assets. DeAngelo and Masulis argue that firms use non-debt tax shields like depreciation as a substitute for tax advantages of debt. Consequently, we should observe firms with high levels of depreciation to have lower levels of debt. Since high depreciation usually comes from a high ratio of tangible assets to total assets, the expected negative relation is not consistent with the relation hypothesized in the previous section. However, since the theoretical rationale seems to be logical and Kim and Sorensen (1986) and Miguel and Pindado (2001) found a significant negative relationship the sixth hypothesis is:

Hypothesis 6: There exists a negative relationship between non-debt tax shields and net long- and short-term leverage.

2.7 Growth

As mentioned earlier, managers of levered firms tend to invest sub-optimally as to expropriate wealth from bondholders to shareholders (Jensen and Meckling, 1976). This agency problem

is strongly present in high growth firms since managers in these firms have an incentive to take on risky projects which have a low probability of a very high payoff. On the other hand these projects also have a very high probability of failure. The problem is, however, that if the project turns out to be a success, the managers and shareholders reap the benefits, but if it fails the bondholders mainly bear the costs. This agency problem makes it hard for high growth firms to take on debt in comparison to more mature firms where the agency problem is mitigated. Therefore a negative relationship between growth and short- and long-term debt can be expected.

Hypothesis 7: A firm's growth level and debt-ratios are negatively related.

2.8 Asset Intensity

The relation between leverage and asset intensity is hypothesized to be positive since firms that have a lower intensity of assets probably are more knowledge based. Low asset intensity means that only a small amount of capital is invested in assets as compared to the revenue generated. If sales are very high relative to book value of assets, this could be due to the fact that the firm has many non-balance sheet items, such as knowledge. Knowledge firms often have lower debt levels, where manufacturing firms for example have many assets relative to the value of sales and, as Myers (1977) concludes, these firms usually have more debt in their capital structure. Hence the last hypothesis is:

Hypothesis 8: Asset intensity and leverage are positively related.

2.9 Other Determinants

2.9.1 Historical Stock Price Performance

Prior research by for example Welch (2004) and Baker and Wurgler (2002) found a company's historical stock price to have an explanatory role in the development of the capital structure. Baker and Wurgler conclude that a firm's current capital structure is the outcome of attempts to time the equity market in the past. They argue that firms issue equity when their stock price is high and repurchase shares when it is undervalued. Despite of the fact that Welch confirms that historical stock performance has much explanatory power regarding the

capital structure, he states that corporate debt issuing motives remain undiscovered. According to him they are not used as a measure to counterbalance stock returns.

It may be clear from the studies of Welch and Baker and Wurgler that firms try to time the market in the short run as to exploit profitable opportunities caused by over- or undervaluation. Welch states that determinants which were found to influence capital structure in earlier studies, possibly only have an indirect effect on the debt ratio through a third variable, stock price return.

The paper of Welch studies whether firms readjust their current debt ratio to a static target or whether they allow it to change with the stock price. This line of research differs from my paper since here the determinants of a suspected long-term static target debt ratio are studied and whether a newly introduced leverage measure can be better explained by previously identified factors. For that reason the historical stock price performance is left out of consideration for the remaining of the paper.

2.9.2 International Differences

Differences seem to exist in capital structure determinants across countries. A study by Rajan and Zingales (1995) was one of the first to find that by comparing the G-7 countries. Although the differences were not large, it asked for further research. McClure, Clayton and Hofler (1999) analyzed a sample of firms from the same seven countries and concluded that there still exist significant differences in the capital structures of companies across the G-7 nations.

Other studies have found even larger differences among firms in larger samples consisting of more different countries.[11] An interesting aspect is introduced by De Jong, Kabir and Nguyen (2008) who make a distinction between direct and indirect country factors. The first have, as suspected, a direct effect on a firm's debt ratio and the latter have an effect on firm-specific factors -such as size, growth, risk, etc.- which in turn influence the level of leverage.

Due to the characteristics of the sample in this paper, country-specific factors do not play a role in this study and are therefore not further discussed.[12]

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[11] See for example Song and Philippatos (2004), Demirgüç-Kunt and Maksimovic (1999) and Fan et al. (2006).
[12] In the data section of this paper an elaborate description of the dataset is given.

3. Data and Methods

3.1 Variables

3.1.1 Leverage ratio

In this study four different leverage ratios are used to be explained by seven capital structure determinants, defined by ten measures. The four dependent variables are split up in pairs of short- and long-term debt measures. This is done in order to compare which of the two models, EBITDA or common measure, can be explained best and give an insight it what factors influence capital structure decision making in practice. In prior research a measure that is used very often is debt-to-assets, as can be seen from table 1. This is a simple book value measure that is used as a proxy for the amount of leverage taken on in the capital structure of companies.[13] Here it was chosen to use debt-to-assets as the measure representing the proxy used in many prior studies since the purpose of the research is to find a leverage measure that can be better explained.

As mentioned earlier, the majority of prior studies explained the effect of firm characteristics on long-term debt using book value figures. Some studies (Titman and Wessels, 1988), study the effects of different determinants on various forms of debt and find significant differences in the relationships. In this paper long-term debt and short-term debt in the capital structure is analyzed. Long-term debt usually is the largest share of total debt and most likely to be used for maintaining the optimal debt-ratio. Yet, there is only one firm characteristic that is hypothesized to have a different effect on short- and long-term debt levels. For the common measures, total assets, long- and short-term debt, are measured by their book values as stated in the financial statements of the particular company.

The other leverage ratios, which are expected to be more related to practice, measure the level of debt in a firm in a somewhat different way. They are defined as book value of net long-term debt to EBITDA, with figures again extracted from the firm's financial statements of the years in the sample period.[14] The reasoning behind these measures, as said, is expected to relate much more to practice than the common one. It was described earlier that bankers and other practitioners tend to determine a firm's debt capacity by multiplying EBITDA with some multiplication factor. Hence it is not the amount of total assets that determines the

[13] See for example Friend and Hasbrouck (1987), Friend and Lang (1988), Ferri and Jones (1979) and Kim and Sorensen (1986).
[14] Net long-term debt = Long-term debt – cash and short term investments.

amount of debt a firm is able to take on, but EBITDA. Therefore, the measures introduced in this paper scale net long-term and short-term debt by EBITDA instead of assets.

In some earlier papers on the subject it is stated that using market value of debt resembles current perceptions of investors and practitioners much more than book value does (Sweeney et al., 1997 and Miguel and Pindado, 2001). Yet, as Myers (1977) argues, managers might be distorted by market values of debt, because these incorporate the present value of growth opportunities. That would not be the case with book value of debt and therefore has an advantage for managers to use in their decision making process. From a survey conducted by Stonehill et al. (1973) it can be concluded that this is indeed the case with the majority of corporate managers. As in virtually all textbooks they seem to use book value of debt in making their treasury decisions. Therefore book value of short- and long-term debt is also used in the leverage measure in this study to proxy for the amount of debt in a firm's capital structure.

Lastly, it should be noticed that the leverage ratio of debt-to-EBITDA could take negative values as opposed to the measure of debt-to-assets, because EBITDA can be negative where assets cannot.

3.1.2 Business Risk

The measures for business risk in prior studies are quite diverse. Bradley et al. (1984) for example use the standard deviation in the first difference of EBITDA, scaled by the book value of total assets. Ferri and Jones (1979), on the other hand make use of two different measures, one that measures fluctuations in sales over some years and one that measures deviations in cash flows. One thing that all studies have in common is that they measure a firm's volatility in some way, whether it is in sales, cash flows or earnings. The underlying reasoning is that the more stable figures are over the years, the more predictable the firm's future is and the less risk is involved.

The standard deviation of earnings before interest and taxes (EBIT), scaled by the average EBIT over the sample period is chosen as the main proxy variable for business risk. Scaling on the basis of EBIT instead of total assets is done in order to exclude influences of firm size from the measure. Additionally a second measure of business risk is found in order to test consistency of the results when using different proxies. This second proxy is the standard

deviation of sales over the 2000 to 2006 period, scaled by the average value of sales in that period.[15]

3.1.3 Profitability

For the variable that measures the profitability, earlier studies by Friend and Hasbrouck (1987), Friend and Lang (1988) and Lakshmi (2009) were followed, hence the value of EBIT to book value of total assets was used.

3.1.4 Size

In prior studies, firm size is usually defined as the amount of assets or the value of total sales and most of the times the natural logarithm of these figures is taken in order to correct for non-normality of the sample.[16] In this study it was chosen to use the natural logarithm of the mean of sales during the sample period. The reason that the total value of assets is not chosen is because it might understate the size of companies that are mainly knowledge based and overstate size for firms with many assets.

3.1.5 Collateral Value of Assets

As a measure of the amount of assets that could be utilized as collateral for issued debt, prior studies mainly use fixed assets or net property, plant and equipment figures from the balance sheet as a fraction of total assets.[17] There is not much debate on the idea behind this, because these items are tangible assets that are in the firm for the long-run. Short-term tangible assets as inventory cannot be used as collateral for long-term debt and should therefore definitely not be included in the measure. In this study the net property, plant and equipment item from every company's balance sheet, scaled by the amount of total assets, is used as the proxy for collateral value of assets.

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[15] In the analysis and tables the business risk measures are referred to as EBIT volatility and Sales volatility.
[16] See for example Friend and Hasbrouck (1987) and Friend and Lang (1988) for the use of natural logarithm of total assets as the measure for firm size and Rajan and Zingales (1995) for the natural logarithm of sales.
[17] See for example Marsh (1982) and Rajan and Zingales (1995).

3.1.6 Non-debt Tax Shields

The largest part of non-debt tax shields is coming from depreciation, which is an expense on paper, but not a cash outflow from the firm. Following Kim and Sorensen (1986) and Lakshmi (2009) in this study, the first choice proxy for the size of the non-debt tax shields of a firm is measured by the depreciation charges as stated in the financial statements as a fraction of the total book value of assets. Scaling by assets has a logical rationale due to the fact that depreciation expenses are charged to resemble the balance sheet assets at their current value, correcting for this gives a pure measure of a possible substitute for debt tax shields as explained by DeAngelo and Masulis (1980).[18] In order to ascertain the consistency of the results when another proxy is used, a second non-debt tax shield measure was found, namely depreciation-to-sales.

3.1.7 Growth

Prior studies often did not include a proxy for growth in their set of variables to explain the amount of leverage in a firm; exceptions are Kim and Sorensen (1986) and Lakshmi (2009). Yet, there is no consistency in the measure they use to explain the relation since the first are using growth figures of EBIT and the latter is using the average percentage change in total book value of assets over the sample period used in the study. Hence it cannot be said that there is a consensus of what is a good measure to serve as a proxy for firm growth, but the rationale behind it is clearly that it should represent the pace at which a firm becomes larger. In this paper first of all the average sales growth over the sample period was used. This proxy serves as the main proxy in the analysis. In addition to also test the consistency of the results of the relationship between growth and leverage a second proxy is chosen, the average growth of EBIT from 2000 to 2006.

3.1.8 Asset Intensity

The last capital structure determinant is the level of asset intensity. This explanatory variable is measured as the book value of total assets divided by sales.

[18] In the hypotheses section a more elaborate explanation of this substitutability hypothesis was given.

3.1.9 Hypothesized Relations

Table 2 gives an overview of the expected relations to short- and long-term leverage hypothesized for the different proxy variables of the capital structure determinants.

Table 2: An overview of the expected relations hypothesized for the different proxy variables.

Hypothesis	Proxy Variable	Relation to Net Long-Term Debt	Relation to Short-term Debt
2. Business Risk	EBIT Volatility	-	-
2. Business Risk	Sales Volatility	-	-
3. Profitability	EBIT/BVA	-	-
4. Size	LnSales	+	-
5. Collateral Value of Assets	PPE/BVA	+	+
6. Non-Debt Tax Shield	Depreciation/BVA	-	-
6. Non-Debt Tax Shield	Depreciation/Sales	-	-
7. Growth	Sales Growth	-	-
7. Growth	EBIT Growth	-	-
8. Asset Intensity	BVA/Sales	+	+

3.2 Sample and data collection

For the analysis to be conducted in this study, a large sample of firms was preferred in order to have as much information as possible. In Compustat North America, required financial statement data for the year 2000 was obtained from the entire database, excluding financial companies.[19] The result was a sample of 12348 observations. In order to get a usable dataset, all observations for which some data was missing were deleted, as well as the firms that had no long-term debt in their capital structure.[20]

In the final dataset it was chosen to use multiple-year averages of the financial statement figures for three different reasons. First of all, to measure sales growth and risk it is required to have figures of some sequential years in order to give an estimate.[21] Secondly, using multiple year data reduces the possibility of exceptionally reported figures. Firms can report exceptional figures for one or two years due to a special occurring, accounting manipulation or tricks, but there could also be measurement errors in the dataset. By taking a multi-year

[19] Financial companies were regarded as being all companies with a 4-digit SIC code from 6000 to 6999.
[20] Firms without long-term debt in their capital structure are not relevant for this study.
[21] Measurement of the variables was discussed in the previous section.

average these inconsistencies can be alleviated or become negligible. Thirdly, a firm's debt-ratio usually fluctuates around its optimal level year by year. In order to get as close as possible to the optimal debt-ratio of a firm it is convenient to choose a multi-year observation period, assuming that companies aim to maintain their optimal debt-equity ratio in the long run.

In other studies the methods of data usage are mixed. Some studies do use single-year observations, but these are criticized by for example Titman and Wessels (1988), Friend and Lang (1988), Ferri and Jones (1979) and Jensen, Solberg and Zorn (1992). They all use multiple-year averages and note the alleviation of errors and exceptionally reported figures as the most prominent reason.

The multi-year period chosen here was from 2000 to 2006. The list of firms for which data was available in the year 2000 was used as the basis and supplemented with data for the years to 2006. Again the observations with missing data in one or more of the years in the observation period were deleted from the sample with the result that 2728 companies were left in the sample for which table 3 gives the descriptive statistics. Deleting observations for which data is not available over the entire sample leads to exclusion of firms that went out of business. In that way a bias towards old, large and surviving firms might be induced by the selection method as Shyam-Sunder and Myers (1999) warn for with their sample. If these firms went out of business because of bankruptcy as a consequence of financial distress, caused by inability to meet debt obligations it might therefore be the case that the results in this study are biased towards lower levels of debt.

Table 3: Descriptive statistics (N=2728)

	Minimum	Q1	Median	Q3	Maximum	Mean	St. Dev.
NLTD-to-EBITDA	-954.129	0.072	1.140	2.647	380.847	0.535	27.863
NLTD-to-Assets	0.0004	0.1228	0.2249	0.3356	2.2180	0.2560	0.1958
STD-to-EBITDA	-252.1579	0.1064	0.2847	0.6217	100.6335	0.3499	6.2597
STD-to-Assets	0.0004	0.0194	0.0397	0.0744	0.8046	0.0606	0.0701
Collateral Value of Assets	0.0025	0.1384	0.2859	0.5264	0.9647	0.3408	0.2384
Non-Debt Tax Shield 1	0.0017	0.0324	0.0442	0.0619	0.6657	0.0531	0.0404
Non-Debt Tax Shield 2	0.0007	0.0320	0.0548	0.0946	3.2553	0.0877	0.1315
Sales Growth	-47.33%	3.04%	9.18%	17.90%	470.43%	13.70%	24.71%
EBIT Growth	-5642.72%	-2.49%	10.63%	28.06%	2810.12%	0.66%	193.29%
Size	9.94	14.80	16.00	17.20	21.70	16.02	1.82
EBIT Volatility	-1127.533	0.193	0.391	0.717	163.677	0.033	23.908
Sales Volatility	0.0165	0.1533	0.2512	0.3993	1.8859	0.3091	0.2247
Profitability	-1.1968	0.0417	0.0752	0.1121	0.6955	0.0616	0.1189
Asset Intensity	0.0858	0.7748	1.1781	1.9691	108.4548	1.6918	2.7060

3.3 Outlier Detection

The descriptive statistics shown in table 1 indicate that some variables have very long-stretching tails. These tails may indicate that there are some outliers among the data which could bias the results from the models. In order to prevent the results from being biased, some outliers should be removed, which will not cause problems in a dataset as large as the one here. There are several rules of thumb as well as own judgment that can help determining which observations are outliers and hence should be removed and which should not. One method involves stricter criteria than another leading to more observations being lost. It should become clear from analysis which outlier removal method yields the best results in terms of the most satisfying model.

3.3.1 Standard Deviation Removal

The first method that is used to detect outliers that could possibly bias the results is one of the standard rules of thumb used in several studies. With this method every observation that lies further away than two times the standard deviation from the mean of the initial dataset for a certain variable, will be deleted. This procedure was applied to the dataset with the exception

for the variable size and caused 710 observations to drop out.[22] This leaves 2018 firms for the analyses to test the hypotheses. In table 4 the descriptive statistics of this sample are shown. It shows that there are less extreme values among the observations in this sample than in the entire sample of 2728 observations.

Table 4: Descriptive statistics after standard deviation removal method (N=2018)

	Minimum	**Q1**	**Median**	**Q3**	**Maximum**	**Mean**	**St. Dev.**
NLTD-to-EBITDA	-39.587	0.044	1.101	2.509	33.201	1.212	3.032
NLTD-to-Assets	0.0004	0.1264	0.2189	0.3142	0.6437	0.2317	0.1397
STD-to-EBITDA	-10.8585	0.1361	0.2992	0.5845	11.7053	0.4394	0.8493
STD-to-Assets	0.0004	0.0194	0.0385	0.0679	0.2007	0.0495	0.0405
Collateral Value of Assets	0.0025	0.1490	0.2897	0.5164	0.8175	0.3352	0.2199
Non-Debt Tax Shield 1	0.0017	0.0323	0.0430	0.0580	0.1318	0.0475	0.0223
Non-Debt Tax Shield 2	0.0018	0.0322	0.0509	0.0810	0.3464	0.0661	0.0512
Sales Growth	-24.99%	3.25%	8.78%	16.42%	62.59%	10.50%	11.23%
EBIT Growth	-369.91%	-0.72%	10.52%	26.19%	372.67%	6.44%	69.58%
Size	11.92	15.08	16.19	17.39	21.70	16.29	1.68
EBIT Volatility	-44.273	0.220	0.397	0.685	45.049	0.488	2.828
Sales Volatility	0.0250	0.1449	0.2328	0.3640	0.7821	0.2676	0.1584
Profitability	-0.1720	0.0523	0.0795	0.1157	0.2924	0.0829	0.0609
Asset Intensity	0.4019	0.7992	1.1426	1.7917	12.3911	1.4378	1.0142

It can be seen from table 3 and 4 that there is hardly any difference between the two samples if the value of debt-to-assets is considered. On the contrary, in the smaller sample the average amount of long-term debt is about 1.21 times EBITDA, which is much higher than the 0.54 in the larger sample, indicating that possibly some firms with very high EBITDA dropped out. Regarding short-term debt we see the same difference among the two samples. Furthermore, some extremely high growth and high risk firms are deleted as well which results in a lower average growth rate and business risk in the this sample. Especially the descriptive statistics of the EBIT growth and volatility measures changed drastically, now resembling a much nicer picture than before. This indicates that some companies with extremely fluctuating profits dropped out of the sample. Yet, the average profitability is higher in this sample which

[22] From personal judgment the observations for the variable size did not seem to be extreme outliers that could possibly bias the results. Due to the fact that the natural logarithm of sales was used the distribution of the observations was not to be called extreme or problematic anymore.

indicates that it consists of a larger share of firms that use their assets more efficiently. These differences in characteristics between both samples indicate that the smaller one probably consists of a larger fraction of mature firms, which could mean that the bias towards old, large and surviving firms, mentioned earlier, is even larger.

3.3.2 Interquartile Range Removal

Another commonly used method of outlier detection and removal is to delete every observation that is more than three times the interquartile range below the highest value in the lowest quartile of the data of a certain variable or more than three times the interquartile range above the lowest value in the highest quartile.[23] This selection method causes 827 observations to drop out of the original sample, leaving 1901 for hypotheses testing.[24] Table 5 shows the descriptive statistics for the sample resulting from the interquartile range removal method.

Table 5: Descriptive statistics after interquartile range removal method (N=1901)

	Minimum	**Q1**	**Median**	**Q3**	**Maximum**	**Mean**	**St. Dev.**
NLTD-to-EBITDA	-6.237	0.222	1.189	2.558	9.512	1.417	1.937
NLTD-to-Assets	0.0004	0.1347	0.2322	0.3284	0.9650	0.2526	0.1666
STD-to-EBITDA	-1.3595	0.1263	0.2731	0.5164	2.1226	0.3816	0.3861
STD-to-Assets	0.0004	0.0184	0.0370	0.0659	0.2372	0.0485	0.0413
Collateral Value of Assets	0.0025	0.1641	0.3103	0.5399	0.9647	0.3603	0.2345
Non-Debt Tax Shield 1	0.0017	0.0323	0.0423	0.0568	0.1397	0.0467	0.0219
Non-Debt Tax Shield 2	0.0018	0.0305	0.0485	0.0801	0.2798	0.0640	0.0498
Sales Growth	-21.85%	3.98%	9.17%	16.35%	62.17%	10.98%	10.85%
EBIT Growth	-93.63%	3.16%	12.09%	26.38%	116.11%	15.06%	29.01%
Size	11.92	15.22	16.30	17.46	21.70	16.39	1.64
EBIT Volatility	-1.344	0.223	0.373	0.596	2.234	0.453	0.365
Sales Volatility	0.0250	0.1400	0.2245	0.3511	1.1058	0.2636	0.1680
Profitability	-0.1668	0.0634	0.0874	0.1217	0.3182	0.0968	0.0529
Asset Intensity	0.2752	0.7574	1.1072	1.8070	12.3911	1.4216	1.0509

[23] The quartiles are given in the descriptive statistics. Every quartile contains 25% of the observations; the ones with the lowest values are in the lowest quartile and the ones with the highest values in the highest quartile. The highest value in the lowest quartile is indicated in the descriptive statistics by Q1 and the lowest value in the highest quartile is given by Q3. The interquartile range is defined as the distance between Q1 and Q3.

[24] As with the standard deviation removal method, this method was not applied to the variable size for similar reasons. See footnote 10.

The sample obtained with this method of outlier removal has approximately the same differences with the original sample as the one resulting from the standard deviation removal method. It probably also contains more mature firms with lower risk and growth rates making more efficient use of their assets. For that reason it could also be that a possible bias towards old, large firms is magnified as compared to the original sample.

One striking difference between the two outlier removal methods is that the interquartile range removal method sample has an average EBIT growth that is more than twice as high as in the other sample, but a much smaller variance, because it excluded some very high negative and positive growth firms from the sample. The firms in this sample are also a bit more levered considering the NLTD-to-EBITDA measure. Finally, it should be noted that the interquartile range method drops more observations from the initial sample leading to a larger loss of information.[25]

3.3.2.1 No Negative Profitability

In order to possibly obtain an even better model, the firms that have on average a negative profitability over the entire sample period of seven years could be removed from the sample. This would remove another 20 observations from the sample obtained by the interquartile range removal method. Now 1881 observations are left in the sample for which table 6 shows the descriptive statistics.

[25] This, however, will not be a problem because the size of the sample is still very large.

Table 6: Descriptive statistics after interquartile range removal method and deleting negative profit observations (N=1881)

	Minimum	Q1	Median	Q3	Maximum	Mean	St. Dev.
NLTD-to-EBITDA	-6.237	0.229	1.189	2.547	9.512	1.407	1.898
NLTD-to-Assets	0.0004	0.1361	0.2326	0.3280	0.9650	0.2527	0.1662
STD-to-EBITDA	0.0022	0.1303	0.2780	0.5212	2.1226	0.3916	0.3740
STD-to-Assets	0.0004	0.0184	0.0371	0.0662	0.2372	0.0486	0.0414
Collateral Value of Assets	0.0025	0.1654	0.3124	0.5410	0.9647	0.3621	0.2346
Non-Debt Tax Shield 1	0.0017	0.0322	0.0423	0.0567	0.1397	0.0466	0.0217
Non-Debt Tax Shield 2	0.0018	0.0304	0.0483	0.0794	0.2798	0.0634	0.0493
Sales Growth	-19.95%	3.98%	9.13%	16.28%	62.17%	10.94%	10.73%
EBIT Growth	-93.63%	3.20%	12.16%	26.38%	116.11%	15.10%	29.05%
Size	11.92	15.24	16.33	17.49	21.70	16.41	1.63
EBIT Volatility	0.011	0.230	0.375	0.601	2.234	0.465	0.343
Sales Volatility	0.0250	0.1390	0.2225	0.3475	1.1058	0.2616	0.1665
Profitability	0.0057	0.0643	0.0880	0.1222	0.3182	0.0991	0.0484
Asset Intensity	0.2752	0.7540	1.1015	1.8046	12.3911	1.4102	1.0349

The rationale behind removing the negative profit firms is that these firms show on average a negative profit over a period of seven years. This could indicate that these firms are in economic distress for several years and are therefore not healthy businesses. In order to draw meaningful conclusions on the decision process about the capital structure of firms in normal circumstances it is probably better to exclude firms that are in an economically distressed situation.

3.3.3 Comparison of the Samples

In order to give a clear overview of the distribution of the four different samples resulting from the different outlier removal methods, table 7 shows the mean and standard deviation of every selection of observations.

Table 7: Mean and standard deviation of the four different samples

	Initial Sample		Standard Deviation Removal		Interquartile Range Removal		No Negative Profitability	
	Mean	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**
LTD-to-EBITDA	0.5354	27.8631	1.2122	3.0317	1.4173	1.9371	1.4065	1.8980
LTD-to-Assets	0.2560	0.1958	0.2317	0.1397	0.2526	0.1666	0.2527	0.1662
STD-to-EBITDA	0.3499	6.2597	0.4394	0.8493	0.3816	0.3861	0.3916	0.3740
STD-to-Assets	0.0606	0.0701	0.0495	0.0405	0.0485	0.0413	0.0486	0.0414
Collateral Value of Assets	0.3408	0.2384	0.3352	0.2199	0.3603	0.2345	0.3621	0.2346
Non-Debt Tax Shield 1	0.0531	0.0404	0.0475	0.0223	0.0467	0.0219	0.0466	0.0217
Non-Debt Tax Shield 2	0.0877	0.1315	0.0661	0.0512	0.0640	0.0498	0.0634	0.0493
Sales Growth	13.70%	24.71%	10.50%	11.23%	10.98%	10.85%	10.94%	10.73%
EBIT Growth	0.66%	193.29%	6.44%	69.58%	15.06%	29.01%	15.10%	29.05%
Size	16.0186	1.8202	16.2868	1.6842	16.3884	1.6429	16.4126	1.6300
EBIT Volatility	0.0329	23.9080	0.4883	2.8284	0.4526	0.3648	0.4652	0.3434
Sales Volatility	0.3091	0.2247	0.2676	0.1584	0.2636	0.1680	0.2616	0.1665
Profitability	0.0616	0.1189	0.0829	0.0609	0.0968	0.0529	0.0991	0.0484
Asset Intensity	1.0118	0.7422	0.9623	0.5061	1.0278	0.6186	1.0321	0.6191
N	2728		2018		1901		1881	

3.4 Multiple Regression Analysis

The dataset is analyzed by means of multivariate models using the ordinary least squares regression method. As stated in the hypotheses section, four different dependent variables will be used in order to obtain four different models. These are a NLTD-to-assets, a NLTD-to-EBITDA, a STD-to-assets and a STD-to-EBITDA measure. Ten independent variables are included in the regression model in order to test the hypotheses by means of t-tests on the significance of the different coefficients. Hypotheses 1 will be tested by comparison of the R^2 of both models which represents the fit of the data in the regression model. In order to deal with possible problems of heteroscedasticity in the model the standard errors will be corrected according to White's (1980) correction. Applying this correction makes sure that there is no heteroscedasticity bias in the standard errors of the coefficients of the regression model. Table 8 shows a definition of all the variables included in the models.

Table 8: Definitions of the variables

Variables	Definition
NLTD-to-EBITDA	Average ratio of net long-term debt and EBITDA from 2000 to 2006.
NLTD-to-Assets	Average ratio of net long-term debt and total book value of assets from 2000 to 2006.
STD-to-EBITDA	Average ratio of short-term debt and EBITDA from 2000 to 2006.
STD-to-Assets	Average ratio of short-term debt and total book value of assets during the period from 2000 to 2006
Collateral Value of Assets	Average ratio of net property, plant and equipment to total book value of assets from 2000 to 2006.
Non-Debt Tax Shield 1	Average ratio of depreciation to total book value of assets over the period from 2000 to 2006.
Non-Debt Tax Shield 2	Average ratio of depreciation to sales from 2000 to 2006.
Sales Growth	Average annual sales growth over the period from 2000 to 2006.
EBIT Growth	Average annual growth of EBIT during the years 2000 to 2006.
Size	Natural logarithm of average value of sales from 2000 to 2006.
EBIT Volatility	Standard deviation of EBIT over the period from 2000 to 2006, scaled by the average EBIT over that period.
Sales Volatility	Standard deviation of sales during the period of 2000 to 2006, divided by the average value of sales during the period.
Profitability	Average ratio of EBIT to total book value of assets from 2000 to 2006.
Asset Intensity	Average ratio of book value of assets to sales from 2000 to 2006.

4. Empirical Results

4.1 Comparison of Outlier Removal Methods

In this paper there were three different methods proposed to find and remove outliers from the initial dataset. The purpose of outlier removal is to obtain a sample which provides proper data in order to test the hypotheses. As mentioned earlier, the amount of observations dropped and labeled as outliers, depends on the method used. In order to determine the most appropriate outlier removal method for the hypotheses testing in this study, I first ran the main regressions, including the seven first choice proxy variables, on all three samples.[26] The results from the twelve regressions -four for each method of outlier removal- showed some similarities, but also some striking differences. [27] Table 9 shows the adjusted-R^2 statistics obtained from them. For two of the three methods, the NLTD-to-EBITDA model has a higher explanatory power than the NLTD-to-Assets model and for STD even in all three cases. It is remarkable that only for the standard deviation removal method, the NLTD-to-EBITDA

[26]The first choice proxy variables are: EBIT Volatility (business risk), EBIT/BVA (profitability), LnSales (size), PPE/BVA (collateral value of assets), Depreciation/BVA (non-debt tax shield), Sales Growth (growth) and BVA/Sales (asset intensity).

[27] The results from these regressions are discussed later on in the paper.

model does not give a better insight in the capital structure than the NLTD-to-Assets model and therefore this outcome will be further discussed later in the paper.

As can be seen from the table, the sample resulting from the interquartile range removal method that leaves out firms with a negative average profitability over the sample period yields the regressions with the highest explanatory power in terms of fit of the models. Because of the rationale that this sample leaves out firms that possibly suffer from economic distress and because it yields the highest fit in the models, it was chosen to continue with this set of observations as the main sample in this study. Results from the models ran on the other two samples are shown in the appendices 1 and 2, but will only be discussed in this paper when strictly relevant.

Table 9: Comparison of adjusted-R^2 statistics of the three different outlier removal methods.

	Standard Deviation Removal	**Interquartile Range Removal**	**Interquartile Range Removal (No Negative Profitability)**
NLTD-to-EBITDA	0.101	0.235	0.259
NLTD-to-Assets	0.113	0.092	0.111
STD-to-EBITDA	0.034	0.125	0.146
STD-to-Assets	0.021	0.011	0.011

4.2 Multicollinearity

Due to the fact that some measures included in the analysis incorporate similar financial statement items, there could be problems with multicollinearity in the data. This is certainly the case with the variables that are double-defined. Multicollinearity between some variables could bias the standard errors of the regression coefficients upwards. This negative effect is strongest if samples are small and variances of the explanatory variables are low. The sample sizes and variances of the variables in this paper are not small which makes multicollinearity unlikely to be a problem.

Usually for samples of the sizes as the ones in this study, multicollinearity problems start to play a role if the correlation between two independent variables is over 0.9. In Appendix 3 a table shows the correlations between all variables and measures from the main sample. The second non-debt tax shield measure correlates with the first measure of this variable, with asset intensity and with the collateral value of assets variables, but the magnitude is not

raising concerns. Furthermore, it can be seen that sales volatility and growth have quite a high correlation coefficient, but not close to 0.9, so no problems with multicollinearity are expected in this dataset.

4.3 Findings

4.3.1 Empirical Results

Table 10 presents the results from the four regressions. The four different measures of leverage, two for net long-term debt and two for short-term debt, are regressed on the seven main proxies. The explanatory power of the NLTD-to-EBITDA model is more than twice as high as that of the NLTD-to-Assets model, this supports hypothesis 1a. Apparently the capital structure determinants are better able to explain differences in debt ratios among firms when this ratio is defined in a manner used commonly by practitioners. The adjusted-R^2 of the NLTD-to-EBITDA model is 0.259 and of the more standard NLTD-to-Assets model 0.111. Concerning the models for short-term debt, similar results regarding the first hypothesis were obtained. The adjusted-R^2 for the STD-to-EBITDA regression model is 0.146 opposed to the 0.011 from the STD-to-Assets model. This provides support for hypothesis 1b, which stated that the short-term leverage can be better explained when using a STD-to-EBITDA measure than when it is defined as STD-to-Assets. It can be seen from table 9 that for all three outlier removal methods the fit of the models for STD-to-EBITDA is higher than for STD-to-Assets. For the long-term debt models, the fit is more than twice as high in two of the three cases and the difference very small in the other. These findings provide even stronger support for hypotheses 1a and 1b.

Table 10: Effect of the capital structure determinants on the different leverage measures (t-values within parentheses).

	Net Long-Term Debt		Short-Term Debt	
	NLTD/EBITDA	**NLTD/Assets**	**STD/EBITDA**	**STD/Assets**
Intercept	2.826***	0.406***	0.596***	0.047***
	(6.453)	(10.267)	(6.389)	(4.171)
EBIT Volatility	-0.942***	-0.066***	0.081***	0.004
	(-6.088)	(-5.752)	(2.713)	(1.226)
EBIT/BVA	-12.924***	-0.669***	-2.346***	-0.032
	(-16.084)	(-8.177)	(-14.207)	(-1.400)
LnSales	-0.019	-0.008***	0.007	0.000
	(-0.835)	(-4.045)	(1.300)	(0.445)
PPE/BVA	1.641***	0.055***	0.102**	0.006
	(7.453)	(2.823)	(2.437)	(1.176)
Depreciation/BVA	-6.022***	0.674***	-2.597***	0.042
	(-2.754)	(2.919)	(-6.590)	(0.808)
Sales Growth	-0.600	-0.005	-0.358***	-0.038***
	(-1.390)	(-0.116)	(-3.864)	(-3.602)
BVA/Sales	0.258***	0.021***	0.002	-0.001
	(4.978)	(4.842)	(0.165)	(-0.820)
Adjusted R^2	0.259	0.111	0.146	0.011
Number of Observations	1881	1881	1881	1881

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

The analysis does find support for hypothesis 2 regarding NLTD. EBIT volatility, which is the proxy for business risk in this model, shows a significant negative relation with NLTD in both the EBITDA and the assets model.[28] For STD the results are contradictory, business risk seems to be positively related to the STD-to-EBITDA leverage measure, with the relation being significant at the 1% level. For the STD-to-Assets measure the table shows an insignificant negative relation. This does not support my hypothesis of a negative relation between business risk and STD, in contrast it does support arguments and results of Myers (1977), Bennet and Donnely (1993) and Lakshmi (2009). Hence it may be the case that the lower agency costs in firms with higher risk, as explained by Myers, only affect the amount of short-term debt in the capital structure. Indeed Myers does conclude that firms with many risky growth options, so with high business risk, should use more short-term debt instead of long term debt, because the underinvestment problem he describes is dissolved when the

[28] As can be seen from Appendices 1 and 2, the relation is also significantly negative for the interquartile range removal method sample, but not for the standard deviation method sample.

exercise decision of the growth options is made after the debt matures. Yet, the negative relation of risk and long-term leverage and positive relation of risk and short-term leverage might also come from the fact that when a firm is riskier, long-term debt, which is often for a large share publicly raised, is harder to negotiate than short-term debt which is most often supplied by banks.

Support is also found for hypothesis 3, which follows from the pecking order theory. Profitability was expected to be negatively related to leverage since firms prefer to use internal funds over external funds. Firms with higher profitability have more cash available and are therefore less dependent on external financing. For all models, the analysis shows a negative effect of profitability on the leverage ratio of firm, which is only insignificant for the STD-to-Assets model. In the Appendices 1 and 2, the results from the regressions with the samples from the other outlier removal methods show that the hypothesized negative relation between profitability and leverage also finds support there.

Concerning size, two opposing effects for NLTD and STD were hypothesized, positive and negative respectively. Yet, as shown in table 10 only a very small significant, but negative, effect was found for the NLTD-to-Assets leverage measure, which contradicts hypothesis 4a. For the NLTD-to-EBITDA model, only an insignificant negative relation was found which leads me to draw the conclusion that there is no evidence found to support hypothesis 4a. A similar conclusion has to be drawn for the short-term debt models which both yield very small and insignificant positive relations for size. So both hypotheses 4a and 4b do not find support from the analysis and it therefore seems that NLTD and STD are not related to size.[29] It can therefore not be concluded that small firms rely more on short-term loans and large firms more on long-term public debt because of differences in debt issuance costs, as stated by Barclay and Smith (1995) or because of differences in diversification as Fama and Jensen (1983) conclude. The results are more favorable for the arguments of Barclay and Smith when they say that large firms often have foreign operations which they could finance with foreign debt, issued in markets that are less liquid than in their home country. This would lead larger firms to make more use of short-term and less of long-term debt, which is a result that comes out of the analysis. Yet, since the relations found are not significant, except for one, conclusions should be drawn with care.

[29] Only in the analysis on the sample resulting from the standard deviation removal method the hypothesized positive relationship between long-term leverage and size was found to be significant, as illustrated in Appendix 1.

The analysis finds support for hypothesis 5. All models, except the STD-to-Assets, find a significant positive relation between the collateral value of assets and debt in the capital structure.[30] Apparently if a firm has higher collateral value to secure its debt, it faces lower costs of borrowing, leading it to take on more debt in the capital structure. This relation was also found by, among others, Marsh (1982) and Rajan and Zingales (1995).

The results regarding the non-debt tax shield are slightly ambiguous. For the NLTD-to-EBITDA and STD-to-EBITDA models, significant negative relations were found which supports the hypothesis.[31] On the contrary, NLTD-to-Assets and STD-to-Assets seem to be positively related to the non-debt tax shield proxy, where only the first relation is significant. This ambiguity might have been caused by the fact that the proxy and the standard leverage measure both are denominated by the book value of assets, leading to distorted coefficients while the true effect is measured by the proxy regressed on the more practical leverage measure. Therefore care is needed when drawing conclusions about hypothesis 6 when leverage is measured by a measure scaled by assets and the proxy for the non-debt tax shield also. However, it can confidently be said that support for hypothesis 6, a negative relation between leverage and the non-debt tax shield, was found for the EBITDA-models, but not for the Assets-models.

Regarding hypothesis 7, a negative relationship is expected between growth and short- and net long-term leverage, because of high agency costs in young and growing firms. As shown in table 10, the analysis does not yield strong support for this hypothesis in the net long-term debt models.[32] The relation, as shown in the table, is as hypothesized, but not significant in both the long-term debt models. For the short-term debt models the results seem to be more satisfactory, in both models a significant negative relationship between growth and leverage is found. Hence concerning short-term debt, the analysis supports hypothesis 7 of a negative relationship between growth and short-term debt in the capital structure, but not enough evidence was found considering long-term debt.

Asset Intensity was hypothesized to be positively related to leverage. As illustrated in the table, evidence supporting hypothesis 8 for the two long-term debt models was found. In both, the NLTD-to-EBITDA and the NLTD-to-Assets model, a significant positive relation

[30] Similar results were found in with the samples from the other two outlier removal methods.
[31] The results from the analyses of the samples from the other two outlier removal methods are similar.
[32] For the analysis on the sample from the interquartile range removal method a significant negative relation was found between growth and NTLD-to-EBITDA, as shown in Appendix 2.

between leverage and asset intensity was found. Hence firms, with a high assets-to-sales ratio, like in the manufacturing and telecom industry tend to have more long-term debt in their capital structure. In the short-term debt models only very small and insignificant effects were found, of which one is positive and one negative. In conclusion, the analysis does find support for hypothesis 8 regarding long-term, but not considering short-term debt.[33]

4.3.2 Robustness Checks

4.3.2.1 Standard Deviation Removal Method

It was found that the regression models run on the samples resulting from the various outlier removal methods, incorporating all the first choice proxies for the capital structure determinants, do not all lead to the same conclusion regarding hypothesis 1a, that a NLTD-to-EBITDA leverage measure could be better explained than a NLTD-to-Assets ratio. This was the case for the samples from the interquartile range removal methods, with and without firms in economic distress, but not for the sample resulting from the standard deviation removal method. The explanatory power of the NLTD-to-EBITDA model was slightly lower than of the NLTD-to-Assets model in that sample, which asks for further investigation. There are several reasons that could cause this contrasting result concerning the fit of the models. In table 11 the results of additional regression models are shown in order to see whether support for hypothesis 1 could be found from the data from the standard deviation removal method sample when alternative proxies are used to represent the capital structure determinants.

[33] The results are consistent with the analyses from all three samples, resulting from the different outlier removal methods.

Table 11: Robustness checks for the standard deviation removal method (t-values within parentheses).

	(1)		(2)	
	NLTD-to-EBITDA	**NLTD-to-Assets**	**NLTD-to-EBITDA**	**NLTD-to-Assets**
Intercept	-1.083	0.150***	-2.052***	0.114***
	(-1.365)	(4.881)	(-2.651)	(3.864)
EBIT Volatility				
Sales Volatility	-2.679**	-0.043*	-2.697**	-0.045*
	(-2.532)	(1.653)	(-2.563)	(-1.679)
EBIT/BVA	-8.724***	-0.302***	-8.613***	-0.276***
	(-4.893)	(-5.342)	(-4.911)	(-4.867)
LnSales	0.188***	0.004**	0.203***	0.005***
	(4.520)	(2.414)	(4.882)	(2.791)
PPE/BVA	3.070***	0.156***	2.783***	0.134***
	(9.309)	(10.285)	(8.851)	(9.017)
Depreciation/BVA	-17.389***	-0.558***		
	(-5.772)	(-3.926)		
Depreciation/Sales			-6.664***	0.002
			(-2.737)	(0.017)
EBIT Growth				
Sales Growth	1.756	-0.004	2.062	0.008
	(1.086)	(-0.095)	(1.287)	(0.192)
BVA/Sales	0.202**	0.018***	0.478***	0.021***
	(2.241)	(4.436)	(3.782)	(3.879)
Adjusted R^2	0.111	0.114	0.104	0.108
Number of Observations	2018	2018	2018	2018

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Table 11 (continued): Robustness checks for the standard deviation removal method (t-values within parentheses)

	(3)		(4)	
	NLTD-to-EBITDA	**NLTD-to-Assets**	**NLTD-to-EBITDA**	**NLTD-to-Assets**
Intercept	1.993***	0.217***	-0.979	0.158***
	(6.460)	(17.886)	(-1.280)	(5.134)
EBIT Volatility				
Sales Volatility	-2.924***	-0.049*	-2.104***	-0.056***
	(-2.715)	(-1.863)	(-4.050)	(-2.835)
EBIT/BVA	-7.826***	-0.283***	-8.963***	-0.342***
	(-4.242)	(-5.013)	(-5.130)	(-6.165)
LnSales			0.184***	0.004**
			(4.504)	(2.395)
PPE/BVA	3.291***	0.161***	3.073***	0.154***
	(9.628)	(10.681)	(9.344)	(10.164)
Depreciation/BVA	-18.755***	-0.588***	-17.753***	-0.550***
	(-6.242)	(-4.147)	(-6.021)	(-3.883)
Depreciation/Sales				
EBIT Growth			0.301*	0.012***
			(1.771)	(2.667)
Sales Growth	1.651	-0.006		
	(1.018)	(-0.153)		
BVA/Sales	0.184**	0.018***	0.203**	0.017***
	(2.005)	(4.347)	(2.266)	(4.345)
Adjusted R^2	0.102	0.112	0.113	0.117
Number of Observations	2018	2018	2018	2018

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

As can be seen from the table, every alternative set of proxy variables is regressed on both leverage measures, the NLTD-to-EBITDA and NLTD-to-Assets. In the first model EBIT Volatility, which is the first choice proxy for business risk, is substituted by its alternative, Sales Volatility. This is done because it became clear from table 7, that the standard deviation of the EBIT Volatility data was much higher in the standard deviation removal method sample than in the other two samples. It could therefore be the case that this variable distorts the outcome of the regression models for the standard deviation removal method sample, shown in Appendix 1. The differences in standard deviations for the Sales Volatility proxy are very similar among the three samples which could make this a better proxy to incorporate in the model. As illustrated in table 11, the business risk proxy shows a significant negative

relation to leverage in the EBITDA and the Assets model. This relation is as hypothesized and did not find support in the initial model from this sample. The other variables again all show the same effect on leverage, except for the relation of Sales Growth which is still insignificant, but now positive in the EBITDA model. However, as can be seen from the adjusted-R^2 of both models, the fit of the NLTD-to-Assets model is still highest. Apparently the difference in the standard deviations of the EBIT Volatility proxy among the three samples is not causing the lower explanatory power of the NLTD-to-EBITDA model.

In the initial models, analyzing the interquartile range removal method sample without economically distressed firms, the relations of the non-debt tax shield to leverage were contradictory for the NLTD-to-EBITDA and NLTD-to-Assets models. The first turned out to be, as hypothesized, negatively related, but the latter showed a positive relation. As mentioned earlier, this ambiguity could be caused by the nature in which the first choice measure of the non-debt tax shield is defined. Namely it is scaled by the book value of assets, as is the case with the NLTD-to-Assets leverage measure. This could cause the relation to be positive, as opposed to what is hypothesized. Yet, in the models shown in Appendix 1, analyzing the standard deviation removal method sample, the non-debt tax shield is negatively related to both long-term leverage measures. Apparently there is a difference among the three samples that causes the variation in the direction of the relation. Hence it could possibly be better to use the alternative non-debt tax shield proxy and see whether such a model could then find support for hypothesis 1a from the standard deviation removal method sample. Model 2 in table 11 incorporated the alternative proxy for the non-debt tax shield, which shows a significantly negative relation with the EBITDA leverage measure, but a very small and insignificant positive effect on NLTD-to-Assets. Yet, again the Assets model has a higher fit of the model, leading me to draw the conclusion that the ambiguity in the non-debt tax shield relations is not the cause of the low explanatory power for the NLTD-to-EBITDA models in this sample either.

Then there is a third remarkable difference between the outcomes of the models analyzing the different samples. For the interquartile range removal method sample without economically distressed firms, none of the models finds a significant effect of size on leverage. However, the size is found to be significantly positively related to NLTD-to-EBITDA and NLTD-to-Assets in the models analyzing the sample resulting from the standard deviation removal method. Hence it might be the case that size causes the different conclusions drawn regarding hypothesis 1a for the three samples. Therefore, model 3 in table 11 incorporates the same

proxies as model 1, for similar reasons, but leaves out the variable size. As shown in the table, the results from model 1 and 3 are very similar in terms of significance of the coefficients and unfortunately also concerning the fit of the models. Again the fit of the Assets model is higher than of the EBITDA. Hence it should be concluded that the size variable is not causing the problem either.

The fourth model in table 11 also incorporates the same proxies as the first model, except for that it substitutes the Sales Growth proxy for its alternative, EBIT Growth. Since EBIT Growth has similar problems as EBIT Volatility regarding differences in standard deviations among the different samples, this model is not expected to bring the cause of the low fit for the EBITDA models in this sample to light. However, the reason that it is shown in the table is that it turns out to be the best model, in terms of explanatory power, of all models analyzing this sample.

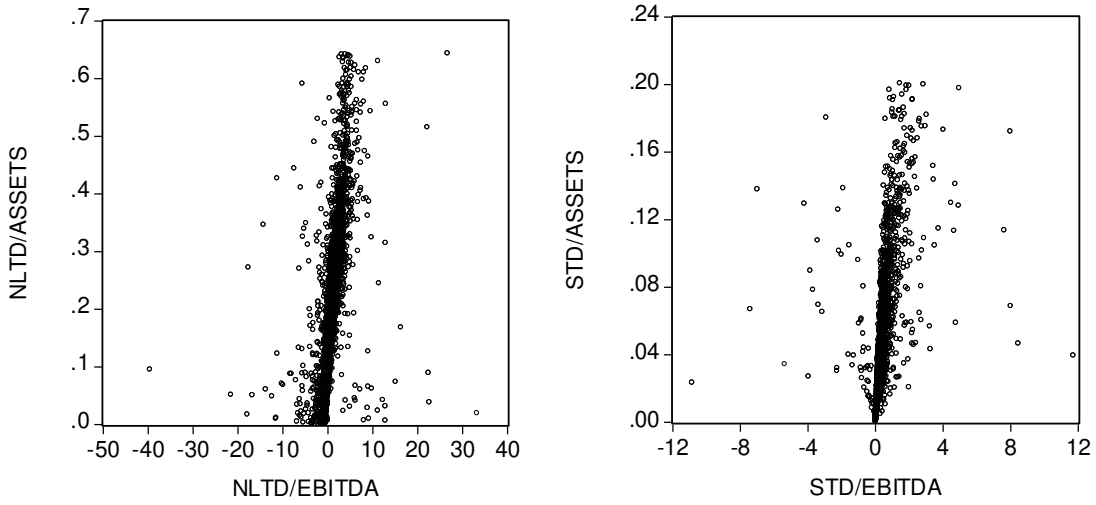
Since the relatively low explanatory power of the EBITDA models analyzing the standard deviation removal method samples compared to the ones analyzing the interquartile range removal method samples without negative profitability firms could not be explained by the choice of the proxy variables, the cause of the problem should be found somewhere else. If the proxies are not the problem, then it might be the case that the dependent variables themselves are it. This does indeed seem to be the case, since the standard deviation of the NLTD-to-Assets leverage measure is quite similar over the three samples, but the standard deviation of NLTD-to-EBITDA is much higher in the standard deviation removal method sample than in the other two samples. The same problem is present among the short-term leverage measures. In figure 1 the scatter plots of the EBITDA and Assets leverage proxies for short- and long-term debt are presented for the standard deviation removal method and the interquartile range removal method without economically distressed firms. It can be seen from the upper graphs that there are some observations for the NLTD-to-EBITDA variable that are far away from the majority of the other observations in the standard deviation removal method sample, while they are reasonably uniformly spread for the NLTD-to-Assets measure. As mentioned earlier, this is also the case with short-term leverage measures. Despite of the fact that there are only a small number of observations that take extreme values, these can have a disastrous effect on the fit of the models, as is the case in this study.[34, 35]

[34] The interquartile range removal method sample contains 137 observations less than the standard deviation removal method sample, of which apparently the majority is shown in the upper graphs in figure 1 as the observations that lay at some distance from the other observations.

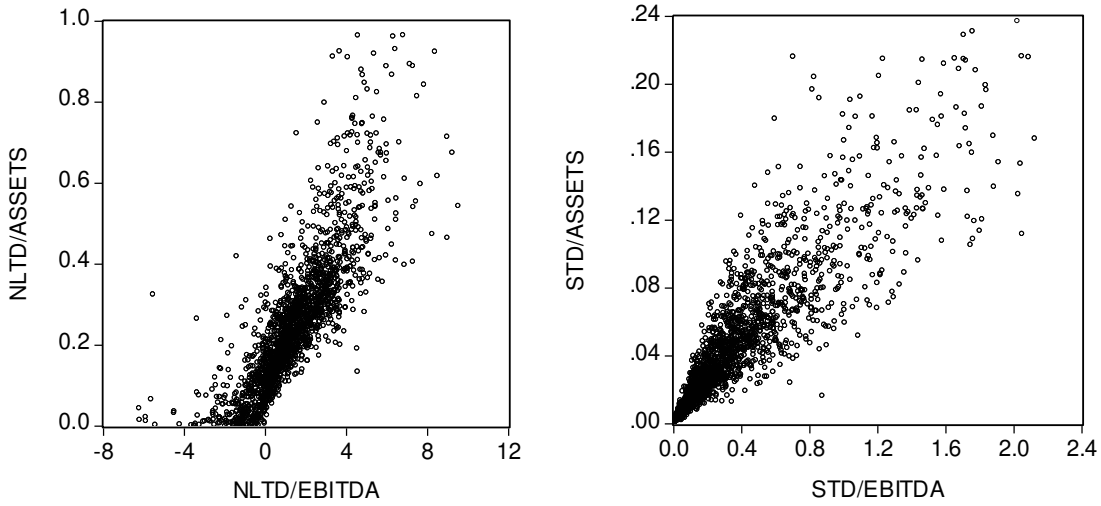
So it can be concluded that the standard deviation outlier removal method did leave some outcome distorting outliers in the sample that cause the low explanatory power of the EBITDA models for long- and short-term leverage. However, the outliers are not that extreme in the short-term leverage case that the explanatory power of the Assets model is higher than that of the EBITDA model, but still the latter has a very low fit as compared to the results from the analyses of the other two samples.

Figure 1: Scatterplots of the dependent variables from the samples resulting from the standard deviation outlier removal method and the interquartile range outlier removal method without negative profitability firms.

Standard deviation removal method



Interquartile range removal method, no negative profitability



[35] The reason that the effect of an outlier can be disastrous for the fit of the model is because the residuals are squared in the R^2 calculation. The higher the sum of squared residuals, the lower the explanatory power of the model.

4.3.2.2 Net Long-Term Debt

In order to test the consistency and validity of the results obtained in the empirical results section regarding the relations of the capital structure determinants with leverage, four additional regression analyses are run. Due to the nature of their definition, some variables might influence one and another or may be better represented by an alternative proxy. Despite of the fact that multicollinearity is found not to be a concern in this sample and will not bias the standard errors, the coefficients might be biased. Table 12 shows four additional models that were run on the NLTD-to-EBITDA leverage measure. This measure turned out to be the best measure of leverage to explain the capital structure and is therefore used here.

Table 12: Robustness checks for net long-term debt (t-values within parentheses).

	NLTD-to-EBITDA			
	(1)	**(2)**	**(3)**	**(4)**
Intercept	2.500***	1.473***	2.757***	1.910***
	(15.575)	(3.485)	(6.328)	(4.485)
EBIT Volatility	-0.985***		-1.008***	
	(-7.011)		(-6.977)	
Sales Volatility		-0.898***		-0.058
		(-3.188)		(-0.141)
EBIT/BVA	-13.318***	-11.899***	-13.614***	-11.138***
	(-17.464)	(-14.830)	(-17.398)	(-13.565)
LnSales		0.017	-0.015	0.006
		(0.750)	(-0.669)	(0.270)
PPE/BVA	1.602***	1.810***	1.589***	1.958***
	(7.244)	(8.244)	(7.186)	(8.825)
Depreciation/BVA	-5.510**		-5.399**	-9.104***
	(-2.504)		(-2.445)	(-4.220)
Depreciation/Sales		-4.172***		
		(-3.034)		
EBIT Growth		0.388**	0.243	
		(1.964)	(1.404)	
Sales Growth				-1.411**
				(-2.148)
BVA/Sales	0.256***	0.437***	0.253***	0.272***
	(4.915)	(6.870)	(4.902)	(5.222)
Adjusted R^2	0.259	0.232	0.260	0.235
Number of Observations	1881	1881	1881	1881

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

In the initial model, the variables size and growth turned out to be insignificant. A Wald joint significance test was performed on the two which could not reject the null-hypothesis of no joint significance.[36] Hence the two variables did not contribute enough to the analysis in terms of additional information about the differences in capital structures among the firms in the sample. Therefore they are left out of the analysis in the first model in table 12 in order to see whether the explanatory power of the model stays the same. As shown in the table, the coefficients of the other variables hardly change and all stay significant at the same level as in the initial model and the adjusted-R^2 is again 0.259.

The second model in table 12 included the alternative proxies for the business risk, non-debt tax shield and growth variables instead of the main proxies. This is done in order to see whether an alternative proxy would yield the same result in a regression analysis. If both proxies truly reflect the variable they represent, the relations with the debt ratio should be equal. As illustrated in the table, the results indeed show similar results for the alternative risk and non-debt tax shield proxy, both have again a significantly negative effect on leverage which supports hypotheses 2 and 6. To continue, in the initial regression model, Sales Growth turned out to have an insignificant negative effect. However, the alternative growth proxy, EBIT Growth, now shows a positive relation with long-term leverage and the relation is significant at the 5% level. This contradicts hypothesis 7 of a negative relationship between firm growth and long-term leverage. In this first model, the relations of the other determinants to long-term leverage are merely the same as in the initial model in terms of magnitude and significance. Remarkably enough, despite of the fact that growth now seems to have a significant effect, the explanatory power of the entire model is lower than in the initial model, indicating that the main set of proxy variables is better able to explain the differences in capital structures among firms.

As mentioned earlier, the variable growth turned out to have an insignificant effect in the initial regression model. Yet, Barclay and Smith (1995) and Myers (1977) argue that growth does have an effect on the capital structure decision. In the second model in table 12, the alternative growth proxy did turn out to be significant, despite the lower explanatory power of the model. For that reason it might yield useful information if all first choice proxies are used, except for the growth proxy. Hence in model 3, EBIT Growth is used as the proxy for growth and for all other variables the proxies that were used in the initial model are incorporated.

[36] Output of the Wald coefficient test is not reported here.

Despite the fact that the explanatory power of the model is slightly higher, growth still does not seem to have a significant effect. All other relations again do not deviate much compared to the initial model, in terms of their magnitude and significance.

Considering the results from the models discussed, growth does not seem to have a clear effect on long-term leverage. Only in model 2 in table 12, the coefficient for the growth proxy seemed to have a significant effect on the long-term debt ratio. However, this relation contradicts the hypothesis, because it is positive. The proxy used for business risk in this model was the alternative proxy, Sales Volatility. It might be due to the fact that this proxy is used instead of EBIT Volatility that the EBIT Growth variable turns out to have a significant effect on leverage. For that reason model 4 includes Sales Volatility as the proxy for business risk and the first choice, Sales Growth, as the measure of growth. The result is a significant negative relation between growth and long-term leverage, which supports hypothesis 7. However, business risk now does not seem to have a significant effect and it should therefore be concluded that there is not enough evidence to support hypothesis 2 with this data. All other hypotheses, except for hypothesis 4a, do find support from this analysis.

4.3.2.3 Short-Term Debt

As with the models for long-term debt, also some additional regressions are run to test the results found for short-term debt on their consistency and validity. Variations are made with the alternative proxy variables in order to see whether similar results are obtained when business risk, the non-debt tax shield or growth is slightly differently defined. In table 13 the results of five additional regression models are shown. As the dependent variable, STD-to-EBITDA was used since it turned out to be the better leverage measure to explain STD in the capital structure.

Table 13: Robustness checks for short-term debt (t-values within parentheses).

	STD-to-EBITDA				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Intercept	0.713***	0.537***	0.609***	0.611***	0.497***
	(23.020)	(5.810)	(6.516)	(6.556)	(5.437)
EBIT Volatility	0.076**			0.051*	
	(2.546)			(1.857)	
Sales Volatility		0.091	0.396***		0.400***
		(1.573)	(3.735)		(3.813)
EBIT/BVA	-2.355***	-2.622***	-2.479***	-2.481***	-2.518***
	(-15.345)	(-15.632)	(-14.963)	(-15.421)	(-15.173)
LnSales		0.006	0.005	0.006	0.007
		(1.204)	(1.003)	(1.144)	(1.310)
PPE/BVA	0.104***	0.063	0.075*	0.086**	0.066*
	(2.680)	(1.610)	(1.863)	(2.078)	(1.708)
Depreciation/BVA	-2.612***		-2.245***	-2.354***	
	(-6.770)		(-5.868)	(-6.027)	
Depreciation/Sales		-1.369***			-1.387***
		(-6.037)			(-6.120)
EBIT Growth		-0.105***		-0.098***	
		(-2.855)		(-2.932)	
Sales Growth	-0.360***		-0.769***		-0.741***
	(-3.947)		(-4.588)		(-4.456)
BVA/Sales		0.047***	-0.000	-0.002	0.051***
		(3.821)	(-0.021)	(-0.185)	(4.072)
Adjusted R^2	0.146	0.143	0.153	0.142	0.154
Number of Observations	1881	1881	1881	1881	1881

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

In the initial STD-to-EBITDA model the results shown that size and asset intensity do not have a significant effect on short-term leverage. In a joint significance test they turned out not to have any additional information and are therefore left out of model 1 in table 13 in order to see whether the explanatory power of that model stays the same as the initial one.[37] As illustrated in the table this is indeed the case.

The second model shown in table 13 included the alternative proxies for business risk, the non-debt tax shield and growth in order to see whether this would alter the conclusions drawn

[37] Results from the Wald coefficient test are not reported in this paper, but the test was unable to reject the null-hypothesis of no joint contribution.

regarding the hypotheses. As in the initial model, the alternative proxies for growth and the non-debt tax shield show a significantly negative effect on short-term leverage. This supports the hypotheses 6 and 7. However, now Sales Volatility is used to represent the firm's risk, this factor does not seem to have any influence on the capital structure anymore. In the initial model a significant positive relation was found, which contradicted hypothesis 2, and this positive relation is also found here in model 2, but now is insignificant. Furthermore, in this model we do not find any support for an effect of collateral value of assets on short-term debt in the capital structure, where previously a significant positive relation was found. Hence now hypothesis 5 is not supported. Besides, previously no support was found for hypothesis 8, but Asset Intensity here seems to have a significant positive effect, supporting the hypothesis. Hypothesis 4b, which predicts a negative relation between STD and size, still does not find any support here.

In model 2 the business risk proxy, Sales Volatility, shows a positive, but insignificant relation with short-term leverage. In this model, EBIT Growth was used as the growth proxy. Yet, in the initial analysis, when EBIT Volatility was used as the risk proxy and Sales growth as the proxy for growth, business risk turned out to have a significant effect. For that reason model 3 tests the alternative risk proxy, Sales Volatility, again, but now incorporates the first choice growth proxy in the analysis. As shown in the table the coefficient of the firm's risk here seems to be significant and positively related to short-term leverage. This still contradicts hypothesis 2, but now at least a significant relation is found. Hence it can be said that business risk has an effect on the short-term debt ratio. Besides, the explanatory power of model 3 is higher than of the initial model and it might therefore be concluded that, in order to explain short-term debt in the capital structure, it might be best to include Sales Volatility and Sales Growth as the proxies for business risk and growth, respectively. In model 3, all other relations do not deviate much from those found in the initial analysis in terms of their magnitude and significance and therefore it can be concluded that the support for hypotheses 3, 5, 6 and 7 is also consistent with this test.

Since the business risk variable did not seem to yield any additional information in model 2 when EBIT Growth was used as the growth proxy, it may be interesting whether this is also the case when the first choice risk proxy is incorporated in the model. If it would then still be the case, EBIT Growth might be the proxy that is able to explain growth and risk all at once. In order to test this, model 4 uses all first choice proxies, except for Sales Growth, which is substituted by EBIT Growth. As can be seen from the table, support is found for hypotheses

3, 5, 6 and 7, for which the relations all turn out to be significant at the 1% or 5% level. Business risk again seems to be positively related to short-term leverage, yet the relation is only significant at the 10% level. Despite the fact that risk turns out to have a significant effect, it is only at a low level and it could therefore be that EBIT Growth captures some information that would otherwise be captured by a business risk proxy, because when the EBIT proxy is used for growth, a risk variable will have no or only minor additional value.

From model 2 it could be seen that the asset intensity variable showed a positive significant relation to short-term leverage, where it seemed to be irrelevant in the initial model. This could be due to the fact that in the second model the alternative non-debt tax shield proxy was used. Hence in model 5 all proxy variables from the initial model were include, except for the non-debt tax shield and business risk, which were represented by their alternative proxies. Sales Volatility was used as the business risk proxy since it proved from previous models to be the best one to explain STD in the capital structure. As can be seen from the table, hypotheses 3, 5, 6 and 7 do find support from the data with this model. Hypothesis 2 again finds a significant relation contradicting the hypothesis, but more remarkable is the fact that hypothesis 8 is now supported. Hence it can be concluded that when the non-debt tax shield is measured by a depreciation-to-sales ratio, asset intensity seems to be positively related to short-term leverage. Since the explanatory power of model 5 is highest of all STD models, it can be said that the proxies used for the variables here explain the short-term leverage in the capital structure best.

5. Summary and Conclusions

Previous studies on capital structure determinants often do not find very satisfactory results, in terms of explanatory power of the models. Despite the fact that several factors have been indicated to influence the decision to target a certain debt ratio, the existing models can only estimate leverage with little precision. This study examines whether that problem finds its cause in the way leverage is defined in previous studies. The proxy variables for leverage do often not relate much to the way in which practitioners decide about the capital structure. In practice, debt capacity is often determined as being a multiple of the earnings before interest, taxes, depreciation and amortization (EBITDA). Therefore, this paper investigates whether a

model which defines debt as a multiple of EBITDA could be explained better by identified capital structure determinants than a commonly used measure.

From the initial dataset, three samples are created, resulting from three different methods of outlier removal. Using the standard models, including all first choice proxy variables, the samples are analyzed to see whether NLTD-to-EBITDA and STD-to-EBITDA models can indeed be better explained by capital structure determinants than NLTD-to-Assets and STD-to-Assets models. It turns out that the method of outlier removal plays a role in the outcome of this. When a proper sample is created, in which the observations are distributed in roughly the same way for both, the EBITDA and Assets measures, the EBITDA models obtain remarkably higher explanatory power. For one of the outlier removal method samples in this study the fit of the models were approximately the same, because the observations were much more dispersed for the EBITDA measures than for the Assets measures.

Since for the proper outlier removal methods the explanatory power of the EBITDA models is higher, the relations between determinants of the capital structure and leverage are reexamined. Business risk turns out to have a negative effect on long-term debt in the capital structure, but it positively affects the amount of short-term leverage. Profitability seems to be, as hypothesized by the pecking order theory, negatively related to short- and long-term debt. Remarkable, however, is that multiple studies have found relations between size and leverage, but in this study it turns out to be unrelated to short- and long term debt in the capital structure, a conclusion that was also drawn by Remmers, Stonehill, Wright and Beekhuisen (1974). Furthermore, the amount of collateral value of assets shows a strong positive relation to long-term debt. It also positively affects the amount of short-term leverage, but this relation turns out to be less strong, depending on what other proxy variables are included in the analysis. The non-debt tax shield is negatively related to both, short- and long-term leverage. Firm growth does not seem to have a clear effect on long-term debt in the capital structure, but on the other hand does seem to negatively affect short-term debt. Lastly, asset intensity does seem to have a strictly positive effect on long-term debt. Firms in for example the telecom and manufacturing industry, in which companies have high asset intensity, seem to have more long-term debt in the capital structure. On the contrary, short-term debt is not affected by a firm's asset intensity.

This paper has presented an alternative explanation for the capital structure by means of using more practically related leverage measures. The use of these alternative measures resulted in

models with higher explanatory power. Besides that, by using the alternative leverage proxies, some insight was given in the relation of the capital structure determinants that were previously found to be most important and on the relation of asset intensity on debt.

6. Suggestions for Further Research

It was discussed earlier that some studies have found historical stock price performance to be determining for the capital structure. Exploitation of windows of opportunity could play an important role in the decision process from which the capital structure results. Further investigation of the subject of market timing as a determinant of the capital structure, when leverage is defined in a more practically related manner as is presented in this paper, might yield even more interesting results and could get research again a little closer to solving the capital structure puzzle.

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Appendix 1

Regression results from the standard deviation removal method (t-values within parentheses).

	Net Long-Term Debt		Short-Term Debt	
	NLTD/EBITDA	**NLTD/Assets**	**STD/EBITDA**	**STD/Assets**
Intercept	-1.913**	0.137***	0.503*	0.043***
	(-2.122)	(4.546)	(1.859)	(4.259)
EBIT Volatility	0.003	0.000	0.016	0.001
	(0.050)	(0.292)	(1.249)	(1.575)
EBIT/BVA	-7.869***	-0.289***	-1.534**	-0.059***
	(-4.369)	(-5.200)	(-2.476)	(-3.636)
LnSales	0.205***	0.004***	0.018	0.001
	(4.624)	(2.589)	(1.162)	(1.118)
PPE/BVA	3.188***	0.158***	0.277**	0.005
	(9.717)	(10.401)	(2.228)	(1.184)
Depreciation/BVA	-17.547***	-0.559***	-5.272***	0.068
	(-5.799)	(-3.921)	(-4.232)	(1.346)
Sales Growth	-0.907	-0.047	-0.645***	-0.032***
	(-1.110)	(-1.603)	(-3.145)	(-3.776)
BVA/Sales	0.207**	0.018***	-0.005	-0.001
	(2.279)	(4.416)	(-0.223)	(-1.620)
Adjusted R^2	0.101	0.113	0.034	0.021
Number of Observations	2018	2018	2018	2018

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Appendix 2

Regression results from the interquartile range removal method (t-values within parentheses).

	Net Long-Term Debt		Short-Term Debt	
	NLTD/EBITDA	**NLTD/Assets**	**STD/EBITDA**	**STD/Assets**
Intercept	2.071***	0.337***	0.279***	0.045***
	(4.349)	(8.536)	(2.653)	(4.204)
EBIT Volatility	-0.626***	-0.034***	0.229***	0.005*
	(-3.484)	(-2.869)	(6.671)	(1.882)
EBIT/BVA	-10.200***	-0.428***	-1.216***	-0.024
	(-9.073)	(-5.232)	(-5.416)	(-1.283)
LnSales	0.003	-0.006***	0.016***	0.000
	(0.121)	(-2.948)	(2.924)	(0.535)
PPE/BVA	1.853***	0.086***	0.225***	0.007
	(8.146)	(4.348)	(4.928)	(1.499)
Depreciation/BVA	-7.934***	0.430*	-3.662***	0.029
	(-3.268)	(1.882)	(-8.029)	(0.581)
Sales Growth	-1.110**	-0.060	-0.586***	-0.038***
	(-2.389)	(-1.526)	(-5.961)	(-3.908)
BVA/Sales	0.278***	0.020***	0.002	-0.001
	(5.243)	(4.435)	(0.194)	(-0.925)
Adjusted R^2	0.235	0.092	0.129	0.011
Number of Observations	1901	1901	1901	1901

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Appendix 3

Correlation matrix for the variables (N=1881).

	LTD-to-EBITDA	*LTD-to-Assets*	*STD-to-EBITDA*	*STD-to-Assets*	*Collateral Value of Assets*	*Non-Debt Tax Shield 1*	*Non-Debt Tax Shield 2*	*Sales Growth*	*EBIT Growth*	*Size*	*EBIT Volatility*	*Sales Volatility*	*Profitability*	*Asset Intensity*
LTD-to-EBITDA	1.0000													
LTD-to-Assets	0.8241	1.0000												
STD-to-EBITDA	0.1991	0.0623	1.0000											
STD-to-Assets	0.0682	0.0321	0.8770	1.0000										
Collateral Value of Assets	0.2899	0.1974	0.0343	0.0282	1.0000									
Non-Debt Tax Shield 1	-0.0381	0.0823	-0.1257	0.0448	0.3510	1.0000								
Non-Debt Tax Shield 2	0.2295	0.2446	-0.0034	0.0155	0.5092	0.5204	1.0000							
Sales Growth	-0.1221	-0.0684	-0.1393	-0.1014	0.0285	-0.0873	0.0212	1.0000						
EBIT Growth	-0.0277	0.0176	-0.1316	-0.0844	0.0077	-0.0083	-0.0036	0.4063	1.0000					
Size	-0.0003	-0.0733	0.0220	0.0129	0.0093	-0.0124	-0.0261	-0.0619	-0.0742	1.0000				
EBIT Volatility	-0.1640	-0.1039	0.0731	0.0147	-0.1358	0.0948	0.0160	0.2154	0.0157	-0.1517	1.0000			
Sales Volatility	-0.0892	-0.0415	-0.0355	-0.0252	0.0159	-0.1001	0.0115	0.7931	0.3506	-0.0654	0.3560	1.0000		
Profitability	-0.3743	-0.2164	-0.3521	-0.0603	-0.1138	0.0409	-0.1937	0.2171	0.1752	0.0159	-0.1598	0.1528	1.0000	
Asset Intensity	-0.2235	-0.1998	-0.0785	0.0070	-0.3078	0.0067	-0.6199	-0.0726	0.0277	0.0276	0.0581	-0.0784	0.2352	1.0000