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Variation in firm-level predictors of capital structure:

A cross industry study

Abstract: This study examines the variation in the effects of firm-level predictors on leverage across industries. Specifically, the variation is studied across nine industries. The sample consists of 48691 firms worldwide for the period 1990 -2017. To discover the existence of industry heterogeneity in firm-level predictors two panel data analyses are conducted: Random Effects Model and Multilevel Model. These analyses are used to compare the explanatory power of a general empirical model to several unrestricted models. Where the unrestricted models each added interaction terms between a firm-level predictor and industries. An increase in explanatory power indicates a variation in effect, this is also tested with the Wald test and likelihood-ratio test. Both analyses concluded that the effects of all firm-level predictors varied across industries. The most relevant variation is in non-debt tax shields and tangibility. Additionally, the robustness check pointed out that the level of industry aggregation influences the variation in effect. When industries are more accurately specified the variation in effects becomes larger. However, incorporating more industries also makes the research increasingly complex. Therefore, a trade-off is to be made between complexity and explanatory power.

Keywords: Capital structure, leverage, firm-level predictors, static trade-off theory, pecking order theory, industry heterogeneity.

Master's Thesis Financial Economics

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1. Introduction

One of the most important decisions firms and institutions face is the much debated capital structure choice. This decision is crucial because of its impact on a firm's value, return and competitiveness (Gill, Biger, & Mathur, 2011). The capital structure is an overview of all the claims of debt holders and equity owners against a firm. This is analyzed by lenders to determine the riskiness of a firm. A capital structure with a higher proportion of debt is considered more risky by lenders. As a result, the firm has to pay a higher interest rate. This increases the cost of capital and consequently decreases a firm's value.

Due to its importance, several theories have emerged to explain capital structures of firms. The foundation of capital structure theory is based on the Modigliani-Miller theorem also called capital structure irrelevance principle (Modigliani & Miller, 1958). This theorem states that in perfect markets without frictions the choice between debt and equity has no effect on the value of the firm nor on the cost of capital (Myers, 2001). However, in imperfect markets the proportions of debt and equity does have an effect on firm value. These issues ushered in new theories such as: static trade-off theory and the pecking order theory. Both provided more realistic and empirically applicable theories by relaxing the assumption of perfect markets from the Modigliani-Miller theorem (Chen, 2004). The static trade-off theory suggests that firms will choose the capital structure by balancing the tax benefits and the cost of financial distress. According to the pecking order theory firms will first use internal funds, then debt and equity only as a last resort (Degryse, De Goeij, & Kappert, 2012).

Since the Modigliani-Miller theorem, numerous empirical research is done on the firm-level predictors of capital structure. Most research use some sort of leverage ratio as a proxy for capital structure. According to Frank and Goyal (2009) the most important firm-level predictors of leverage are industry median, tangibility, profitability, firm size, growth opportunities and expected inflation. Despite extensive literature, there are still unresolved conflicting results regarding the effects of firm-level predictors on leverage. For example, Rajan and Zingales (1995) and Chen (2004) found evidence of a positive effect of tangibility on leverage whereas Psillaki and Daskalaskis (2009) found a negative correlation.

Only a limited amount of research is focused on the causes of these differences. In addition, the number of studies focusing on the role that industries play is relatively small compared to other capital structure research (Talberg, Winge, Frydenberg, & Westgaard, 2008). In capital structure literature it is known that leverage ratios differ across industries (Harris & Raviv, 1991). Certain industries are more leveraged than others. Several studies have researched the industry fixed effects on leverage. Bradley et al. (1984) regressed 24 industry dummies on firm leverage. The result was an

R^2 of nearly 0.54 which indicates that the variation in leverages can for almost 54% be explained by industrial classification. This signifies the strong connection between industries and leverage. However, the results from Balakrishnan and Fox (1993), Michaelas et al. (1999) and Mackay and Philips (2005) indicate that the connection is less strong. They conclude that industry effects are important in explaining leverage but not as important as firm level predictors. Both Balakrishnan and Fox (1993) and Michaelas et al. (1999) proved that inter-industry differences only account for only 10.5% of the total variance in leverage (Degryse, De Goeij, & Kappert, 2012). Mackey and Philips reported a slightly stronger impact of the inter-industry differences. According to their analysis 13% of the variation in leverage ratios can be explained by industry effects and 54% by firm-level predictors. If industry fixed effects are a significant determinant of the variation in capital structure they similarly could be a driver of differences in firm-level predictors.

This is evidenced by studies from Hall et al. (2000) Talberg et al. (2008) and Degryse et al. (2012). These studies showed that the effect of a number of firm-level predictors on leverage vary significantly across industries. Degryse et al. (2012) studied the variation in firm-level predictors for Dutch small and medium-sized firms. They found that for most firm-level characteristics the relation with leverage ratio varies significantly across industries. This was most significant for tangibility, intangible assets, tax rate and profitability (Degryse, De Goeij, & Kappert, 2012). Hall et al. (2000) tested the variation of firm-level predictors for 3500 small and medium-sized firms from the United Kingdom. They found significant variation in the effect of growth opportunities, size and age. The effect of profitability did not vary (Hall, Hutchinson, & Michaelas, 2000). Talberg et al. (2008) studied the variation in the relationship between firm-level predictors and leverage. They used a sample that consisted of companies listed on the NYSE, NASDAQ and AMEX. Results show that the effect of profitability differed the most and growth opportunities, size and age performed quite similar across industries (Talberg, Winge, Frydenberg, & Westgaard, 2008).

It is clear that results from Hall et al. (2000) Talberg et al. (2008) and Degryse (2012) are not compatible. For most firm-level predictors the results are mixed. This study aims to contribute to the capital structure literature by using international data. It also significantly expands the number of industries to 73 in a robustness check. Moreover, a considerably longer time frame ranging from 1990-2017 is used. We study the variation in effect on leverage across industries for the following firm-level predictors: profitability, growth opportunities, size, non-debt tax shields, volatility and tangibility. The following research question is answered: *What are the differences in firm-level predictors of capital structure across industries*.

The differences in the effect of profitability, growth opportunities, size, non-debt tax shields, volatility and tangibility across nine industries are examined for 48691 firms in the period 1990-2017. This is done by comparing a general empirical model with unrestricted models. The general empirical model regresses firm-level predictors and industry dummies against leverage. Unrestricted models are equal to the general model but each adds interaction terms between one firm-level predictor and industries. This boils down to six unrestricted model, one for each firm-level predictor, each including nine interaction terms representing the industries. A Random Effects Model and Multilevel Model are used for the regression analyses. The result from the Random Effects Model show how much the adjusted R^2 of the general empirical model improves when interaction terms of one firm-level predictor are added. In other words, what is the explanatory value of interaction terms of each firm-level predictor. When the added value is low the firm-level predictor does not differ significantly across industries. This is formally tested with the Wald test which results in the F-statistic. The F-statistic shows whether the interaction effects are significantly different from each other or not. The results from the Multilevel Model are the likelihood-ratios. These ratios will, like the F-statistics, point out whether the slopes of the firm-level predictors vary across industries. Overall, the results of this study show that adding interaction effects between firm-level predictors and industries increase the explanatory power. In addition, the F-statistics and likelihood-ratios of all firm-level predictors were significant. This indicates that the effects of all firm-level predictors vary across industries. The two most relevant predictors were: non-debt tax shields and tangibility. The interaction terms of these predictors add explanatory power comparable with those of initial firm-level predictors. These statements are dependent on the level of disaggregation of industry classification. The benefits of including interaction effects increase when industries are more accurately specified. Therefore, the variation in effects of firm-level predictors is larger when industries are more accurately specified.

The remainder of this study is organized as follows. In section 2 the capital structure literature is discussed in twofold. First, theories that explain capital structure of firms are described. Second, empirical evidence of firm-level predictors explaining capital structure are reviewed. Section 3 explains the capital structure hypotheses development. Section 4 presents the data as well as a description of the statistics and ends with the research method. Section 5 presents and discusses the results of this research and also elaborates on several robustness checks. Section 6 provides a discussion of results, research limitations and suggestions for further research. Finally, section 7 concludes this research.

2. Literature Review

This section defines capital structure and elaborates on several theories that explain the capital structure decisions made by firms. The most important findings of empirical studies in capital structure literature are also reviewed.

2.1. Theories of capital structure

A firm's capital structure is nothing more than the structure of its liabilities on the balance sheet. It is the proportion of debt and equity that is used to finance its projects. A firm is considered unleveraged when it is operating with only equity and without debt. Highly leveraged means that a firm uses more debt than equity. Countless combinations of debt and equity are possible because firms can us many sources of capital (stocks, bonds and derivatives). Each alternative has its own costs and benefits which increases the complexity of many capital structures.

The study of capital structure attempts to explain the mix of debt and equity financing sources used by firms. This is important because it affects the overall market value of firms (Abor, 2005). The capital structure decision eventually depends on the preference of the firm and the constraints given by capital providers such as banks. To this day no universal theory of debt-equity choice exist and there is no reason to expect one. However, there are several conditional theories that partially explain the capital structure pattern (Myers, 2001). These theories are the Modigliani-Miller theorem, static trade-off theory and pecking order theory.

2.1.1. Modigliani-Miller theorem

The theory of capital structure is based on the paper by Modigliani and Miller (1958). Their Modigliani-Miller theorem, also called capital structure irrelevance principle, consists of two propositions. First, the market value of any firm is independent of the firm's proportion of debt and equity (capital structure). Second, the cost of equity for a leveraged firm is the same as the cost of equity for an unleveraged firm plus a risk premium (Modigliani & Miller, 1958). In other words, a firm's capital structure decision has no effect on a firm's value nor its cost of capital (Myers, 2001).

The assumptions underlying this theorem are that markets are efficient with no taxes, bankruptcy costs and asymmetric information. Modigliani and Miller (1963) later found that the tax advantages of debt financing were greater than suggested in their original theorem. Firm's income is taxed by governments, but interest is a tax-deductible expense. An additional dollar of interest is partially offset by an interest tax shield that lowers taxes paid (Myers, 2001). Therefore, Modigliani and Miller reviewed their earlier work and incorporated tax benefits as determinants of capital structure for firms. According to this reviewed theory firms should use as much debt as possible in order to maximize their value because financing with debt instead of equity increases tax shields and therefore total after tax return (Abor, 2005). This statement is wrong because there should be costs involved to excessive borrowing (Myers, 2001). Because of this flaw and the theoretical assumptions of the Modigliani-Miller theorem it lacks empirical applicability (Chen, 2004). Additional theories emerged to address these issues by relaxing the assumptions of the theorem.

2.1.2. Static trade-off theory

There are a number of trade-off models but the most important in capital structure theory is the tax-shields and financial distress trade-off discovered by Kraus and Litzenberger (1973). It states that a firm will borrow up to the point where the marginal benefits of interest tax shields on additional debt is offset by the increase in the present value of possible costs of financial distress (Myers, 2001). Costs of financial distress include the costs of bankruptcy, reorganization, moral hazard, monitoring and contracting costs which could decrease firm value even if default is avoided (Myers, 1984). Based on the costs of financial distress two statements can be made regarding capital structure decisions. First, firms with a higher variance in income streams should borrow less because they have a higher probability of defaulting on their debt obligations. Their costs of financial distress are high and they offset the benefits interest tax shields in an early stage. In contrast, safe firms should be able to borrow more before costs of financial distress offset the tax benefits of borrowing (Myers, 1984). Second, firms holding tangible assets should borrow more than firms specialized in intangible assets or valuable growth opportunities. Firms specialized in intangible assets have higher costs of financial distress because they are more likely to lose value in times of financial distress (Myers, 1984) (Myers, 2001).

According to the static trade-off theory, financial distress costs pushes firms towards less leverage whereas interest tax shields pushes firms towards more leverage (Fama & French, 2002). This results in an equilibrium or optimal debt ratio representing the capital structure of a firm. This differs from the Modigliani and Miller theorem (1963) because it takes a penalty for excessive borrowing into account (financial distress costs). The static trade-off theory can therefore explain why firms do not exclusively use debt to finance their investments. This is something the Modigliani-Miller theorem failed to do. Many empirical studies reported findings that support the static trade-off theory (Shyam-Sunder & Myers, 1999). For example Long and Malitz (1985) found evidence that intangible assets are negatively correlated to debt ratios. In addition, Smith and Watts (1992) formulated that a negative correlations exist between growth opportunities and debt ratios. Bradley et al. (1984) conclude that their findings support the static trade-off theory (Shyam-Sunder & Myers, 1999). However, other papers found evidence inconsistent with the previous studies. Titman and

Wessels (1988) only found mixed evidence of the effects predicted by the static trade of theory. They found a strong negative correlation between debt ratios and profitability. This claim is supported by Rajan and Zingales (1995), Chen (2004) and Psillaki and Daskalaskis (2009). These findings go directly against the static trade-off theory because the static trade-off theory advocates a positive correlation between debt ratios and profitability (Shyam-Sunder & Myers, 1999). Moreover, Myers (1984) states that the static trade-off theory works to some extent in explaining capital structure decisions, but the explanatory power of the model is not sufficient (unacceptably low R-squared). If the static trade-off theory holds, actual debt ratios of similar firms (with similar financial distress costs) should not vary. In reality debt ratios vary widely across similar firms, which cannot be explained by the static trade-off theory (Myers, 1984). From this point of view an alternative theory came forward: the pecking order theory.

2.1.3. Pecking order theory

An alternative theory that explains capital structure decisions is the pecking order theory developed by Myers and Majluf (1984). This theory considers three funds available to firms: retained earnings, debt and equity. It predicts capital structure decisions in the following way: firms prefer internal finance to external finance and debt is preferred over equity. In other words, internal funds (retained earnings) are used first, if this is depleted then debt is issued. Equity is only issued when both internal funds and debt are no longer available (Myers, 1984). The pecking order theory is based on the idea of asymmetric information. The management of firms are assumed to know more about a firm's value than potential investors. Both investors and managers are aware that this is the case when making investment decisions (Myers & Majluf, 1984). For example, managers use private information to issue securities when they are over overpriced. Investors are aware of this asymmetric information problem and use higher discount rates to evaluate the securities and therefore require lower prices. Managers anticipate this increase in costs of equity financing. They prefer exhausting other forms of financing such as internal financing and debt, which have no or minor asymmetric information problems, before using equity (Fama & French, 2002).

Both the pecking order theory and static trade-off theory have similar predictions to some extent. For instance, when a firm needs financing and its debt ratio is currently below its optimal debt ratio, both static trade-off theory and pecking order theory predict the firm to issue debt (De Jong, Verbeek, & Verwijmeren, 2011). The main difference between the static trade-off and pecking order theory is that there is no optimal debt ratio according to the pecking order theory (Shyam-Sunder & Myers, 1999). The static trade-off theory argues that a firm increases its leverage until the optimal debt ratio is reached, whereas the pecking order predicts that a firm increases leverage until its maximum debt capacity is reached. This difference only occurs when the debt ratio is above the optimal debt ratio but below the debt capacity (De Jong, Verbeek, & Verwijmeren, 2011). It is this difference that allows the pecking order theory to explain the negative relation between debt ratios and profitability. This is an improvement compared to the static trade-off theory because this was one of the major shortcomings of the static trade-off theory. Many studies have found evidence in favor of the pecking order theory. Shyam-Sunder & Myers (1999) found strong evidence for both the pecking order and static trade-off theory. They concluded that pecking order theory had statistical power relative to the static trade-off theory and that pecking order theory was the best model for capital structure decisions (Shyam-Sunder & Myers, 1999). However, Fama and French (2002) stated that there is no clear winner in the confrontation between the pecking order and static trade-off theory. The shared predictions of both theories were confirmed in their tests. Other predictions, where the two theories differ, in some cases supported the pecking order and in others the static trade-off theory. Fama and French (2002) concluded that both models are not conclusive, but rightfully predict capital structure decisions in most cases (Fama & French, 2002). This view is reinforced by Serrasqueiro and Caetano (2013). Their results confirm both pecking order and static trade-off theories. However, they concluded that these theories are not mutually exclusive in explaining capital structure decisions (Serrasqueiro & Caetano, 2013). In conclusion, there is convincing evidence that both theories work. Yet, neither the pecking order or static trade-off theory provides a general explanation of financing strategy. According to Myers (2001), both theories are not designed to be general. They are rather conditional where each theory emphasizes different costs and benefits of capital structure decisions (Myers, 2001).

2.2. Empirical studies

2.2.1. Firm-level predictors of capital structure

In the capital structure literature leverage is used as a quantification for capital structure. A firm's capital structure is divided in different parts such as internal and external funds. It is not quantifiable in one ratio or number and therefore almost all empirical studies use some sort of leverage ratio (long, short or total debt) as a proxy for capital structure.

When firms make capital structure decisions they consider a number of factors. These factors have been studied and empirically tested for decades. According to Frank and Goyal (2009), from this extensive literature a list of the most important factors came forward. This list contains the following factors: industry median leverage, tangibility, profit, firm size, market to book assets ratio and expected inflation. Frank and Goyal (2009) found that these factors account for more than 27% of the variation in leverage, while other factors only add 2% (Frank & Goyal, 2009). They call this set the core factors of leverage because they have consistent signs and statistical significance across many treatments of the data. Other factors are not nearly as consistent (Frank & Goyal, 2009). This roughly corresponds with the view of Harris and Raviv (1991), who did a thorough literary study on the determinants of capital structure. They found that the existing literature is mostly focused on: volatility, bankruptcy probability, fixed assets, non-debt tax shields, advertising, R&D expenditures, profitability, growth opportunities, size, free cash flow and uniqueness.

A part of the study from Harris and Raviv (1991) is summarized in in Table 1. Harris and Raviv (1991) concluded that the existing literature generally agrees that leverage is positively correlated with growth opportunities, size, non-debt tax shields and tangibility, and negatively correlated with profitability and volatility (Harris & Raviv, 1991). As can be seen in Table 1, these statements are not completely in line with the results of several studies. Titman and Wessels (1988) found opposite results in which growth opportunities, size and non-debt tax shields are all negatively correlated with leverage. The same results are found by Kim and Sorensen (1986). Even without a proper significance level these are still conflicting results. These discrepancies become even more puzzling because Rajan and Zingales (1995) found a negative correlation between size and leverage, and a positive correlation between tangibility and leverage. In contrast, Psillaki and Daskalaskis (2009) found a positive correlation between size and leverage, and a negative correlation between tangibility and leverage. These examples illustrate that there are still discrepancies about basic facts in capital structure literature. This renders the claim of a consensus, made by Harris and Raviv, at least questionable (Frank & Goyal, 2009). According to Frank and Goyal (2009), there is no general consensus because the existing literature is unsatisfactory. They state that that the factors that drive capital structure are still elusive because of the discrepancies in results from different studies (Frank & Goyal, 2009).

Table 1: Overview of empirical determinants of leverage

Reference	Profitablity	Growth opportunities	Size	Non-debt tax shields	Volatilty	Tangibility
Marsh (1982)			+			+
Bradley, Jarell & Kim (1984)				+	–	
Long & Malitz (1985)	+*					+
Kester (1986)	–	+	–*		–*	
Kim & Sorensen (1986)		–	–*	–	+	
Friend, Hasbrouck & Lang (1988)	–		+*		–	+
Titman & Wessels (1988)	–	–*	–*	–*	–*	+*
Chaplinsky and Niehaus (1990)		–*	–*	+		
Rajan & Zingales (1995)	–		–			+
Chen (2004)	–	+	+*	+*		+
Psillaki & Daskalaskis (2009)	–	+*	+			–

Notes: * Indicates that the correlation was not statistically significant at usual levels. Plus and minus signs indicate the direction of the relationship found.

Industry differences in and industry-level predictors of capital structure

The conflicting results provided in Table 1 could have a number of causes. Industry heterogeneity could be one of the drivers of this phenomenon for three reasons.

First, previous research finds that capital structures differed across industries. Bowen et al. (1982), Long and Malitz (1985) and Kester (1986) documented leverage ratios across industries. These industry leverage rankings showed that certain industries are more leveraged than others. They concluded that industries exhibit significant differences in leverage ratios. This could be caused by inter-industry differences. Each industry experiences different business environments and economic conditions which translates in industry-specific challenges within technology development, regulations, etc (Talberg, Winge, Frydenberg, & Westgaard, 2008). In addition, the accessibility of capital can also differ across industries. All these cross-industry differences can cause differences in capital structures across industries. Consequently, the effect of determinants of leverage could similarly be different across industries.

Second, several studies have researched the cross-industry differences of capital structures. Bradley et al. (1984) did a variance analysis (ANOVA) to test the statistical significance of the differences in capital structures across industries. They regressed 24 industry dummy variables on firm leverage. The result was an R^2 of 0.536 which indicates that the differences of firm capital structures can for almost 54% be explained by industrial classification (Bradley, Jarrell, & Kim, 1984). In addition, Bradley et al. (1984) found there is more variation in capital structures across industries than within industries (Bradley, Jarrell, & Kim, 1984). Firms within an industry are more similar than those in different industries (Harris & Raviv, 1991). Consequently, firms within an industry are expected to have more similar capital structures compared to firms in other industries. In contrast, Balakrishnan and Fox (1993) found different results. According to their variance analysis (ANOVA) inter-industry differences only account for 10.5% of the total variance in capital structures. Firm-level predictors (determinants) proved to be the most important with 52.1%. This is reinforced by Michaelas et al. (1999) who found similar percentages (Degryse, De Goeij, & Kappert, 2012). MacKay and Phillips (2005) reported that industry effects accounts for 13% of the variation in capital structures while firm effects explain 54% and the remaining 33% is within-firm variation. This shows that most variation of firm capital structure arises within industries rather than between industries. When industry effects are important firms operating in the same industry should exhibit similar capital structures (Balakrishnan & Fox, 1993). Both Balakrishnan and Fox (1993) and MacKay and Phillips (2005) conclude that this is not the case. The studies mentioned above conclude that industry effects are important in explaining the differences in firm capital structure. However, not as important as firm effects. If the industry effect on capital structure differences are significant it could similarly have a significant impact on the differences in determinants of capital structure. In other words, different capital structures across industries could also indicate differences in determinants of capital structure across industries.

Third, there is evidence, to some extent, that the relationship between firm-level predictors (determinants) and capital structure vary significantly across industries. A number of studies have addressed this issue. However, this number is relatively small compared to other capital structure research (Talberg, Winge, Frydenberg, & Westgaard, 2008). Degryse et al. (2012) studied the variation in firm-level predictors for Dutch small and medium-sized firms. They found that the effect of most firm-level predictors varied significantly across industries. This was most significant for tangible assets, intangible assets, tax rate and profitability (Degryse, De Goeij, & Kappert, 2012). In addition, Hall et al. (2000) distinguished long and short term debt and tested whether determinants of capital structure vary across industries. For long term debt only the effect of profitability did not vary significantly across industries. The effects of growth, asset structure, size and age did vary. With short-term debt the effect of growth did not vary while the effect of profitability, asset structure, size and age varied across industries (Hall, Hutchinson, & Michaelas, 2000). Talberg et al. (2008) also examined the variation in effects of firm-level predictors of capital structure across industries. They found that the effect of profitability differed the most followed by asset structure. Growth, size and age performed quite similarly for all industries (Talberg, Winge, Frydenberg, & Westgaard, 2008). In summary, these studies made clear that there indeed are inter-industry variations in the firm-level predictors of capital structure. This is another indication that industry heterogeneity could be one of the causes of conflicting results.

3. Hypotheses Development

The purpose of this section is to present the research problem of this study that followed from the literature. The research problem functioned as the starting point of the hypotheses formulation. The literature review made clear that the term leverage refers to capital structure. This study will continue this trend and from now on uses the term leverage as a reference to capital structure.

3.1. Research problem

After the literature review it becomes clear that there is still work to be done regarding the consensus about the determinants of capital structure. According to Harris and Raviv (1991), models that relate capital structure to products and inputs are the most promising. This area is still in its infancy and short on relating capital to industrial organization whereas other models have reached the point where new insights seem unlikely (Harris & Raviv, 1991). However, the number of studies that are specifically focused on this matter is relatively small. Little is known about the variation of firm-level predictors across industries. Degryse et al. (2012), Hall et al. (2000) and Talberg et al. (2008) are one of the few papers that address this issue. However, these results are not compatible because they show mixed results on a number of firm-level predictors. Therefore, this area of capital structure remains inconclusive. This resulted in the following research question:

What are the differences in firm-level predictors of capital structure across industries?

This study will focus on the industry heterogeneity in firm-level predictors of capital structure. The purpose is to identify the variations in firm-level predictors across industries. It will not develop new theories that can explain why variations exists or not.

3.2. Hypotheses

The literature review made clear which firm-level predictors have the most and significant effect on leverage. Based on papers from Harris and Raviv (1991) and Frank and Goyal (2009) the following predictors are included in this research: profitability, growth opportunities, size, non-debt tax shields, volatility and tangibility (Frank & Goyal, 2009) (Harris & Raviv, 1991) (Hall, Hutchinson, & Michaelas, 2000). The effect of these firm-level predictors on leverage might vary across industries. This is hypothesized below.

The pecking order theory states that firms prefer retained earnings over debt and debt over equity financing. If this is true, a highly profitable firm will have more retained earnings and therefore a lower leverage ratio. These firms have less need to borrow either long or short term debt (Hall, Hutchinson, & Michaelas, 2000). In contrast, an unprofitable firm will have a higher leverage ratio. The static trade-off theory predicts a positive correlation between leverage and profitability. However, the majority of the empirical evidence favors the pecking order theory (Harris & Raviv, 1991). Therefore, profitability is expected to be negatively correlated with leverage.

We expect variation in the effect of profitably on leverage across industries. Firms in particular industries are more reliant on retained earnings (profits) than others. For example in a mature industry the earnings are less volatile as opposed to an immature industry. The immature industry is more dependent on retained earnings because it has limited access to capital due the volatile nature of earnings. Therefore, a change in profitability could have a larger effect on their capital structure because retained earnings accounts for a larger part of the total capital. A mature industry is less dependent on retained earnings because it has easier access to capital. Capital structures in these industries are matured, stable and should be less affected by a change in profitability compared to immature industries. The expected inter-industry differences in the effect of profitability is in accordance with finding from all Talberg et al. (2008) Degryse et al. (2012). They found evidence that the effect of profitability on leverage varies significantly across industries.

H1: *The effect of profitability on leverage varies across industries.*

Static trade-off theory suggests that leverage is inversely related to growth opportunities (Myers, 1984). Growth opportunities would increase the future value of the firm. However, these growth opportunities cannot be collateralized and do no generate income (Titman & Wessels, 1988). They are intangible of nature which makes them more likely to lose value in times of financial distress (Myers, 1984) (Ozkan, 2001). However, according to Rajan and Zingales (1995) it is unlikely that costs of financial distress are responsible for the negative correlation. They figure that firms with more growth opportunities have high market to book ratios. Thus, these firms are more tended to issue stock instead of debt because their stock price is relatively high (Rajan & Zingales, 1995). The static trade-off theory suggests that these firms borrow less than firms with less growth opportunities. On the contrary, the pecking order states that firms with more investments should accumulate more debt over time (Frank & Goyal, 2009). These firms want to take advantage of the opportunity and are more likely to exhaust internal funds and require additional capital (debt) (Psillaki & Daskalaskis, 2009). Thus, growth opportunities and leverage are positively correlated according to the pecking order theory (Tong & Green, 2005).

We expect variation in the effect of growth opportunities on leverage across industries. Different industries can experience different growth opportunities. Typically, immature and innovative industries have much higher growth potential than matured industries. For industries with high growth potential it is of great importance to capitalize on those opportunities. Large amounts of capital are needed to fund these activities and therefore firms are looking for any form of capital (internal or external). They might be willing to apply major changes in their capital structure, for example borrow excessively, to capitalize on the growth opportunities. In other words, growth opportunities could have a large positive effect on leverage in these industries. In contrast, matured industries presumably have more ways of financing. They have more internal funds and easier access to capital. Firms in these industries don't have to borrow excessively when major growth opportunities occur. They could more easily balance financing in a way that would cause less interference in their(optimal) capital structure. Therefore, the effect of growth opportunities would be less great in these industries compared to innovative industries. Hall et al. (2000) and Degryse et al. (2012) found in their studies that the effect of growth opportunities varies across industries.

H2: *The effect of growth opportunities on leverage varies across industries.*

There is evidence that costs of financial distress or bankruptcy costs increases in proportion when firm size is lower. Small firms are less diversified in comparison with large firms and therefore more susceptible to bankruptcy and financial distress costs (Titman & Wessels, 1988). In addition, large firms have lower costs of issuing debts (interest rates) than small firms and have easier access to capital markets (Ozkan, 2001). Thus, the static trade-off theory suggests that size and leverage are positively correlated (Frank & Goyal, 2009). The pecking order predicts the inverse relation between firm size and leverage. However, the origins of this effect is ambiguous and remains unclear (Rajan & Zingales, 1995) (Psillaki & Daskalaskis, 2009).

We hypothesize that the effect of size on leverage experiences inter-industry differences. Each industry experiences its own set of market conditions. This can be analyzed with Porter's Five Forces Framework, which states that industries differ in: threat of new entrants, threat of substitutes, bargaining power of customers, bargaining power of suppliers and industry rivalry (Porter, 1979). These differences result in different competitiveness across industries. In industries with low competitiveness firms can exercise higher profit margins. This makes them less dependent on debt financing. When size of the firms in these industry changes, little change is expected in the leverage ratios. In contrast, high competitive industry firms are more dependent on debt financing due to lower profit margins. Leverages of firms in these industries are more affected because when size increases firms can and probably will borrow more. The effect can be stronger in these industries compared to low competitive industries. This statement is line with the findings of both Hall et al. (2000) and Degryse et al. (2012) who reported that the effect of size varies across industries.

H3: *The effect of size on leverage varies across industries.*

Non-debt tax shields represent tax deductions that are not related to debt, for instance depreciation and investment tax credits. These tax deductions are considered substitutes for the tax benefits of debt financing (Titman & Wessels, 1988). Therefore, an inverse relation exist between non-debt tax shields and leverage (Ozkan, 2001). The static trade-off theory predicts firms with large non-debt tax benefits to issue less debt (Frank & Goyal, 2009).

Our hypothesis states that the effect of non-debt tax shields varies across industries. Some industries such as Construction, Mining and Manufacturing require heavy machinery. These industries usually have more depreciation compared to other industries such as Services or Finance. Industries that experience high non-debt tax shields are mostly matured industries (e.g. Construction and Mining). Because of their maturity they have easier access to capital which could increase debt ratios. Firms in immature industries firms tend to have less non-debt tax shields. In addition, they have to deal with capital restraints which limits their debt ratios. Therefore, the effect of non-debt tax shields on leverage could be less strong in immature industries compared to mature industries. Degryse et al. (2012) found evidence in line with the hypothesis. Results showed that the effect of non-debt tax shields varies across industries.

H4: *The effect of non-debt tax shields on leverage varies across industries.*

The risk of a firm is captured by the volatility of earnings. Static trade-off theory states that firms with more volatility earnings also have higher costs of financial distress and therefore use less debt. On the other hand, the pecking order expects riskier firms to have higher leverage (Frank & Goyal, 2009) (Harris & Raviv, 1991).

We expect variation in effect of volatility on leverage across industries. In general, when firms have more volatile earnings they are more restricted in debt financing. This is mostly the case for immature industries. Firms in these industries tend to borrow as much as is allowed. If the volatility of earnings would go down these firms could and probably will borrow more. Therefore, the volatility of earnings has a strong impact on the leverage of firms. In contrast, firms in mature industries have more financing possibilities besides debt. They are less dependent on debt. These firms might have collateral or other assurances that could grand them access to capital not available to firms in immature industries. When volatility of earnings changes its impact on leverage could be less strong compared to firms in immature industries.

H5: *The effect of volatility on leverage does varies across industries.*

Tangible assets are easy to collateralize (Rajan & Zingales, 1995). Property, plant and equipment are easier to value than intangible assets such as goodwill. This is closely related to the financial distress costs of a firm. A firm that has mostly tangible assets will have lower costs of distress than firms with a high percentage of intangible assets (Myers, 1984). In addition, tangible assets are generally considered to offer more security than current assets. Therefore, the static trade-off theory suggests that firms with more tangible assets should issue more debt (Psillaki & Daskalaskis, 2009). According to the pecking order the relationship between tangible assets and leverage can be both positive and negative. This depends on the information asymmetry. Leverage ratios are positively related to tangibility when information asymmetry is low. When information asymmetry is high tangibility increases adverse selection and leverage ratios (Frank & Goyal, 2009).

Our expectation is that the effect of fixed assets on leverage varies across industries. Fixed assets can serve as collateral which means easier access to capital and more borrowing possibilities. Immature industries are more dependent on debt. Thus, an increase in fixed assets and collateral could have a strong effect on firms in immature industries. On the other hand, mature industries are less dependent on debt. Therefore, the effect of fixed assets could be less strong in these industries. This proposition is in accordance with findings of Hall et al. (2000), Talberg et al. (2008) and Degryse et al. (2012).

H6: *The effect of tangibility on leverage varies across industries.*

4. Data and Method

In this section the sample will be described. Next, the variables are defined and an overview of the data is given by discussing the descriptive statistics. Finally, the research method will be discussed and illustrated with a statistical model.

4.1. Data source and sample

The sample consists of data on 48691 firms for the period 1990 to 2017. This data is obtained through Thomson Reuters database, which provides financial data of (mostly) listed companies worldwide. From the database the following data are extracted: total assets, long-term debt, sales, earnings before interest taxes and amortization (EBITDA), fixed assets and depreciation. The official database description of this data is presented in Appendix 1. This information is used to calculate the values of the dependent and independent variables. Besides the firm-level data, the database provided each firm with a SIC (Standard Industrial Classification) code that represents the industry in which the firm operates. Appendix 2 gives an overview of the nine 1-digit industries used in this study. From the 1-digit industries there can be 76 industries be distinguished. These are the 2-digit industries and are used for the robustness check. Note that firms located in the Finance industry are dropped because firms in the financial sector such as banks and insurance companies have a remarkable different (balance) structure than those of nonfinancial firms (Chen, 2004).

The panel of this research is considered long (37 years) and also wide (48691 firms). This means that missing values are almost inevitable. Missing values in the dependent variable are the most problematic. Therefore, firms with missing values in leverage were dropped. Other problems might arise when firms are not be assigned with a clear ISIN code or SIC code. These firms were also dropped from the sample. Firms whose SIC code or ISIN code were not constant were dropped as well. Firms with missing values in the firm-level predictors were kept in the sample because we would lose a significant amount of data if they were dropped. This results in a dataset with values of 48699 firms that can be analyzed with Stata.

4.2. Variables and measures

4.2.1. Dependent variable

In order to test if the effect of the firm-level predictors on leverage differs across industries, it is necessary to define leverage. A broad definition is given by Rajan and Zingales (1995), they state that leverage is the ratio of total liabilities to total assets. However, debt to total assets and debt to net assets are also widely used measures (Rajan & Zingales, 1995). Difficulties can emerge when defining and measuring leverage because there are many ways to do this (Harris & Raviv, 1991). For example, Titman and Wessels (1988) used as much as six measures of leverage. There are several alternative definitions of leverage used in the literature but most studies consider some sort of debt ratio (Frank & Goyal, 2009). Most definitions differ in whether book or market value is used and also whether short-term debt, long-term debt or total debt is used (Frank & Goyal, 2009).

Our study defines leverage as long-term debt divided by total assets. The distinction between short-term and long-term debt is important because leverage-related costs of short term debt could differ from those of long term debt. In addition, firms might have separate policies regarding short-term debt and long-term debt (Hall, Hutchinson, & Michaelas, 2000). This indicates that the effects of the independent variables on short-term debt could differ from those on long-term debt. In this study long-term rather than short-term debt is used because short-term debt fluctuates with the operations of the firm (Talberg, Winge, Frydenberg, & Westgaard, 2008). This is not the case with long-term debt since it is more stable over time. Total debt is also not considered because studies have proved that total debt conceals two opposite effects for short and long term debt (Hall, Hutchinson, & Michaelas, 2000). Van der Wijst and Thurik (1993) found that in the small business sector the effects on long and short term debt tends to cancel each other out. This mitigates the effects on total debt and also makes it more susceptible to industry and time specific effects (van der Wijst & Thurik, 1993). Therefore, long-term debt is used to calculate the leverage of firms and short-term debt is not.

Due to data limitations this study uses book value rather than market value for the dependent variable as well as all the independent variables. Book value measures are considered backward looking whereas market value measures are more forward looking (Frank & Goyal, 2009). Our study is more backward looking because it uses historical data and is interested in the past relationship of firm-level predictors on leverage. According to Titman and Wessels (1988) it might be better to use market value. However, they also state that the correlation between book value and market value of debt is high, so the errors of using book value are probably very small (Titman & Wessels, 1988). This view is contradicted by Fama and French (2002) who made the distinction between book leverage and market leverage in their study. They found relatively large differences between book leverage and market leverage (Fama & French, 2002). Due to data limitations our study uses book value instead of market value. This is in accordance with Titman and Wessels (1988) and Talberg et al. (2008). Table 2 provides an overview of the variables and their definitions.

4.2.2. Firm-level independent variables

The following firm-level predictors of capital structure are defined consecutively: profitability, growth opportunities, size, non-debt tax shields, volatility and tangibility. Profitability: the most common measure of profitability in capital structure literature is operating income or EBIT (earnings before interest) divided by total assets (Titman and Wessels, 1988; De Jong et al., 2008). Other studies use alternative measures for profitability, for instance EBITD which includes depreciation (Ozkan, 2001; Chen, 2004; Degryse et al.,2012). Following Titman and Wessels (1988) and De Jong et al. (2008), profitability is measured as the ratio of EBIT divided by total assets. Growth opportunities can be difficult to grasp, therefore a proxy is used. The consensus seems that market value of total assets divided by book value of total assets is the best proxy to measure growth opportunities (Rajan and Zingales, 1995; De Jong et al., 2008; Frank and Goyal, 2009). However, due to data limitation market value of total assets is not available for this study. The annual change in total assets is used instead to measure growth opportunities. This is in accordance with Titman and Wessels (1988) and Degryse et al. (2012). Size: the natural logarithm of sales is the most accurate proxy for the size of the firm. Over the years it is still widely used (Titman and Wessels, 1988; Rajan and Zingales, 1995; Ozkan, 2001; Chen, 2004; De Jong et al., 2008) and no better alternative proxy came forward in the literature. Consequently, this study also uses the natural logarithm of sales as a proxy for the size of the firm. Non-debt tax shields: are tax deductions that are not related to debt. This tax deduction consist for the most part of depreciation. Therefore, depreciation divided by total assets is used as a proxy for non-debt tax shields (Titman and Wessels, 1988; Ozkan, 2001; Chen, 2004; Degryse et al., 2012). Volatility: the volatility of a firm’s earnings is a measure of the risk this firm faces. Following Titman and Wessels (1988) we use the annual percentage change in EBIT to measure volatility. Tangibility: a firm’s tangibility represents assets that are easy to collateralize, for instance property, plant and equipment. Fixed assets divided by total assets is the best proxy for tangibility (Titman and Wessels, 1988; Rajan and Zingales, 1995; Hall, 2001; Chen, 2004; De Jong, 2008; Degryse et al., 2012). Similar to most studies in capital structure literature fixed assets divided by total assets is used as a proxy for a the tangibility of the firm. Table 2 provides an overview of all variables and their definitions.

Table 2: Variable definitions

Variables	Definition	Reference
Leverage	Long-term debt / total assets	(Titman & Wessels, 1988); (Talberg, Winge, Frydenberg, & Westgaard, 2008)
Profitability	EBIT / total assets	(Titman & Wessels, 1988); (De Jong, Kabir, & Nguyen, 2008)
Growth opportunities	[(total assets (t) – total assets (t-1)] / total assets (t-1)	(Titman & Wessels, 1988); (Degryse, De Goeij, & Kappert, 2012)
Size	Natural logarithm of sales	(Titman & Wessels, 1988); (Rajan & Zingales, 1995); (Ozkan, 2001); (Chen, 2004); (De Jong, Kabir, & Nguyen, 2008)
Non-debt tax shields	Depreciation / total assets	(Titman & Wessels, 1988); (Ozkan, 2001); (Chen, 2004); (Degryse, De Goeij, & Kappert, 2012)
Volatility	Standard deviation of [EBIT (t) – EBIT (t-1)] / EBIT (t-1)	(Titman & Wessels, 1988)
Tangibility	Fixed assets / total assets	(Titman & Wessels, 1988); (Rajan & Zingales, 1995); (Hall, Hutchinson, & Michaelas, 2000); (Chen, 2004); (De Jong, Kabir, & Nguyen, 2008); (Degryse, De Goeij, & Kappert, 2012)

Notes: Long-term debt, total assets, depreciation and fixed assets are all measured in book values.

4.3. Descriptive statistics

The summary statistics of the dataset are included in Appendix 3. Appendix 3 shows the mean, standard deviation, minimum and maximum of the dependent and independent variables. Appendix 3 shows that almost all minima and maxima of the variables are similar across industries. This is due to the winsorization of all the variables at a 2% level, 1% at each tail. Winsorization limits the impact of outliers and extreme values in a dataset by replacing these extreme values with the highest and lowest value of an interval. In this case values below the 1st and above the 99th percentile are replaced with the value of the 1st and 99th percentile. The values of the 1st and 99th percentile are most likely the minima and maxima and similar across industries. Therefore, we mainly look at the mean statistics of the variables.

Appendix 3 shows that on average the Public Administration has the highest leverage ratio (0.3366) while Wholesale Trade has the lowest (0.13937). More interesting is the variation of leverage ratios across industries. This was already established by several studies for example Bradley et al. (1984), Long and Malitz (1985) and Titman and Wessels (1988). This is an indication that that leverage could be affected by the industry in which a firm operates. Moreover, we find that the averages of all variables vary across industries. Profitability has one of the highest variation across industries. Remarkable is that the mean of profitability is negative for all industries except Construction and Retail Trade. Public Administration has the most negative profitability (-0.69486). The most growth opportunities reside in the Mining industry (0.38592) which means this industry experienced the largest total assets growth. Manufacturing, Retail and Wholesale Trade have the lowest growth potential. These are mostly matured industries in satisfied market and therefore have limited growth opportunities. Size, had one of the lowest variation across industries. All industries have on average fairly similar size firms in this sample. Notice that the non-debt tax shields mean is very low. This indicates that depreciation is only a small part of the total assets across all industries. Volatility shows high industry variation because means are both positive and negative across industries. Mining is by far the most volatile industry which could be attributed to the volatility of mineral prices. In addition, Mining also had the highest tangibility. This could be due to necessary machinery for mining activities.

The correlation matrix presented in Appendix 4 shows the cross correlation terms for the independent variables. Potential multicollinearity problems, where there is a significantly strong correlation among independent variables, will be discovered with this matrix. This is important because multicollinearity could produce misleading results and less reliable p-values. Looking at Appendix 4, it does not suggest a high degree of collinearity among independent variables. The correlation coefficients are all fairly small with the highest correlation between non-debt tax shields and Tangibility (0.4444). This indicates little multicollinearity problems. However, most correlation coefficients are significant which indicates multicollinearity. The VIF test is used to test whether multicollinearity is present or not. Results of this test are presented in Appendix 5 and show no values higher than 5 which indicates no multicollinearity problems.

4.4. Empirical model

The dataset consists of multiple entities over multiple years, hence a panel data analysis is applied. In order to test the hypotheses two regression models are distinguished: the general empirical model and the unrestricted model. The general empirical model regresses leverage against the firm-level predictors plus all industry dummies. The following general empirical model is estimated:

$$L_{i,t} = \beta_0 + \beta_1 P_{i,t} + \beta_2 G_{i,t} + \beta_3 S_{i,t} + \beta_4 N_{i,t} + \beta_5 V_{i,t} + \beta_6 T_{i,t} + \beta_7 AgricultureDummy_{i,t} + \beta_8 MiningDummy_{i,t} + \beta_9 ConstructionDummy_{i,t} + \beta_{10} ManufacturingDummy_{i,t} + \beta_{11} TransportationDummy_{i,t} + \beta_{12} WholesaleDummy_{i,t} + \beta_{13} RetailDummy_{i,t} + \beta_{14} ServiceDummy_{i,t} + \beta_{15} AdministrationDummy_{i,t} + \varepsilon_{i,t}$$

$L_{i,t}$ = the leverage ratio (long term) of firm i at time t,

$P_{i,t}$ = the profitability of firm i at time t,

$G_{i,t}$ = the growth opportunity of firm i at time t,

$S_{i,t}$ = the size of firm i at time t,

$N_{i,t}$ = the non-debt tax shields of firm i at time t,

$V_{i,t}$ = the percentage change in EBITDA to total assets of firm i between time t and t-1,

$T_{i,t}$ = the tangibility of firm i at time t,

$\varepsilon_{i,t}$ = the error term.

There are nine dummies generated representing the 1-digit industries of this study. These are the industry fixed effects and do not change over time. The unrestricted model is equal to the general empirical model but with the addition of the interaction terms between one firm-level predictor and the industries. There are six firm-level predictors thus this boils down to six unrestricted models, one for each firm-level predictor each including nine interaction terms. Interaction terms are generated by multiplying each firm-level predictor with the industry of interest. The hypotheses are tested by comparing the results of the general empirical model with those of the unrestricted model. This is done with two different analyses: Random Effects Model and Multilevel Model.

A Random Effects Model is used to regress the general empirical model and the unrestricted models. This model is preferred over the Fixed Effects Model because the Fixed Effects Model cannot measure variables that do not change over time. This means that all industry dummies would be omitted if the Fixed Effects Model is used. In order to improve the reliability of the results from the regressions, several adjustments are made to the variables. Only size was normally distributed whereas leverage, profitability, growth opportunities, non-debt tax shields, tangibility and volatility were not normally distributed. These variables were made normally distributed by taking the natural logarithm of their values. Furthermore, the command ‘cluster’ is used to counteract possible autocorrelation and heteroscedasticity problems (Hoechle, 2007). Our dataset can be clustered by 1-digit industries or according to a 2-digit SIC code (see Appendix 2). According to Kézdi (2004) 50 clusters are often enough to provide accurate predictions. Therefore, the data are clustered based on a 2-digit SIC code which provides 70 industry clusters.

With the Random Effects Model industry heterogeneity in firm-level predictors is tested by comparing the adjusted R^2 of the general empirical model with those of the unrestricted models. The comparison shows how much the explanatory power general empirical model improves when interaction terms of one firm-level predictor are added. The interaction terms add value when their effect differ from each other. In this case the effect of firm level predictors vary across industries. This is formally tested with a Wald test which uses the estimated coefficients and variances of the unrestricted model to compute an F-statistic. The F-statistic verifies whether the coefficients of the interaction terms in the unrestricted model are equal or not. The Wald test hypothesizes that the coefficients of all the interaction terms are equal. In other words, the inclusion of interaction terms do not add explanatory power to the model. The significance of the F-statistic will point out if the hypothesis can be rejected or not. When the p-value of the F-statistic is lower than 0.05 the hypothesis can be rejected. This implies that the interaction effects are not equal and thus the effect of firm-level predictors varies across industries.

The Multilevel Model is the second analysis to test for industry heterogeneity in firm-level predictors. This statistical analysis is particularly useful when data is nested in more than one category. Multilevel models allows both intercepts and slopes to vary across groups and therefore allows us to study the differences in slopes (effects) across those groups (industries). With this analysis the general empirical model and unrestricted models are carried out. In the general empirical model the intercepts but not the slopes are allowed to vary. The unrestricted models each have one firm-level predictor slope that is allowed to vary across industries. A likelihood-ratio test is performed to compare the goodness of fit of two models. The test compares the log-likelihood of the general empirical model with that of the unrestricted models. The null hypothesis of the likelihood-ratio test states that the fit of the general empirical model is statistically better than the unrestricted model. This is the case when the log-likelihood of the empirical model is the same or greater than that of the unrestricted model. When the p-value of the likelihood-ratio is below 0.05 the null hypothesis can be rejected. This means that the random slope of the firm-level predictor is significant and therefore the unrestricted model provides a better fit. We then conclude that the effect of firm-level predictors varies across industries.

5. Results

In this section the research results are presented. First, the results of the general empirical model are compared with those of the unrestricted models. This is done with both Random Effects Model and Multilevel Model. Second, the robustness checks are presented and discussed.

5.1. Random Effects Model

Table 3 presents the regression results of the general empirical model and unrestricted models. Each unrestricted model adds the interaction terms between one firm-level predictor and all 1-digit industries. The results from the general empirical model show that profitability exhibits a statistically significant negative relationship with leverage (p-value < 0.05). This indicates that highly profitable firms with high retained earning tend to borrow less. Which is in line with the prediction of the pecking order theory and against the static trade-off theory. All the other firm-level predictors experience a positive correlation with leverage on at least a 5% level significance level. Regarding growth opportunities and volatility this is evidence in favor of the pecking order theory. Regarding size and tangibility this favors the static trade-off theory. Overall, the results are more in favor of the pecking order theory than the static trade-off theory.

In order to test the hypotheses of this research, the R^2 of the general empirical model is compared separately to those of the unrestricted models. In addition, the F-statistic from the Wald test will point out whether the effect of firm-level predictor varies across industries. The second column of Table 3 shows the regression results when interaction terms between 1-digit industries and profitability are added to the general empirical model. The results show that the addition of profitability interaction terms result in a higher R^2. This means that adding profitability interaction terms increases the explanatory power. This increase, however, is rather small (0.06%). Therefore, the variability in in effects of profitability on leverage is expected to be low because added explanatory power by interaction terms is greater when their effect varies across industries. If they do not vary then the explanatory power is limited. Looking at the interaction effects matrix included in Appendix 6, one can see that all profitability interactions are not significant except for the Construction industry. This could explain why the increase in R^2 is relatively small. The F-statistic is statistically significant (p-value < 0.05) which indicates that the interaction effects are not equal. This implies that the effect of profitability varies across industries. The addition of growth opportunities interaction terms (growth opportunities times 1-digit industries) result in an almost similar increase in R^2. Appendix 6 shows that all interaction terms are significant. This is unexpected because we would expect a higher increase in R^2 if interaction effects are significant. The significant F-statistic points out that interaction effects are not equal and therefore the effect of growth opportunities varies across industries. Adding size interaction terms (size times 1-digit industries) strangely lowers the R^2. This might be due to flaws in the data which are not solved. The significant F-statistic does indicate that the effect of size varies across industries. From all the unrestricted model, the one that includes non-debt tax shields interaction terms (non-debt tax shields times 1-digit industries) adds the most explanatory power (R^2 increases with 0.67%). This makes sense because in Appendix 6 can be seen that all non-debt tax shields interaction effects are significant. The F-statistic is also significant which indicates that the effect of non-debt tax shields on leverage varies across industries. Volatility interaction effects add little explanatory power (0.06%) but the F-statistic is significant. This indicates that the effect of volatility varies across industries. The addition of tangibility interaction effects account for the second highest increase in R^2. Appendix 6 shows that all interaction effects are significant as is the F-statistic. Thus, the effect of tangibility varies across industries. Finally, when all interaction terms are added to the general empirical model the R^2 increases the most. An increase of 0.76% to be exact. This does not seem much but when considering a total R^2 of 9.18% then 0.76% does make quite a difference. Therefore, it is worthwhile to include the interaction terms in capital structure regressions.

Table 3: Comparing general empirical model with unrestricted models using Random Effects Modelling

	General Empirical Model	Adding Profitability interaction terms	Adding Growth opportunities interaction terms	Adding Size Interaction terms	Adding Non-debt tax shields interaction terms	Adding Volatility interaction terms	Adding Tangibility interaction terms	Adding all interaction terms
Profitability	-0.329***	-0.652***	-0.331***	-0.329***	-0.330***	-0.330***	-0.332***	0.571
	(-15.49)	(-3.64)	(-15.90)	(-16.03)	(-15.62)	(-15.56)	(-16.41)	(0.77)
Growth	0.0210***	0.0211***	-0.332**	0.0217***	0.0227***	0.0213***	0.0202***	-0.233*
	(4.08)	(4.22)	(-3.16)	(4.10)	(4.24)	(4.13)	(3.89)	(-2.40)
Size	0.118***	0.118***	0.117***	-0.0277	0.117***	0.117***	0.118***	0.000655
	(8.96)	(9.05)	(8.92)	(-0.19)	(9.15)	(9.04)	(9.01)	(0.00)
NDTS	0.0887**	0.0884**	0.0897**	0.0923***	1.209***	0.0891**	0.0964***	1.307**
	(3.16)	(3.11)	(3.19)	(3.45)	(4.92)	(3.17)	(3.60)	(2.99)
Volatility	0.0117*	0.0115*	0.0120*	0.0126**	0.0111*	0.0633	0.0125**	0.0668
	(2.45)	(2.40)	(2.50)	(2.71)	(2.29)	(0.67)	(2.60)	(0.80)
Tangibility	0.105***	0.105***	0.104***	0.105***	0.108***	0.105***	0.603***	0.129
	(7.57)	(7.57)	(7.50)	(7.66)	(8.40)	(7.59)	(3.56)	(0.55)
Constant	-3.543***	-4.236***	-4.111***	-1.821	0.483	-3.513***	-1.902***	3.798
	(-7.89)	(-5.61)	(-6.73)	(-1.24)	(0.91)	(-7.70)	(-3.96)	(1.14)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Profitability interaction terms	No	Yes	No	No	No	No	No	Yes
Growth interaction terms	No	No	Yes	No	No	No	No	Yes
Size interaction terms	No	No	No	Yes	No	No	No	Yes
NDTS interaction terms	No	No	No	No	Yes	No	No	Yes
Volatility interaction terms	No	No	No	No	No	Yes	No	Yes
Tangibility interaction terms l	No	No	No	No	No	No	Yes	Yes
Observations	91988	91988	91988	91988	91988	91988	91988	91988
R^2	0.0918	0.0924	0.0925	0.0904	0.0985	0.0924	0.0950	0.0994
F-statistic		42.70	76.20	86.04	48.78	31.18	77.27	2.3e+08
P-value		0.0000	0.0000	0.0000	0.0000	0.0089	0.0001	0.0000

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.2. Multilevel Model

The results of the Multilevel Model are presented in Table 4. This table shows the outcomes of the likelihood-ratio tests. It does not display coefficients of other statistical parameters since our main interest lies in the variability of effects.

Table 4: Comparing general empirical model with unrestricted models using Multilevel Modelling

Unrestricted Model	Likelihood ratio	p-value	Result
Adding profitability interaction terms	87.39	0.0000	Effect of profitability varies
Adding growth opportunity interaction	73.48	0.0000	Effect of growth opportunities varies
Adding size interaction terms	48.00	0.0000	Effect of size varies
Addin non-debt tax shields interaction terms	695.47	0.0000	Effect of non-debt tax shields varies
Adding volatility interaction terms	51.43	0.0000	Effect of volatility varies
Adding tangibility interaction terms	361.69	0.0000	Effect of tangibility varies
Adding all interaction terms	987.52	0.0000	Effect of all firm-level predictors varies

Table 4 shows that the likelihood-ratio of all unrestricted models are significant (p-value < 0.05). This means the goodness of fit of all unrestricted model is significantly better than the general empirical model. It also indicates that the coefficients of the interaction terms per firm-level predictor are not equal. Therefore, the effects of profitability, growth opportunities, size, non-debt tax shields, volatility and tangibility vary across industries. The most variability in slopes seems to be in non-debt tax shields and tangibility. Adding their interaction terms results in the highest likelihood-ratios. This is in line with the results found in Table 3 because these predictors also add the most explanatory power.

When combining the results of Table 3 and 4, it becomes clear that both results indicate that industry heterogeneity exist in all firm-level predictors. All unrestricted models have more explanatory power than the general empirical model except for the one that adds size interaction terms. However, the F-statistics indicates that interaction effects of size vary across industries. All F-statistics and likelihood ratios are significant. Therefore, all hypotheses can be accepted based on results from both Radom Effects Model and Multilevel Model.

5.3. Robustness checks

5.3.1. Sensitivity to industry classifications

The results in Tables 3 and 4 are based on the distinction of nine 1-digit industries. In this chapter the same methodology is applied but now for 2-digit industries. This includes 76 industries, however, three industries were omitted because they had no observations. These industries were Private Households, Administration of Human Resource Programs and Administration of Economic Programs. As a result 73 industries are distinguished. The data are again clustered based on a 2-digit SIC code which provides 70 clusters. Table 5 presents the results from the Random Effect Model.

Table 5 shows that the relationships between the firm-level predictor in the general empirical model goes into the same direction as in Table 3. There is a small difference in the coefficients compared to Table 3. The significance levels are the same except for volatility which is significant at a 1% level compared to 5% level before. These results are still more in favor of the pecking order theory as opposed to the static trade-off theory. Furthermore, it becomes clear that the R^2 of the general empirical model is higher than in Table 3. This makes sense because we have distinguished more industries and can therefore more accurately specify relationships between leverage and independent variables. Notice that the R^2 increases more in Table 5 than in Table 3 when interaction effects are added. For example in Table 3 the inclusion of profitability interaction effects increased the R^2 with only 0.06% compared to 0.29% in Table 5. Similar to the results from Table 3, the interaction terms of non-debt tax shields and tangibility add the most explanatory power. When all interaction terms are added the R^2 increases with 1.52% which is double the amount in Table 3. Also notice that the F-statistics of all unrestricted models are significant.

Overall, this means that there is evidence for industry heterogeneity in all firm-level predictors. The level of industry aggregation does influence the amount of added explanatory value. The more accurately industries are specified the more explanatory power is gained. This indicates more variability in effects across industries. Even though 2-digit industries add more explanatory power, it also increases the complexity. Therefore, a trade-off between explanatory value and complexity is present.

Table 5: Comparing general empirical model with unrestricted models distinguishing industries on 2-digit SIC code level

	General Empirical Model	Adding Profitability interaction terms	Adding Growth opportunities interaction terms	Adding Size interaction terms	Adding Non-debt tax shields interaction terms	Adding Volatility interaction terms	Adding Tangibility interaction terms	Adding all interaction terms
Profitability	-0.318***	-1.029***	-0.319***	-0.318***	-0.318***	-0.318***	-0.320***	5.548***
	(-15.01)	(-32.33)	(-15.41)	(-15.56)	(-15.10)	(-15.03)	(-15.78)	(22102864.48)
Growth	0.0231***	0.0232***	0.301***	0.0241***	0.0246***	0.0234***	0.0218***	1.130***
	(4.49)	(4.76)	(20.55)	(4.56)	(4.60)	(4.52)	(4.24)	(7042.27)
Size	0.119***	0.121***	0.119***	-0.176***	0.118***	0.118***	0.119***	-0.481***
	(8.83)	(9.06)	(8.77)	(-41.64)	(9.05)	(8.90)	(8.89)	(-3841.43)
NDTS	0.0786**	0.0780**	0.0797**	0.0822***	0.309***	0.0791**	0.0900***	-0.618***
	(3.02)	(2.93)	(3.05)	(3.33)	(21.71)	(3.03)	(3.55)	(-810.40)
Volatility	0.0123**	0.0123**	0.0124**	0.0132**	0.0117*	0.280***	0.0131**	0.147***
	(2.59)	(2.59)	(2.62)	(2.90)	(2.44)	(76.18)	(2.75)	(12885.27)
Tangibility	0.101***	0.102***	0.0996***	0.101***	0.104***	0.101***	0.752***	-0.398***
	(7.22)	(7.29)	(7.15)	(7.31)	(7.97)	(7.23)	(56.88)	(-1688.13)
Constant	-3.137***	-4.123***	-2.706***	0.457***	-1.715***	-3.026***	-1.221***	15.82***
	(-12.39)	(-15.04)	(-10.65)	(3.48)	(-7.27)	(-12.13)	(-6.59)	(3835.88)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Profitability interaction terms	No	Yes	No	No	No	No	No	Yes
Growth interaction terms	No	No	Yes	No	No	No	No	Yes
Size interaction terms	No	No	No	Yes	No	No	No	Yes
NDTS interaction terms	No	No	No	No	Yes	No	No	Yes
Volatility interaction terms	No	No	No	No	No	Yes	No	Yes
Tangibility interaction terms l	No	No	No	No	No	No	Yes	Yes
Observations	91988	91988	91988	91988	91988	91988	91988	91988
R^2	0.1219	0.1248	0.1230	0.1224	0.1289	0.1230	0.1276	0.1371
F-statistic		70092.58	1.3e+05	1.9e+10	25325.88	15469.41	1.1e+05	6.1e+14
P-value		0.0000	0.0000	0.0000	0.0000	0.0089	0.0001	0.0000

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6 summarizes the results from the Multilevel Model based on a 2-digit SIC code level. All likelihood-ratios are significant which indicates that all independent variables experience industry heterogeneity. Furthermore, all likelihood-ratios in Table 6 are higher than those of Table 4 except for non-debt tax shields. This indicates that for most predictors the variation in effects are stronger when industries are more accurately specified. Overall, the Random Effects and Multilevel Model indicated that all firm-level predictors vary across industries. Therefore, they confirm the main results of this research (Table 3 and 4).

Table 6: Comparing general empirical model with unrestricted models distinguishing industries on a 2-digit SIC code level

Unrestricted Model	Likelihood ratio	p-value	Result
Adding profitability interaction terms	192.79	0.0000	Effect of profitability varies
Adding growth opportunity interaction	72.72	0.0000	Effect of growth opportunities varies
Adding size interaction terms	160.71	0.0000	Effect of size varies
Addin non-debt tax shields interaction terms	645.64	0.0000	Effect of non-debt tax shields varies
Adding volatility interaction terms	62.67	0.0000	Effect of volatility varies
Adding tangibility interaction terms	3506.78	0.0000	Effect of tangibility varies
Adding all interaction terms	1329.19	0.0000	Effect of all firm-level predictors varies

5.3.2. Possible effects of winsorizing

The final robustness check addresses how winsorizing might affect the results. In Table 3 variables have been winsorized at a 2% level. This robustness check will construct the same table but with variables winsorized at a 5% level. The results are presented in Appendix 7. These results show similar patterns with those of Table 3. Coefficients from the general empirical model are slightly different. Non-debt tax shields becomes more significant when winsorized at 5%. The R^2 of the general empirical is also higher than in Table 3. This might be due to the fact that more outliers have been removed so the model becomes more accurate.Adding interaction terms lead to a roughly similar increases in the R^2 compared to Table 3. The F-statistics are all significant which means that effects of all firm-level predictors vary across industries. This is the same conclusion as the one drawn from Table 3.

6. Discussion

This section discusses the interpretation and significance of the results. First, the significance of the results will be explained. In addition, the explanations of unexpected results are given. Finally, limitations and possible ideas for future research are described.

6.1. Explanation of results

The main results made clear that the effects of all firm-level predictors varied significantly across industries. Besides the statistical significance, we are also interested in the (statistical) relevance of these results. In other words, how much these results contribute to the understanding of leverage. This is done by putting the results in perspective. The increases in R^2 from the main results are compared with the increase in R^2 coming from the initial firm-level predictors. The increases in R^2 from adding interaction terms are: 0.06% (profitability), 0.07% (growth opportunities), -0.14% (size), 0.67% (non-debt tax shields), 0.06 (volatility) and 0.32% (tangibility). The increase in R^2 resulting from initial firm-level predictors are: 2.85% (profitability), 0.24% (growth opportunities), 0.37% (size), 0.55% (non-debt tax shields), 0.55% (volatility) and 0.73% (tangibility). In general, these increases in R^2 are much higher compared to the increases coming from the inclusion of interaction effects. However, the increase of R^2 coming from the addition of non-debt tax shields interactions (0.67%) and tangibility interactions (0.32%) come close or even surpasses the increase in R^2 resulting from initial firm-level predictors. Therefore, these interaction terms are not only statistically significant but also significantly contribute to a better understanding of leverage. The interaction terms of these firm-level predictors are the most (statistically) relevant.

This study has so far proved that variation in effects exist and therefore interaction terms add explanatory power but not how this relates to the conflicting results described in section 2.2. In Table 3 we can see that initial effects of predictors change when interaction terms of a firm-level predictor are. This change is quite substantial for all firm-level predictors but the biggest change is observed in the effects of non-debt tax shields and tangibility. For example the effect of non-debt tax shields was 0.0887 (general empirical model) and when non-debt tax shields interactions were added this effect was 1.209. In most cases the effect becomes larger but remains in the same direction. Only the effect of size changed from a positive correlation (0.188) to a negative correlation (-0.0277). Nevertheless, industry heterogeneity could contribute to solving the puzzle of conflicting results because the initial effects of firm-level predictors change substantially when interaction terms are added. However, it remains ambiguous how much of the puzzle is solved when industry heterogeneity in firm-level predictors is incorporated in regression models.

A remarkable finding is that the R^2 decreased from 9.18% to 9.04% when size interaction terms are added to the general empirical model. This is puzzling because we expected the R^2 to be at least equal to that of the general empirical model. One possible explanation could be that of data inconsistencies. The sample of this research has many missing values. Stata might eliminated cases with missing values in the unrestricted model that were present in the general empirical model. A solution could be to drop observations. However, dropping observations that may be important could also introduce biases in results (Frank & Goyal, 2009). In addition, we would lose a great amount of data when observations with missing values were dropped. Therefore, the dataset is left untouched.

The second noteworthy result is the significance of the F-statistics and likelihood-ratios of firm-level predictors. All F-statistics have a p-value of 0.0000, 0.0001 or 0.0089 and all likelihood-ratios have p-values of 0.0000. This indicates extremely high significance. Additionally, the F-statistics and likelihood ratios itself are also very high. The F-statistics and likelihood-ratios all depend on the number of observations. The dataset used in this study has many observations. This increases the chances of observations whose slopes vary from the mean. This will be detected by the Wald test and likelihood-ratio test. These tests then conclude that the unrestricted models provide a significantly better fit.

As stated in section 2, previous studies found conflicting results regarding the effect of firm-level predictors on leverage. Even fewer studies have considered industries as a potential cause for this issue. Studies from Hall et al. (2000) , Talberg et al. (2008) and Degryse (2012) all found evidence that the relationship between firm-level predictors and leverage vary across industries. The results of this research were in accordance with Degryse et al. (2012). They found variation in effect of profitability, non-debt tax shields and tangibility. Additionally, Hall et al. (2000) found similar results except the effect of profitability did not vary across industries. Talberg et al. (2008) found different results in the sense that the effects of growth opportunities and size were similar.

Compared to the previous mentioned studies, this research contributes to the capital structure literature in three ways. First, by using international data and not exclusively use firms from one country or continent. Second, a considerably longer time frame is used ranging from 1990-2017. Third, this research distinguishes nine industries but this is extended to 73 industries in a robustness check. The use of international data over with a long time frame improves the generalizability of the results. Furthermore, the expansion of industries improves the accuracy of the research because the effects can be better specified per industry.

6.2. Limitations and future research

Even though this research aims to be as complete and thorough as possible it still has a number of limitations. First, this research only proved the existence of industry heterogeneity in firm-level predictors but did not find what causes these differences to occur. There might be certain industry characteristics that have a big impact on the differences in industry slopes of firm-level predictors. These industry characteristic could be a valuable addition in explaining leverage. Second, this research is limited to one measure for each variable. There are several definitions of the dependent and independent variables in capital structure literature. For example, long-term debt to market value of total assets or long-term debt to net assets as a measure of long-term debt. This argument also applies to the measures of firm-level predictors. For example, market value of assets to book value of total assets as an alternative measure for growth opportunities. Although the measures in this study are commonly used, one could use the different measures as a robustness check for the effects of firm-level predictors on leverage. Third, the dataset contained many missing values. One potential drawback is that cases with missing values might be eliminated. Another issue is that missing values could influence the t-values. Ideally, a dataset without missing values should be used. However, these data are difficult to gather.

A suggestion for future research is to examine what causes the industry heterogeneity in firm-level predictors. When the main drivers of industry heterogeneity are known it could be transformed into a single or multiple variables. This could then be included in capital structure regression models without having to include dozens of industry fixed effects and interaction effects. In addition, future research could increase the number of industries by using 3-digit or even 4-digit SIC codes. The results made clear that an increased number of industries increased the explanatory power added by interaction effects as well as the R^2 of the general empirical model. Even though this would make the research more complex, with more accurately specified industries one can conclude whether is fruitful to include industries on a 3- or 4-digit level.

7. Conclusion

Capital structure choice is one of the most important decisions faced by firms. Many studies have been devoted to find firm characteristics that explain leverage. They aim to prove or disprove two capital structure theories: static trade-off theory and the pecking order theory. Despite extensive literature, there are still unresolved conflicting results regarding the effects of firm-level predictors on leverage. However, little is known about the causes of the conflicting results and the role that industries play in this phenomenon.

This study employs a large panel dataset to research the variation in effects of firm-level predictors across industries. The research question was: *What are the differences in firm-level predictors of capital structure across industries*. In order to investigate this question, two regression models are carried out: Random Effects Model and Multilevel Model. For the Random Effects Model the R^2 and the F-statistics are analyzed while the Multilevel Model looks at the likelihood ratio. The results showed that adding interaction terms between firm-level predictors and industries increase the explanatory power, except size interaction terms. Furthermore, all F-statistics and likelihood-ratios were highly significant. Therefore, the effect of profitability, growth opportunities, size, non-debt tax shields, volatility and tangibility all vary across industries. We also conclude that when interaction terms of firm-level predictors are added it changes the initial effects of the predictor. This indicates that industry heterogeneity could contribute to solving the puzzle of conflicting results. However, it remains ambiguous how much of the puzzle is solved when industry heterogeneity in firm-level predictors is incorporated in regression models. Note that this is dependent on the level of aggregation in industries. When industries are more accurately specified (3-digit SIC code) the increase in explanatory power coming from the addition of interaction effects is greater. In the case of 3-digit industries the addition of interaction effects results in a greater increase in explanatory power and higher F-statistics and likelihood ratios. Therefore, the variation in effects is larger when industries are more accurately specified.

This study showed that variation in effects of firm-level predictors across industries exist. It also presented evidence of the benefits of distinguishing industries and incorporating their interaction terms in statistical models. Industry heterogeneity in non-debt tax shields and tangibility are the most relevant because they add the most explanatory power. In addition, they observed the biggest change in their initial effects when interaction terms were added. Benefits increase when industries are more accurately specified. Therefore, this study advocates that the industry heterogeneity in firm-level predictors should be incorporated in statistical models. Ideally, this is done with the highest level of disaggregation of industries. However, this increases the complexity. Therefore, a trade-off is to be made between explanatory power and complexity.

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Appendices

Appendix 1: Variable description

Variables	Description
Total assets	Total assets represent the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.
Long-term debt	All interest bearing financial obligations, excluding amounts due within one year. It is shown net of premium or discount.
Sales	Net sales or revenues represent gross sales and other operating revenue less discounts, returns and allowances.
EBITDA	Earnings before interest and taxes (EBIT) represent the earnings of a company before interest expense and income taxes. It is calculated by taking the pre-tax income and adding back interest expense on debt and subtracting interest capitalized.
Fixed assets	Capital expenditure represent the funds used to acquire fixed assets other than those associated with acquisitions.
Depreciation	Depreciation represents the process of allocating the cost of a depreciable asset to the accounting periods covered during its expected useful life to a business. It is a non-cash charge.

Notes: These descriptions are extracted from the Thomson Reuters database.

Appendix 2: 1-digit and 2-digit SIC code Industrial Classification

1-digit industry	2-digit SIC codes	Industrial Classification
Agriculture, Forestry, Fishing	01	Agricultural Production - Crop
	02	Agricultural Production - Livestock
	07	Agricultural Services
	08	Forestry
	09	Fishing, Hunting and Trapping
Mining	10	Metal Mining
	12	Bituminous Coal and Lignite Mining
	13	Oil and Gas Extraction
	14	Mining and Quarrying of Nonmetallic Minerals, except Fuels
Construction	15	Building Construction General Contractors and Operative Builders
	16	Heavy Construction other than Building Construction Contractors
	17	Construction Special Trade Contractors
Manufacturing	20	Food and Kindred Products
	21	Tabacco Products
	22	Textile Mill Products
	23	Apparel and other Finished Products Made from Fabrics and Similar Materials
	24	Lumber and Wood Products, except Furniture
	25	Furniture and Fixtures
	26	Paper and Allied Products
	27	Printing, Publishing and Allied Industries
	28	Chemicals and Allied Products
	29	Petroleum Refining and Related Industries
	30	Rubber and Miscellaneous Plastics Products
	31	Leather and Leather Products
	32	Stone, Clay, Glass, and Conrete Products
	33	Primary Metal Industries
	34	Fabricated Metal Products, except Machinery and Transportation Equipment
	35	Industrial and Commercial Machinery and Computer Equipment
	36	Electronic and other Electric Equipment and Components, except Computer Equipment
	37	Transportation Equipment
	38	Measuring, Analyzing, and Controlling Instruments; Photographic, medical and Optical Goods; Watches and Clocks
	39	Miscellaneous Manufacturing Industries
Transportation & Public	40	Railroad Transportation
	41	Local and Suburban Transit and Interurban Highway Passenger Transportation
	42	Motor Freight Transportation and Warehousing
	43	United States Postal Service
	44	Water Transportation
	45	Transportation by Air
	46	Pipelines, except Natural Gas
	47	Transportation Services
	48	Communications
	49	Electric, Gas and Sanitary Services
Wholesale Trade	50	Wholesale Trade-Durable Goods
	51	Wholesale Trade-Nondurable Goods
Retail Trade	52	Building Materials, Hardware, Garden Supply, and Mobile Home Dealers
	53	General Merchandise Stores
	54	Food Stores
	55	Automative Dealers and Gasoline Service Stations
	56	Apperal and Accessory Stores
	57	Home Furniture, Furnishing, and Equipment Stores
	58	Eating and Drinking Places
	59	Miscellaneous Retail
Services	70	Hotels, Rooming Houses, Camps, and other Lodging Places
	72	Personal Services
	73	Business Services
	75	Automotive Repear, Services, and Parking
	76	Miscellaneous Repair Services
	78	Motion Pictures
	79	Amusement and Recreation Services
	80	Health Services
	81	Legal Services
	82	Educational Services
	83	Social Services
	84	Museums, Art Galleries, and Botanical and Zoological Gardens
	86	Membership Organizations
	87	Engineering, Accounting, Research, Management, and Related Services
	88	Private Households
	89	Miscellaneous Services
Public Administration	91	Executive, Legislative, and General Government, except Finance
	92	Justice, Public Order, and Safety
	93	Public Finance, Taxation, and Monetary Policy
	94	Administration of Human Resource Programs
	95	Administration of Environmental Quality and Housing Programs
	96	Administration of Economic Programs
	97	National Security and International Affairs
	99	Nonclassifiable Establishments

Appendix 3: Descriptive statistics

Industryid2	stats	Leverage	Profit~y	Growth	Size1	NDTS	Volati~y	Tangib~y
1	mean	.16749	-.00407	.17366	10.633	.02654	.01919	.05515
	sd	.16308	.41996	.5341	2.1818	.02222	2.2853	.06261
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	17.931	.14824	9.2226	.33253
2	mean	.22913	-.38291	.38592	10.346	.04375	.43375	.12826
	sd	.21121	.86793	.98442	3.3347	.04531	3.0192	.112
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	19.968	.14824	9.2226	.33253
3	mean	.14697	.02435	.15432	11.363	.01467	-.06805	.03024
	sd	.1472	.2387	.47867	2.1985	.01835	2.1366	.04893
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	18.828	.14824	9.2226	.33253
4	mean	.15701	-.03924	.14804	11.411	.03498	-.04169	.05394
	sd	.16323	.46913	.5125	2.2999	.02569	2.1617	.05765
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	19.954	.14824	9.2226	.33253
5	mean	.27118	-.03099	.17624	12.214	.04558	.06397	.07683
	sd	.19846	.46455	.57968	2.5534	.03363	2.1102	.07334
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	18.96	.14824	9.2226	.33253
6	mean	.13937	-.02364	.13512	11.626	.02192	-.04269	.03386
	sd	.15592	.44094	.50742	2.5664	.02414	2.1266	.0488
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	19.106	.14824	9.2226	.33253
7	mean	.18422	.0085	.13396	12.52	.03888	-.02709	.06352
	sd	.16708	.37487	.45339	2.4435	.02761	2.0799	.06079
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	20.031	.14824	9.2226	.33253
8	mean	.19453	-.21213	.27458	10.374	.03688	.06747	.05056
	sd	.2148	.75321	.79286	2.6458	.03658	2.5617	.06801
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	18.524	.14824	9.2226	.33253
9	mean	.3366	-.69486	.24371	8.9029	.05212	.17137	.06645
	sd	.26758	1.1803	1.0169	3.3404	.04452	3.5653	.08463
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	15.085	.14824	9.2226	.33253
Total	mean	.1787	-.08698	.18889	11.306	.03538	.02129	.05953
	sd	.18142	.56315	.62047	2.5464	.03069	2.2989	.06957
	min	.00062	-3.2167	-.58651	.69315	.0008	-7.7287	.00064
	max	.81575	.30729	3.3414	20.031	.14824	9.2226	.33253

Notes: where Industy1= agriculture, forestry, fishing and Industry2=mining and Industry3=construction and Industry4=manufacturing and Industry5=transportation & public utilities and Industry6=wholesale trade and Industry7=retail trade and Industry8= services and Industry9=public administration.

Appendix 4: Correlation matrix

	Leverage	Profit~y	Growth	Size	NDTS	Volati~y	Tangib~y
Leverage	1.0000						
ofitabil~y	-0.0534*	1.0000					
Growth	-0.0050*	0.1171*	1.0000				
Size	0.1286*	0.0564*	-0.2074*	1.0000			
NDTS	0.1440*	0.0738*	-0.2018*	0.1242*	1.0000		
Volatility	-0.0004	0.0042*	0.2760*	-0.2037*	-0.0443*	1.0000	
angibility	0.1294*	0.1570*	0.0688*	0.1600*	0.4444*	-0.0280*	1.0000

Notes: * Indicates that the correlation coefficients are significant at the 10% level or better.

Appendix 5: VIF test

Variable	VIF	1/VIF
NDTS	1.67	0.598460
Tangibility	1.61	0.621340
Growth	1.19	0.841083
Volatility	1.08	0.922260
Size	1.05	0.956906
Profitabil~y	1.04	0.959694
Mean VIF	1.27	

Appendix 6: Interaction effects matrix

	Profitability	Growth opportunities	Size	Non-debt tax shields	Volatility	Tangibility
Agriculture, Forestry, Fishing	0.342	0.411***	0.146	-1.026***	-0.0524	-0.431*
	(1.84)	(3.86)	(0.99)	(-3.96)	(-0.55)	(-2.47)
Mining	0.275	0.359***	0.134	-1.066***	-0.0471	-0.441*
	(1.48)	(3.40)	(0.91)	(-4.23)	(-0.50)	(-2.54)
Construction	0.426*	0.366***	0.226	-1.367***	-0.0373	-0.609***
	(2.37)	(3.48)	(1.51)	(-5.41)	(-0.39)	(-3.51)
Manufacturing	0.320	0.368***	0.104	-1.058***	-0.0410	-0.455**
	(1.77)	(3.50)	(0.72)	(-4.29)	(-0.43)	(-2.69)
Transportation & Public Utilities	0.363	0.326**	0.144	-1.166***	-0.0592	-0.550**
	(1.86)	(3.09)	(0.99)	(-4.66)	(-0.62)	(-3.23)
Wholesale Trade	0.408*	0.347***	0.207	-1.088***	-0.0609	-0.462**
	(2.23)	(3.30)	(1.43)	(-4.38)	(-0.64)	(-2.74)
Retail Trade	0.272	0.316**	0.151	-1.136***	-0.0681	-0.561**
	(1.45)	(3.00)	(1.03)	(-4.49)	(-0.71)	(-3.29)
Services	0.261	0.329**	0.235	-1.090***	-0.0882	-0.525**
	(1.43)	(3.10)	(1.62)	(-4.38)	(-0.93)	(-3.10)
Public Administration (Reference category)	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix 7: Regression results robustness winsorization

	General Empirical Model	Adding Profitability interaction terms	Adding Growth opportunities interaction terms	Adding Size interaction terms	Adding Non-debt tax shields interaction terms	Adding Volatility interaction terms	Adding Tangibility interaction terms	Adding all interaction terms
Profitability	-0.312***	-0.738***	-0.314***	-0.313***	-0.311***	-0.313***	-0.314***	0.232
	(-16.18)	(-3.58)	(-16.66)	(-16.71)	(-15.96)	(-16.23)	(-17.00)	(0.46)
Growth	0.0222***	0.0223***	-0.331**	0.0228***	0.0232***	0.0225***	0.0216***	-0.232
	(4.54)	(4.72)	(-2.73)	(4.56)	(4.60)	(4.60)	(4.41)	(-1.95)
Size	0.122***	0.122***	0.122***	-0.0304	0.121***	0.121***	0.122***	-0.0190
	(9.27)	(9.36)	(9.26)	(-0.22)	(9.48)	(9.37)	(9.36)	(-0.13)
NDTS	0.0899***	0.0896***	0.0909***	0.0931***	1.192***	0.0903***	0.0962***	1.163***
	(3.83)	(3.76)	(3.86)	(4.16)	(4.84)	(3.84)	(4.17)	(3.37)
Volatility	0.0101*	0.00985*	0.0104*	0.0109*	0.00968*	0.0363	0.0107*	0.0552
	(2.22)	(2.17)	(2.29)	(2.49)	(2.11)	(0.33)	(2.36)	(0.57)
Tangibility	0.102***	0.102***	0.101***	0.102***	0.105***	0.102***	0.579***	0.162
	(7.74)	(7.78)	(7.66)	(7.86)	(8.68)	(7.76)	(3.30)	(0.69)
Constant	-3.488***	-4.409***	-4.063***	-1.686	0.502	-3.465***	-1.905***	3.009
	(-8.69)	(-5.48)	(-6.90)	(-1.18)	(0.83)	(-8.10)	(-3.72)	(1.09)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Profitability interaction terms	No	Yes	No	No	No	No	No	Yes
Growth interaction terms	No	No	Yes	No	No	No	No	Yes
Size interaction terms	No	No	No	Yes	No	No	No	Yes
NDTS interaction terms	No	No	No	No	Yes	No	No	Yes
Volatility interaction terms	No	No	No	No	No	Yes	No	Yes
Tangibility interaction terms l	No	No	No	No	No	No	Yes	Yes
Observations	91988	91988	91988	91988	91988	91988	91988	91988
R^2	0.0975	0.0981	0.0982	0.0961	0.1034	0.0981	0.1000	0.1042
F-statistic		39.52	73.72	85.68	35.55	31.25	76.18	4.0e+08
P-value		0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$