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Firm leverage: Growth dynamics in low interest rate environment

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ABSTRACT:

The selection of a capital structure stands as one of the pivotal decisions shaping a firm's financial landscape. Although Modigliani and Miller (1958) assert the irrelevance of capital structure, real-world financial conditions often do not align with the assumptions underlying this statement. Various theories on capital structure have been proposed, yet a consensus on which theory represents the norm remains elusive. This complexity impedes the examination of capital structure's impact on firm operations. A significant question arises regarding how leverage influences a firm's investments and growth.

This thesis aims to contribute to the ongoing discourse on the relationship between firm leverage and its impact on firm growth, measured through employment, capital expenditure growth, and net investments. It adopts a methodology similar to that originated in Lang et al. (1996).

This study utilizes the US dataset from 2010 to 2018. To be included, firms must possess a Standard Industrial Classification (SIC) code falling between 2000 and 3999 (to minimize regulatory effects) and maintain annual sales of at least $1 billion in any given year, measured in 2010 USD. The final dataset comprises 159 companies, yielding approximately 900 to 1,500 firm-year observations, depending on the specific growth measure under examination: net investment, one-year and three-year employment growth rates, and one-year and three-year capital expenditure growth rates. In addition to book leverage, the independent variable, control variables such as sales growth, capital expenditures, cash flow, and Tobin's q are incorporated into the regression model.

The results suggest that in positive business cycle periods like the 2010s, there is no correlation between leverage and firm growth. Over the sample period, the average leverage level of the companies in the dataset increased gradually from 28% to 35%. Concurrently, the US economy rebounded from the financial crisis and received support from government interventions. This had an impact on corporate earnings, employment, and capital expenditures.

KEYWORDS: Capital structure, leverage, debt, firm growth, Tobin's q

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TIIVISTELMÄ:

Valitessaan pääomarakennetta yritys tekee yhden keskeisimmistä taloudellista asemaa muokkaavista päätöksistä. Vaikka Modigliani ja Miller (1958) väittävät, että pääomarakenteella ei ole merkitystä, todelliset taloudelliset olosuhteet eivät usein vastaa tämän väitteen taustalla olevia oletuksia. Erilaisia pääomarakenneteorioita on ehdotettu, mutta yhteisymmärrystä siitä, mikä teoria edustaa normia, ei ole saavutettu. Tämä ristiriitaisuus vaikeuttaa pääomarakenteen vaikutuksen tutkimista yrityksen toimintaan. Merkittävä kysymys on, kuinka velkaantuneisuus vaikuttaa yrityksen investointeihin ja kasvuun.

Tämä tutkielma pyrkii edistämään keskustelua yrityksen velkaantuneisuuden ja sen kasvun vaikutusten suhteesta, mitattuna työllisyydellä, investointimenojen kasvulla ja nettoinvestoinneilla. Tutkimuksessa käytetään Lang et al. (1996) -tutkimuksesta lähtöisin olevaa menetelmää.

Tutkielma hyödyntää Yhdysvaltain data-aineistoa vuosilta 2010-2018. Mukaan otettavien yritysten on oltava Standard Industrial Classification (SIC) -koodin 2000 ja 3999 välillä (regulatiivisten vaikutusten minimoimiseksi) ja niiden vuosittaisten liikevaihdon on oltava vähintään miljardi (US) dollaria minä tahansa vuonna, mitattuna vuoden 2010 Yhdysvaltain dollareina. Lopullinen aineisto käsittää 159 yritystä, mikä tarkoittaa noin 900–1500 yritysvuosi-havaintoa riippuen tarkasteltavasta kasvumittarista: nettosijoitukset, yhden ja kolmen vuoden työllisyyskasvu sekä yhden ja kolmen vuoden investointimenojen kasvu. Riippumattomana muuttujana olevan kirjanpidollisen velkaantuneisuuden lisäksi regressiomalliin sisällytetään kontrollimuuttujia, kuten myynnin kasvu, investointimenot, kassavirta ja Tobinin q.

Tulokset viittaavat siihen, että positiivisina suhdannekausina, kuten 2010-luvulla, ei ole korrelaatiota velkaantuneisuuden ja yrityksen kasvun välillä. Aineistossa mukana olevien yritysten keskimääräinen velkaantumisaste kasvoi asteittain 28 prosentista 35 prosenttiin tarkastelujakson aikana. Samanaikaisesti Yhdysvaltain talous elpyi finanssikriisistä ja sai tukea hallituksen interventioista. Tämä vaikutti yritysten tuloksiin, työllisyyteen ja investointimenoihin positiivisesti.

AVAINSANAT: Capital structure, leverage, debt, firm growth, Tobin's q

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Abbreviations

BV	Book Value
CapEx	Capital expenditures
FA	Fixed assets
MM	Modigliani and Miller
MV	Market value
MWW	Mann-Whitney-Wilcoxon

1 Introduction

Throughout a firm's lifespan, its management repeatedly grapples with the question of the optimal debt level. Despite Modigliani and Miller's (MM) assertion (Modigliani and Miller, 1958; Modigliani and Miller, 1963) of the irrelevance of capital structure, real-world deviations from their assumptions raise numerous inquiries about the impact of capital structure on a firm. One pivotal and ambiguously answered question pertains to the relationship between firm leverage and future growth. If such a relationship exists, it is expected to be negative – high leverage hindering firm growth. Empirical studies, like Lang et al. (1996), provide support for this notion. Findings also indicate that the relationship is intricate, intertwined with other firm-specific factors such as anticipated growth opportunities (Tobin's q), and possibly influenced by external factors like economic cycles.

The economic significance of gaining a deeper understanding of the connection between firm growth and capital structure should not be overlooked. All stakeholders stand to gain if firm management and owners are guided early on toward more effective decision-making regarding various funding sources. Additionally, there should be a focus on both theoretical and practical interests in determining whether leverage truly has a negative impact on growth in certain situations, or if this potential relationship merely mirrors other factors such as managerial decision-making and insider information.

1.1 Purpose of the study

The aim of this thesis is to contribute to the discourse on corporate leverage and its impact on firm growth, as measured by increases in employment, capital expenditures, and net investment. Additionally, the study explores the influence of anticipated growth opportunities (Tobin's q) on this relationship. The dataset encompasses U.S. companies during the base years of 2010-2018, with sales reaching one billion dollars measured in 2010's currency. The research closely follows the framework established by Lang et al.

(1996), who investigated similar relationships using U.S. data from 1970-1989. Notably, the data is examined at the overall period level, focusing on the time between financial crisis and onset of the COVID-19 crisis. During this period, interest rates were exceptionally low, so the research does not specifically include divergent global economic conditions.

1.2 Structure of the study

The remaining sections of the paper are structured as follows: Chapter 2 offers a comprehensive theoretical framework on capital structure and explores discussions regarding the connection between leverage and firm growth. Building upon this foundation, various theories of capital structure are discussed, including the trade-off theory, pecking order theory, and agency theory. Chapter 3, keeping previous empirical evidence foundations in consideration. Through a systematic review of the literature, we aim to build upon the existing body of knowledge and contribute new insights to the field of capital structure research. Chapters 4 and 5 delve into the data and econometrics methodology necessary to derive the results to analyze the relationship between firm growth characteristics and capital structure choices. The findings are presented in chapter 5 and briefly discussed in Chapter 6.

2 Theoretical framework

The topic of capital structure and firm leverage has been extensively debated in finance literature over the past century. Beginning with Modigliani and Miller's (MM's) theory on the irrelevance of capital structure (refer to chapter 2.1.1), researchers have developed various models and theories to elucidate optimal capital structures. These frameworks aim to explain firms' choices regarding capital structure and its implications on their operations, performance, and broader economic significance. In addition to theoretical contributions, empirical findings have also been abundant. Nevertheless, numerous questions remain unanswered, outweighing the established truths. The limited span of recorded history alone underscores the need for more comprehensive studies to grasp firm behavior and performance through the lens of capital structure.

2.1 Capital structure theories

This chapter provides an overview of existing literature concerning theories of capital structure. While the emphasis of this study lies in examining the impact of capital structure choices, specifically the proportion of debt financing, rather than determining the optimal capital structure, it is essential to discuss notable works, publications, and overarching approaches to the issue. These diverse theories of capital structure serve as the foundation for comprehending and analyzing the results. However, it's important to note that this thesis cannot offer a comprehensive review of all relevant material. The chapter is loosely organized around the most commonly utilized determinants of capital structure.

2.1.1 Modigliani-Miller theorem

The formation of modern capital structure dates back to the 1950s as Modigliani and Miller (1958) published their capital structure irrelevancy theory which, as its name suggests, indicates that under certain conditions a firm's capital structure is irrelevant. The basis of their propositions consists of following assumptions: firms are able to lend

money without risk and with equal rate, there is not taxes and transaction costs, the existence of perfect information symmetry and the firm's management desire to maximize the value of the firm. In addition, they assume that in efficient capital markets, all price differences caused by the capital structure are exploited promptly. Based on these presumptions, Modigliani, and Miller (M&M) created two pioneering propositions.

According to MM Proposition I: The market value of a firm is independent regardless how it is financed and thus the mixture of debt and equity do not have impact on the market value of a firm. Therefore, there is no direct relation between firm's value and the cost of capital and consequently it can be stated that there is no optimal capital structure. Below the proposition I is presented as an expression.

$$\text{I)} \qquad V_L = V_U$$

Where:

V_L: The value of a levered firm

V_U: The value of an unlevered firm

The theorem took a new step as Modigliani and Miller (1963) published proposition II where corporate taxation was included. They discover that leveraging through debt can provide a notable tax benefit, yet companies shouldn't invariably strive to employ the utmost level of debt in their capital frameworks. For example, opting for retained earnings instead of debt for financing projects can prove more cost-effective, irrespective of the tax advantage. Furthermore, constraints imposed by creditors and additional expenses stemming from debt must be considered. In the following the proposition I is presented as an expression.

II) $r_E = r_a + D/E\ (r_a - r_D)$,

Where:

r_E: Cost of levered equity

r_a: Cost of unlevered equity

r_D: Cost of debt

D/E: Debt-to-equity ratio

Following MM's seminal papers in 1958 and 1963, much of the literature and research has traced the trajectory they established. Modern theories concerning capital structure endeavor to elucidate the elements influencing a firm's selection of capital structure and the most advantageous balance between equity and debt, under relaxed MM assumptions. The exploration of capital structure can take various perspectives, with theories delving into considerations such as agency costs, corporate governance or control, information asymmetry, tax implications, and product-market interactions, among others.

2.1.2 Trade-off theory

The propositions by Modigliani and Miller (1958, 1963) provide comprehensive framework from the point of view that firm's capital structure is irrelevant under certain circumstances. However, in practice, there are still asymmetrical information, imperfect markets, corporate and personal taxation, and several other costs which the propositions do not take into consideration. Based on M&M theorem, Kraus and Litzenberg (1973) initially suggest the trade-off theory of capital structure as they consider an equilibrium between the tax saving benefits of debt and the deadweight costs of going bankrupt. The name, trade-off theory originates from the intention to optimize the total value of a company by trading rewards and costs of debt.

Generally, trade-off theories can be divided into static and dynamic subgroups. In their paper Fischer, Heinkel and Zechner (1989) challenge the static trade-off model according to which there is only one optimal level of leverage. As stated by Fischer et al. (1989),

static model is too far away from actual world and their results indicate that firms do not have stable debt ratio, which in a way disproved prior models. Instead, the dynamic model that they presented, set the upper and lower limits for debt by determining tax-shield, costs related to debt and interest rates and transaction costs of recapitalization among other things.

According to Fischer et al. (1989), there is possibility for investors to obtain "fair" risk-adjusted rate of return if the firm follows an optimal financing policy, hence unlevered firms generate "below fair" risk adjusted rate of return due to the assumption that the leverage is beneficial because of the tax-shield. However, in a no-arbitration environment, the transaction costs regarding to the issuing of debt ought to be equal compared to the difference between value of the leveraged firm and value of the unleveraged firm. After all, as stated by Fischer et al. (1989) the lower limit for debt is defined at the level where the benefit of the leverage is corresponding with its costs and the upper limit for debt is set on the level where the bankruptcy costs exceed the transaction costs of re-capitalization.

2.1.3 Agency cost theory

The pioneering study that model capital structure based on agency cost is the paper *Theory of firm: Managerial Behavior, Agency Costs and Ownership Structure* by Jensen and Meckling (1976) where the principal-agent problem and capital structure are examined for the first time. The principal-agent problem is also known as agency dilemma, and it occurs when the person or entity "agent" can do decisions on behalf of another person or entity "principal". The one essential factor behind their theory is the contract between principal and agent and the assumption that both parties try to maximize utility. When both parties pursue their own interest, it can be supposed that some decisions are more favorable to other and therefore the agent prefer those which are the most favorable for itself. This problem is often occurring due to asymmetric information between the parties. Compared to the company's owners and creditors the management has much more inside information and exact pieces of information about the company

and for that reason it is extremely difficult to monitor the actions of management perfectly. Therefore, the principals set conditions of incentives in order to prevent management to do decisions that deviate from principals' interests. Jensen and Meckling (1976) define agency costs as a sum of three factors:

1. the monitoring expenditures by the principal,
2. the bonding expenditures by the agent,
3. the residual loss.

The theory by Jensen and Meckling (1976) observes more specifically financial stress costs that come generally from the conflict between the shareholders and creditors or between company management and shareholders. Regarding the first mentioned conflict, the debt urges shareholders to invest in risky projects even if they eventually end up being low-yielding projects. If the debtholders predict this to happen in the future, it reduces the value of debt and hence shareholders must pay costs of poorly generating projects. Thus, a situation is reached in which agency cost are incurred. The latter conflict presented by Jensen and Meckling (1976) ensue between shareholders and company management due to the risk managers bear, as they are not rewarded with all the benefit, they generate for the firm but instead they take full responsibility of the costs of these operations.

The conflict between firm management and shareholders has also been widely studied by other authors. According to Harris and Raviv (1991) managers tend to proceed with ongoing operations even though the liquidation of firm would be better option for owners. Firms with higher liquidation value such as those with tangible assets, and/or firms with lower investigation costs tend to have more debt. Despite being more prone to default, these firms often exhibit higher market values compared to their counterparts. This phenomenon arises because a higher liquidation value increases the potential benefits of liquidation as a strategy. Consequently, the informational value of debt is enhanced, rendering a higher level of debt more favorable. Additionally, under a constant-

return-to-scale assumption, they demonstrate that a high level of debt is associated with larger firm value and a higher debt-to-income ratio.

The conflicts between equity holders and debt holders mainly revolve around the managerial reputation. It is argued that concerns about reputation help mitigate the asset substitution problem. For instance, leveraged equity holders may be incentivized to opt for risky, negative NPV projects since the costs are disproportionately borne by debt holders. However, managers are motivated to uphold their reputation by avoiding failures, thus preferring relatively safer projects. This perspective is supported by Diamond (1989) and Hirshleifer and Thakor (1992).

2.1.4 Pecking order theory

Pecking order theory is originally presented by Myers and Majluf (1984) as they argue how asymmetric information appears between the managers and other insiders of a firm compared to external investors. Their initiation of the study was greatly influenced the study of corporate debt policy by Donaldson (1961). The name, pecking order, can be considered to come from the order of capital selection that firms' managers do to reduce costs of their firm when executing decisions how to finance firm operations. According to pecking order theory, the managers prefer retained earnings as a financing method before debt financing and equity financing and they comply with the hierarchy as follows. Retained earnings is the most preferable source of financing due to unrecognized costs compared to other financing methods. By choosing retained earnings, a firm evades interest cost of debt and dividends of external equity. When there is a demand for external financing, debt is preferred to equity according to pecking order theory (Myers and Majluf, 1984).

As mentioned above, in accordance with pecking order theory the internal financing is the first choice of firm managers due to possible cost savings. In addition, managers also have information advantage compared to the other stakeholders. Hence, by financing operations with retained earnings, managers are in the position where they do not have

to precisely clarify the use of funds in comparison to position where the financing method would be debt or issuance of new stocks. Consequently, this can result in a situation where the firm's management makes decisions that do not efficiently create value for the firm and thus do not maximize value creation for the owners. This is evident, for example by proceeding with too secured investment instead of seeking the most profitable projects. Nevertheless, stable financial condition is an advantage as it facilitate firm investment when the ideal opportunity arises. (Myers and Majluf, 1984; Myers, 1984).

When examining debt-equity choice Hovakimian, Opler and Tatman (2001) find that when firms are profitable, the amount of retained earnings is increasing and conversely having unprofitable business firms tend to become more leveraged. Thus, their results are consistent with pecking order theory as the empirical data indicates that there is negative relationship between profitability and leverage. In terms of surplus retained earnings, the firms tend to manage those by paying back the debt and firms also commonly issue equity when a stock performs well in the market, implicating that the good performance decrease the firm's leverage level. According to Hovakimian et al. (2001), the pecking order theory seems to be valid only in short-term financing consideration, whereas the long-term capital structure decisions are mainly affected by target debt ratios which are consistent with trade-off models.

2.2 Financial distress

Considering the potential for financial distress is crucial in determining a company's optimal capital structure. It is viewed as costly because, during financial distress, firms tend to make decisions that harm the interests of debtholders and non-financial stakeholders. Consequently, conflicting interests between the firm and various stakeholders make accessing credit more challenging and increase the costs associated with different stakeholder relationships (Stulz, 1990; Maksimovic and Titman, 1991; Gilson and Vetsuypens, 1993).

A consensus on the effects of financial distress on corporate performance remains elusive. It is posited that high leverage and financial distress compel managers to make challenging decisions necessary for value maximization, such as enhancing stakeholders' control and governance over management (Jensen, 1989). Conversely, for instance, Opler and Titman (1994) examine the relationship between leverage and market share during market downturns. They find evidence that more highly leveraged firms lose significantly larger market share and experience lower operating income and sales growth than their more conservatively financed competitors during industry downturns. Financial distress may also lead to aggressive competition, or predation, by stronger and more conservatively financed competitors seeking to gain market share (Bolton and Scharfstein, 1990).

2.3 Debt as a strategic tool

The probability and success of takeovers are influenced by the company's capital structure. The connection between the market for corporate control and capital structure emerged in the late 1980s. The key principle in this connection is that equity carries voting rights, while debt does not (Harris et al., 1988, and Stulz, 1990). Due to the allocation of votes, the capital structure plays a role in the results of takeover battles. Harris and Raviv (1988) assert that the capital structure indirectly determines the proportion of equity owned by a firm's manager. If the manager holds a significant stake, a rival's takeover attempt is challenging, even if the rival manager is more adept at running the firm. Conversely, if the manager's stake is small, a takeover might occur, even if the new manager has a lower ability to control the firm. A third possibility is that the rival accumulates enough equity from passive investors, enabling these investors to influence the outcome of the takeover.

In Harris et al. (1988), the manager's stake is indirectly influenced by the capital structure decisions of the firm. Managers can augment their stake by repurchasing equity from passive investors and financing this repurchase through debt. When debt is issued, the equity's value decreases, enabling the manager to acquire a larger stake than would be

possible without debt issuance. To thwart a takeover attempt, managers often choose to elevate the firm's leverage. In cases of unsuccessful tender offers, leverage is increased, accompanied by a rise in stock prices. Additionally, there appears to be a negative correlation between leverage and the likelihood of a successful tender offer. Similar to Harris et al. (1988), where the manager's stake can be increased by issuing debt, Stulz (1988) proposes a comparable idea. In this case, takeover targets enhance their debt levels, similarly increasing the gains for takeover target shareholders if the takeover transpires, but also diminishing the likelihood of such an occurrence. Shareholder gains increase because the takeover premium is positively linked to the debt/equity ratio, leading to a higher stock price with increased leverage.

It's crucial to recognize that takeover threats, leading to changes in capital structure in the form of increased leverage, should be considered as transient alterations. Firms typically boost their leverage temporarily to adjust their capital structure optimally in response to imminent and hostile takeover threats. Therefore, these theories do not provide insights into the enduring capital structure decisions of firms in the long run (Harris et al., 1990).

2.4 Reputation

Reputational concerns often spark conflicts among managers, equity holders, and debt holders. Managers or firms may be inclined to opt for safer projects that ensure debt repayment, with the goal of safeguarding their reputation. Particularly, well-established firms with a solid reputation are likely to favor relatively secure projects, thereby mitigating the risk of asset substitution to preserve their reputation. Conversely, in the absence of reputational effects, young firms with limited history and less to lose in terms of reputation may lean towards riskier projects. Concurrently, lenders base their lending decisions and loan terms on the firm's default track record and its assurances regarding the use of new funds (Diamond, 1989).

Besides the firm's reputation, managers also have their personal reputations to consider. A manager's reputation depends on the success or failure of a project rather than solely on the expected value for shareholders. Consequently, a manager is inclined to select a project with a higher likelihood of success over a high-risk, high-return project that might offer greater expected value for other equity holders. This approach diverges from the conventional perspective on the agency problem of debt, as managers now tend toward conservative behavior rather than satisfying shareholders' preferences for riskier choices. Therefore, if the firm's conservative decisions stem from managers' concerns about their reputations, shareholders might benefit from increasing leverage (and consequently the manager's relative share of equity), thus influencing management's behavior in a different direction (Brander and Lewis, 1986).

2.5 Financial market outlook

In this chapter, a brief overview of the U.S. economic landscape is provided, focusing on the interest rate and stock market perspectives throughout the period covered in this paper. The objective is to offer insights into the financial conditions experienced by U.S. firms between 2010 and 2018.

Over the entire decade the U.S. economy has not had any recessions but the real GDP growth per annum has only averaged 2.2%. GDP growth was generally positive, although there were fluctuations from year to year. Growth rates ranged from around 1.5% to 3.0% annually, with some years seeing stronger growth than others. Overall, the economy expanded steadily, albeit at a moderate pace compared to previous decades. The US labor market showed marked improvement during the 2010s. The unemployment rate, which peaked at over 10% during the recession, steadily declined over the decade. By the end of the 2010s, the unemployment rate had fallen to historically low levels, hovering around 3.5% to 4.0%. Job creation was robust in various sectors, contributing to the overall decline in unemployment.

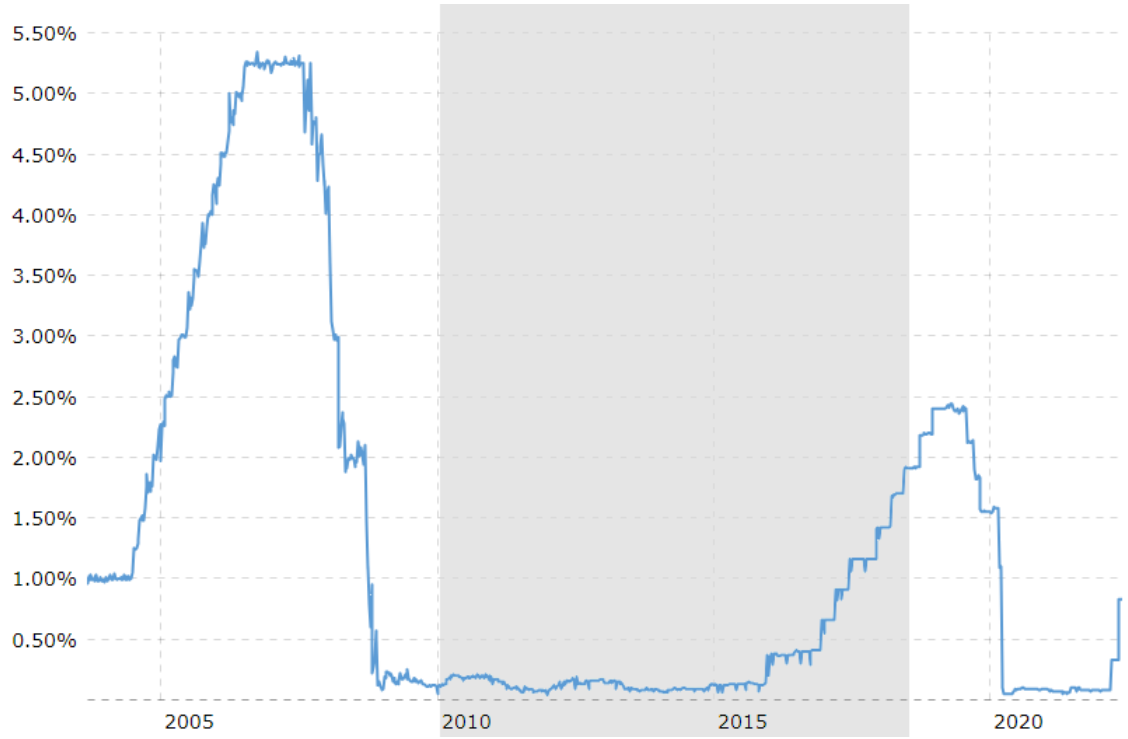

Figure 1. Daily Federal Funds rate 2005-2020. Source Macrotrends

In response to the recession, the Federal Reserve implemented a policy of ultra-low interest rates to stimulate economic activity. Throughout much of the 2010s, interest rates remained at historically low levels. The Fed gradually began raising rates from near-zero levels starting in late 2015, aiming to normalize monetary policy as the economy strengthened. However, interest rate hikes were relatively gradual and cautious, and rates remained relatively low compared to historical norms. As it can be seen from the Figure 1 the rates increased gradually from 2015 but fell rapidly towards 0% after coronavirus pandemic in 2019.

Entering to 2010 the entire U.S. stock market had just experienced a rollercoaster ride by facing a 49% decline from 2000 to 2002, followed by a 101% increase over the period of next five years and finally experiencing a financial crisis from 2007 to 2009 and 57% decline.

Stock market development in the 2010s is illustrated in figures 2 and 3 as Dow Jones Industrial Average Indexes and NASDAQ Composite Indexes give comprehensive view how the stock market has developed. Both Indexes saw remarkable growth, driven by factors such as strong corporate earnings, low interest rates, and investor optimism. Technology stocks , in particular, performed exceptionally well, contributing to the overall market rally. Both Indexes also reacted strongly negatively to coronavirus pandemic in 2019, however this time period has intentionally been excluded in the study.

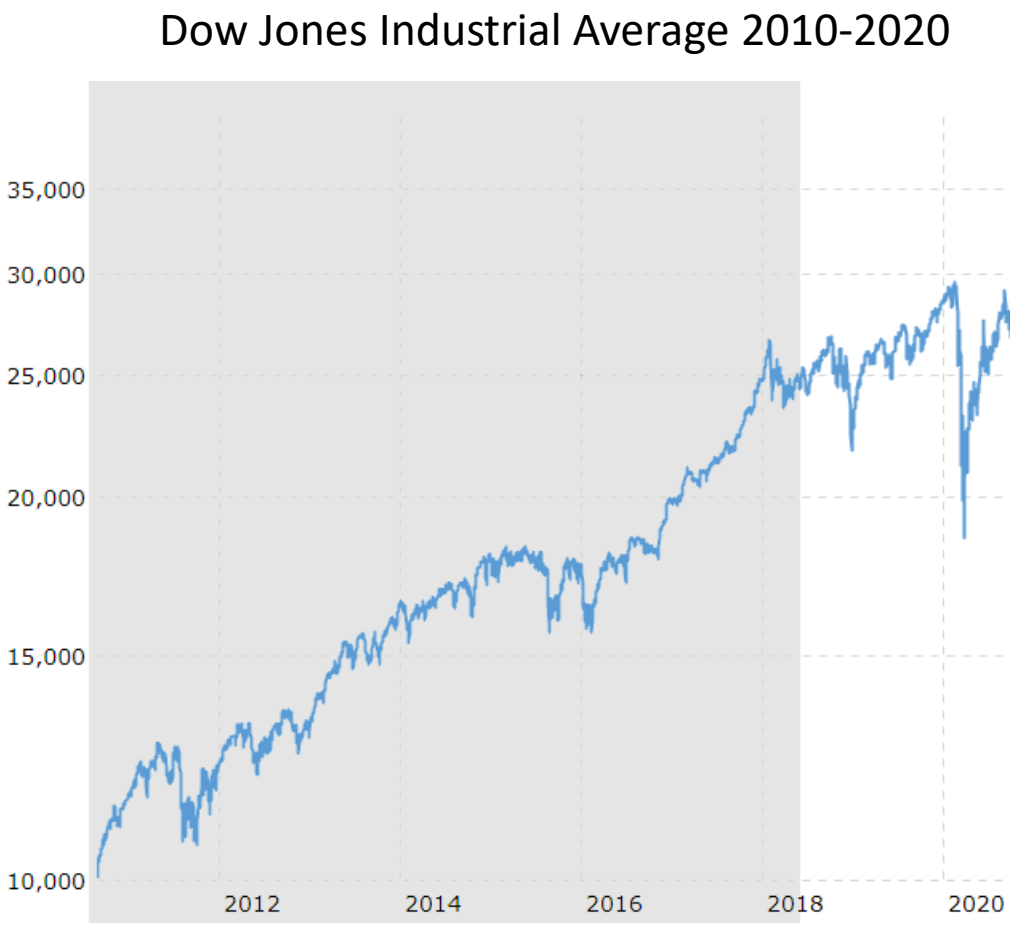

Figure 2. Dow Jones Industrial Average closing values 2010-2020. Source Macrotrends

During the period from 2010 to 2018, the performance of the U.S. economy, as reflected by the Dow Jones Industrial Average (DJIA), exhibited notable success. (See figure 2) The

Dow Jones index, composed of major publicly traded companies, experienced substantial growth during these years. Factors contributing to this economic prosperity included a recovering financial system after the 2008 recession, increased corporate profits, low interest rates, and overall positive sentiment in financial markets. The U.S. economy demonstrated resilience and expansion during this period, with the Dow Jones index serving as a key indicator of the nation's economic health and investor confidence.

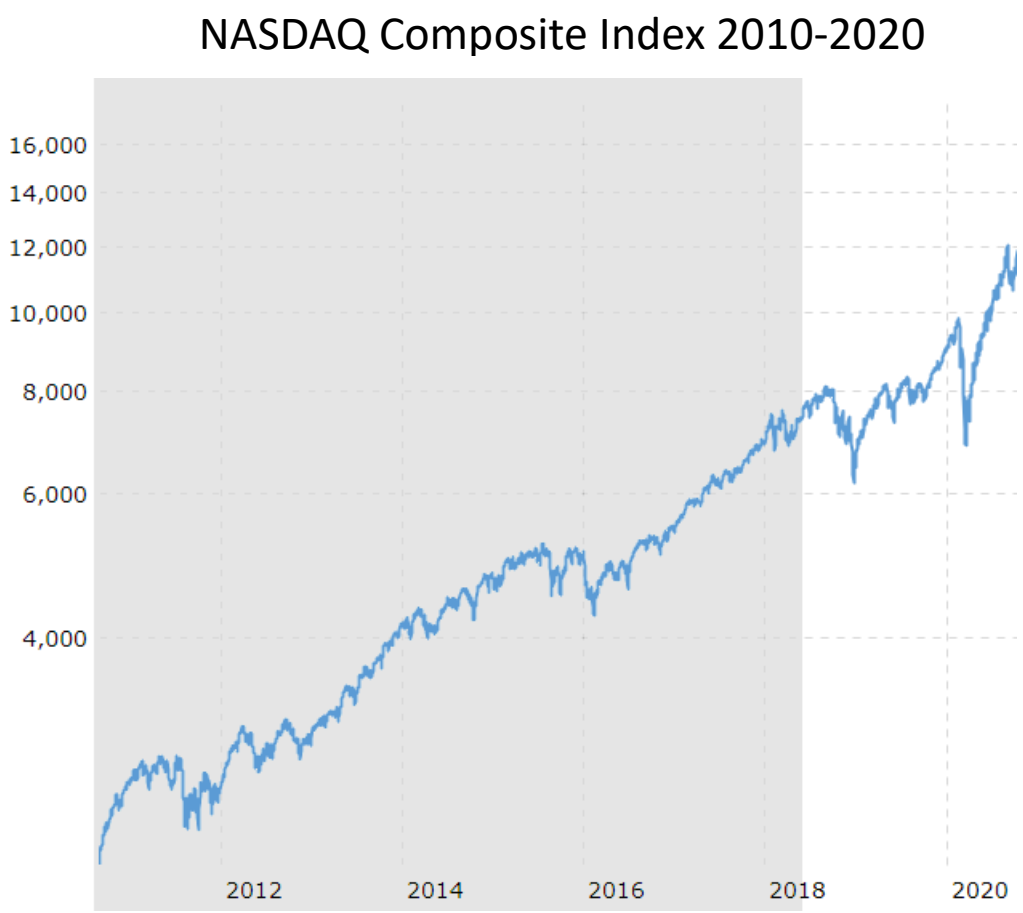

Figure 3. NASDAQ Composite index closing values 2010-2020. Source Macro-trends

When it comes to Nasdaq Composite Index From 2010 to 2018, the United States experienced notable economic success, and this prosperity is reflected in the performance of the Nasdaq Composite Index. The Nasdaq Composite Index, which predominantly includes technology and internet-based companies, witnessed substantial growth during this period. Several factors contributed to this economic success, including the recovery

from the 2008 financial crisis, the rapid expansion of the technology sector, and a generally positive investor sentiment. The Nasdaq Composite Index served as a key barometer for the health of the U.S. economy, showcasing the resilience and growth of the nation's technological and financial sectors during this timeframe.

The mid-2010s witnessed a surge in technology-related stocks, which significantly influenced the Nasdaq Composite Index. Companies like Apple, Google (now Alphabet), and Amazon experienced substantial growth, driving the index to new highs. This period was characterized by innovation, expansion in the tech sector, and strong investor interest in disruptive technologies. Despite continued growth in the technology sector, the Nasdaq Composite faced bouts of volatility and occasional corrections during this time frame. Factors such as geopolitical tensions, concerns about interest rates, and trade disputes contributed to market uncertainty and led to periodic selloffs.

3 Previous Empirical Evidence

Different capital structure theories suggest that leverage is associated with firm growth. However, more precise knowledge about the nature of the relation between leverage and growth is crucial, because the optimal growth may not be possible to high leveraged firms due to their debt burden. Overall, research has concentrated on leverage relatively little and has paid more attention on other proxies for liquidity such as cash flow and liquid assets, even though the amount of the leverage effects on both, available current funds for investments and options to raise new funding. Nevertheless, there are many prior studies that focus on the effect of leverage on the firm growth and in more detail, on employment and investments.

In general, among the studies there is a consensus that leverage is negatively associated with firm growth opportunities. Stultz (1990) discover that the debt payments caused by high leverage constrains managers to pay out cash flow and therefore high leverage decreases firm's investment. According to the study by McConnell and Servaes (1995) the "high-growth" firms lose value when the leverage increases while "low-growth" firms increase their value when the leverage rise. This supports their hypothesis as for those firms with a lot of growth opportunities, the negative effect predominates because debt forces managers to ignore the projects with positive net present value. Similarly, for firms with few growth opportunities, the positive effect predominates because debt prevents managers from selecting negative net present value projects.

Cantor (1990) compares highly and low leveraged firms, and he suggests that investment is more sensitive to cash flows for firms with high level of leverage. In more detail, each extra dollar more in cash flow generates 45 cents more investment for highly leveraged firm than firms which are low leveraged. If the firm is highly leveraged, the firm's ability to raise new funding is limited, which forces the firm to pursue a steady positive cash flow. Therefore, Cantor (1990) states that the burden of debt obligations partly causes this sensitivity to cash flow fluctuation. Even though Cantor (1990) finds positive correlation between firm's leverage and the sensitivity of investment and employment,

Titman and Wessel (1988) end up with the opposite results as they find no evidence about the relationship between leverage and firm's expected growth.

Sharpe (1994) investigates the relationship between firm's leverage and the cyclicality of employment. The results suggests that firm size and leverage effects directly on changes in workforce when the firm's sales declines. The findings also indicate that during the recession, high degree of leverage leads to faster layoffs of employees among small firms but during the economy upswing the same firms are not hiring new labor equally fast. These findings give support to the argument that by forcing managers to operate effectively and promote the interest of firm's owners during recession, high leverage decreases the management-related agency costs.

Lang, Ofek and Stultz (1996) find a negative relationship between leverage and growth. They demonstrate that the results are conclusive across industries, for various measures of investment opportunities, for different book value-based leverage measures and for smaller firms with random sample. Their results indicate positive effects of debt financing with low growth opportunity firms, whereas the negative effect which can also be stated as underinvestment is not equally clear.

As this paper mainly follows the study by Lang et al. (1996), corresponding results can be expected also in the light of newer data set. The following Table 1 displays a summary of the results by Lang et al. (1996).

Table 1. Summary results by Lang et al. (1996)

The table express the relation between leverage and growth measures. Relation is stated as "Positive"/ "Negative" (5%-level significance) or "No significance", *Weak (10%-level significance) mentioned separately.

Data 1970-1989 ***Book leverage***	**Investment**	**1-year employment growth**	**3-year employment growth**	**1-year capital expenditures growth**	**3-year capital expenditures growth**
Whole sample *Unadjusted leverage*	Negative	Negative	Negative	Negative	Negative
Industry-adjusted leverage	Negative	Negative	Negative	Negative	Negative
Tobin's q < 1 *Unadjusted leverage*	Negative	Negative	Negative	Negative	Negative
Industry-adjusted leverage	Negative	Negative	Negative	Negative	Negative
Tobin's q > 1 *Unadjusted leverage*	No significance	No significance	No significance	Negative	No significance
Industry-adjusted leverage	No significance	No significance	No significance	*Weak negative	No significance

The data Lang et al. (1996) use contains the years from 1970 to 1989 and they apply firms with revenue of $1 billion or more adjusted in 1989-dollars in each base year. According to financial theory, the impact of leverage on growth should not be as significant if a firm possesses valuable investment opportunities. These opportunities are often assessed using Tobin's q, where a high q value (greater than 1) signifies numerous valuable investment prospects, and vice versa. When Lang et al. (1996) incorporated investment opportunities into their analysis of the relationship between leverage and growth, they discovered that for firms with low Tobin's q (<1), metrics such as employment growth rate net investment growth, and investment change rate were all significantly negatively correlated with leverage. Conversely, for firms with high Tobin's q, they found a less pronounced negative relationship between leverage and growth, with only one variable, 1-year capital expenditures growth, exhibiting significance. However, even this relationship showed a coefficient significantly lower than that for low-q firms.

Additionally, half of the coefficients for high-q firms were positive, though not statistically significant. These findings undermine the initial results of Lang et al. (1996), which indicated a universally negative and significant relationship between leverage and growth across all firms. This suggests that high-q firms, whose valuable investment opportunities are acknowledged in capital markets, face fewer challenges in securing external funding. Conversely, firms with high leverage may experience reduced growth due to difficulties in obtaining external funding, as their investment opportunities are not recognized, leading investors to hesitate in providing funding. Consequently, this results in higher opportunity costs for these low-q firms. The observed negative relationship between growth and leverage for low-q firms holds true within and across industries, irrespective of different leverage and investment opportunity measures, estimation methods, subsamples of better-performing firms, subperiods, and small firm classifications (Lang et al., 1996).

Aivazian, Ge and Qiu (2005) investigate the impact of financial leverage on the firms' investment decisions using Canadian publicly traded companies in the time span 1982-1999. They find that leverage is negatively related to the level of investment and specifically the effect is significantly more robust for firms with low growth opportunities than for high growth opportunity firms. Furthermore, their results give support to agency theories of corporate leverage and particularly to the theory which state that leverage is a disciplining part for low growth opportunity firms.

4 Data and methodology

All analyses in this paper are done by with Microsoft Excel. Chapter 4.1 describes more specifically the data used in the thesis. Chapter 4.2 explains the dependent and explanatory variables one by one. Following that, the findings of descriptive statistics are presented, offering an overview of the utilized data. This encompasses key measures, dispersion, and other statistical properties that aid in understanding the nature and distribution of the data. The fourth subsection explores the correlation among variables, examining the extent and nature of relationships between different variables. This section may reveal potential connections or dependencies among variables, which could be crucial to the research objectives. Finally, methods employed in the study are outlined—the analytical techniques and approaches utilized to explore the research questions and uncover answers. This section elucidates the research methodology and provides a foundation for interpreting the results.

4.1 Data

The data used in this this study consists only listed large sized industrial U.S. companies with the annual revenue of at least $1 billion. There are several reasons behind this choice. It would be reasonable to expect that if there is a relation between leverage and growth, it would be weaker for large firms. Additionally, the needed data to conduct study is more straightforward available for large firms, therefore concentrating on large firms can decrease the selection bias resulting from inadequate data.

The data includes the years from 2010 to 2018 and all data is obtained from DataStream. All firms must have data available on sales, leverage, cash flow, assets, market value and capital expenditures to determine the explanatory variables. Additionally, all firms must have data available on number of employees capital expenditures and depreciations which are needed for the depended variables in regression. In order to validate the data and mitigate any biases present, the selection of companies in sample is limited to those

listed on either the New York Stock Exchange or Nasdaq. Firms that are unlisted or traded in OTC are excluded from the data sample.

4.2 Variables

In this chapter all the variables which are used in this paper are introduced shortly. The dependent variables, which measure firm growth in three various ways are defined firstly. Next, the explanatory variables (independent variables) which effect on firm growth are explained.

4.2.1 Dependent variables

The first of three dependent variable measuring firm growth is the ratio of the number of employees in year +1 (+3) compared to the number of employees in year 0.

$$\frac{Employees\ (+1\ or +3) - Employees\ (0)}{Employees\ (0)} \tag{1}$$

The next variable is the growth rate of real capital expenditures. It is defined as the ratio of capital expenditures in year +1 (+3).

$$\frac{CapEx\ (+1\ or +3) - CapEx\ (0)}{CapEx\ (0)} \tag{2}$$

The last growth measure is real capital expenditures in year +1 minus depreciation divided by the book value of total fixed assets in year 0. That measures firms' net investment.

$$\frac{Investment\ (+1)}{Fixed\ Assets\ (0)} = \frac{CapEx\ (+1) - Depreciation\ (+1)}{Fixed\ Assets\ (0)} \tag{3}$$

4.2.2 Explanatory variables

The first explanatory variable is cash flow before interest expenses in year 1 divided by total assets.

$$\frac{Cash\ Fow\ Before\ Interest\ Expenses\ (1)}{Total\ Assets\ (0)} \tag{4}$$

The next explanatory variable is percentage sales growth from year -1 to 0.

$$\frac{Sales\ (0)}{Sales\ (-1)} \tag{5}$$

The third explanatory variable is capital expenditures in year 0 which is divided by fixed assets in year 0.

$$\frac{CapEx\ (0)}{Fixed\ Assets\ (0)} \tag{6}$$

The final explanatory variable is Tobin's q which is used to define whether the firm has high or low growth opportunities. It is defined as the sum of market value of equity and book value of debt divided by total assets.

$$\frac{Market\ Value\ (Equity)+Book\ Value\ (Debt)}{Total\ Assets} \tag{7}$$

4.3 Descriptive Statistics

Table 4.2 presents the statistical description of the dataset. A comparison with the corresponding data from Lang et al. (1996) suggests that my data exhibits a noticeably higher upward bias in terms of Tobin's q mean value. One plausible explanation for this difference could be that market values of companies studied have been highly valued in

equity markets. However, the data sample still demonstrates typical positive skewness in most of the measures examined, indicating that the median would be a more appropriate descriptive statistic in many situations instead of the mean.

Table 2. Descriptive statistics

The data covers the period from 2010 to 2018, with selected companies consistently achieving $1 billion in sales annually, adjusted for 2010-dollar value. Information is sourced from the Datastream database. Capital expenditures and employment growth are measured as the percentage change in capital expenditures and employment respectively, comparing years +1 to 0 and +3 to 0. Net investment growth is calculated by subtracting depreciation from capital expenditures for year +1, then dividing by the book value of fixed assets for year 0. Cash flow is calculated before accounting for interest expenses. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is assessed by comparing sales for year +1 to those of year 0. Tobin's q, a measure of a firm's value, is computed as the total market value of equity plus the book value of total debt divided by the book value of total assets.

	Average	25th Percentile	Median	75th Percentile	Standard Deviation	# of Observations
Net Investment (1) / Fixed Assets (0)	0.0777	-0.0201	0.0343	0.1043	0.3333	1431
1-year Employment Growth	0.0603	-0.0148	0.0159	0.0702	0.4766	1272
3-year Employment Growth	0.2280	-0.0353	0.0685	0.2367	1.3317	954
1-year Capital Expenditures Growth	0.2476	-0.3455	0.046	0.4899	4.2809	1272
3-year Capital Expenditures Growth	0.5821	-0.4274	0.1098	0.9742	13.5010	954
Cashflow (0) / Total Assets(-1)	0.1745	0.1080	0.1614	0.2371	0.1121	1272
Sales Growth	0.058	-0.0071	0.0414	0.1042	0.1503	1272
CapEx / Fixed Assets	0.1646	0.096	0.1532	0.2248	0.2145	1431
Leverage	0.3297	0.2187	0.3175	0.4191	0.1877	1431
Tobin's q	1.6382	0.9204	1.3253	1.9527	1.169	1431

Similar to Lang et al. (1996), the dataset demonstrates positive median values across all growth metrics. However, leverage median appears notably higher compared to Lang et al. (1996), with a median value over 35% greater. Furthermore, in contrast to their findings, the Tobin's q values are significantly elevated in this dataset, with the median Tobin's q nearly doubling. Notably, even the 25th percentile approaches one, which serves as the threshold for delineating firms with high or low growth opportunities. This suggests that a majority of companies in this dataset are highly valued in equity markets, consequently inflating Tobin's q. The only median metric that is lower compared to Lang et al. results is net investment which is marginally lower.

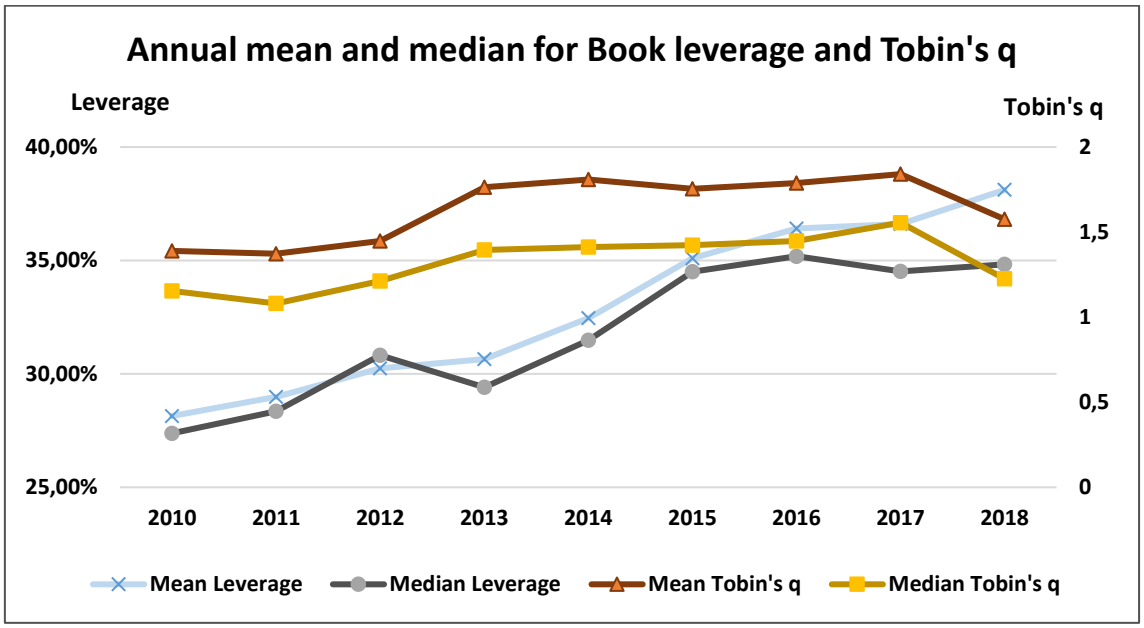

Figure 4. Annual development of the mean and median for leverage and Tobin's q in the sample set.

Given that a significant portion of this research endeavors to ascertain whether leverage exerts varying effects on growth across firms with differing levels of growth opportunities, it is logical to depict the evolution of leverage and Tobin's q over this time frame. Figure 4 shows the development of the mean and median for book leverage and Tobin's q between 2010 and 2018. 2010s were decade of recovery and expansion for the U.S.

economy following the Great Recession. Book leverage tracks general booming economic cycle moderately. Mean and median leverage steadily rise during the review period, mean leverage from 28% to 38% and median leverage from 28% to 35%. Especially mean leverage has increased steadily during sample period.

4.4 Correlation Among variables

Table 3 displays the correlations among the variables. The first row presents the unadjusted correlations, while the second row presents the correlations adjusted for industry effects. The dependent variables include 1-year and 3-year employment growth 1-year and 3-year capital expenditures (CapEx) growth, and net investment growth. Leverage serves as the independent variable, while the other variables act as control variables, following the framework outlined in Lang et al. (1996) paper.

In the unadjusted observations, leverage demonstrates a slight negative correlation with employment growth and 1-year Capex growth, although none of these correlations reach statistical significance. In addition, upon adjusting for industry effects, significant correlations do not emerge, between leverage and growth variables. As the findings of Lang et al. (1996), these correlations appear to be negative, but only slightly. Nevertheless, it's worth noting that all correlations between leverage and growth measures remain moderately low.

Table 3. Correlation among variables

The data covers the period from 2010 to 2018, with selected companies consistently achieving $1 billion in sales annually, adjusted for 2010-dollar value. Information is sourced from the DataStream database. Capital expenditures and employment growth are measured as the percentage change in capital expenditures and employment respectively, comparing years +1 to 0 and +3 to 0. Net investment growth is calculated by subtracting depreciation from capital expenditures for year +1, then dividing by the book value of fixed assets for year 0. Cash flow is calculated before accounting for interest expenses. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is assessed by comparing sales for year +1 to those of year 0. Tobin's q, a measure of a firm's value, is computed as the total market value of equity plus the book value of total debt divided by the book value of total assets.

	1-year Employment Growth	3-year Employment Growth	1-year CapEx Growth	3-year CapEx Growth	Net Investment (1) / FA (0)	Sales Growth	Cashflow (0) /Total Assets(-1)	CapEx (0) / Fixed Assets	Leverage
3-year Employment Growth	0.676**	1							
	0.020	1							
1-year CapEx Growth	0.062*	0.052	1						
	0.054	-0.002	1						
3-year CapEx Growth	0.002	0.060	0.353**	1					
	0.000	0.056	-0.018	1					
Net Investment (1) / Fixed Assets (0)	0.074**	0.066*	-0.025	-0.014	1				
	0.004	-0.006	-0.041	0.002	1				
Sales Growth	0.242**	0.213**	0.133**	0.004	0.245**	1			
	0.222**	0.026	0.129**	-0.019	-0.030	1			
Cashflow (0) / Total Assets(-1)	0.075**	0.046	0.073**	0.021	0.041	0.208**	1		
	0.062*	0.053	0.078**	0.023	-0.038	0.219**	1		
Cap Ex (0) / Fixed Assets	0.077**	0.086**	0.013	-0.001	0.543**	0.201**	0.121**	1	
	-0.009	0.025	-0.037	0.011	0.545**	-0.039	-0.026	1	
Leverage	-0.023	-0.022	-0.006	0.036	0.008	-0.037	-0.156**	-0.088**	1
	-0.021	-0.035	-0.021	-0.030	0.001	0.010	0.009	-0.088**	1
Tobin's q	-0.008	-0.015	0.006	0.039	-0.007	0.070*	0.441**	0.088**	0.066*
	-0.012	-0.004	0.040	-0.001	-0.005	0.040	0.031	0.107**	0.030

** Correlation is significant at the 0.01 level.

* Correlation is significant at the 0,.05 level.

4.5 Methods

The focus of this research paper centers on analyzing the correlation between leverage and firm growth through regression analyses. Additionally, the study explores the impact of varying levels of Tobin's q on this relationship by examining subgroups categorized by Tobin's q. Previous scholarly works indicate that the influence of leverage on firm growth may differ between firms with high Tobin's q and those with low Tobin's q. It is hypothesized that firms with high Tobin's q, indicating ample investment opportunities, may experience a lesser impact of leverage on their growth trajectory. This weakened effect is presumed to arise from capital markets' recognition of these firms' valuable investment prospects, thereby instilling confidence that invested funds will yield sensible and value-enhancing returns. Conversely, capital markets may struggle to discern the investment potential of firms with low Tobin's q, leading to diminished market capitalization and heightened capital costs due to investor uncertainty regarding the profitability of allocated funds. Given these premises, it is relevant to investigate whether there exists a statistically significant divergence in the influence of leverage on the growth dynamics of firms with high and low Tobin's q.

The explanatory variables, which encompass independent, control, and dummy variables, are subjected to multiple linear regressions against the dependent variables (growth measures) with n data points and m independent variables. The regression model assumes constant variances and no correlation among the error terms. However, such assumptions are unlikely to hold true for this dataset, given the presence of industry effects or similar factors that may amplify correlation. Heteroskedasticity-consistent standard errors are derived and utilized to calculate more dependable t-statistics for the regression coefficients.

Correlation among the variables employed in the study is defined by using sample correlation r_{XZ} as

$$r_{XZ} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(z_i - \bar{z})}{(n-1)s_x s_z} \quad (8)$$

Where *n* is the total number of measurements of variables X and Z denoted as x_i and z_i, $i=1,2,\ldots,n$. $\bar{x}$ and $\bar{z}$ are equally the sample means of X and Z, s_x and s_z are the sample standard deviations of X and Z.

Explanatory variables are regressed against each growth measure by using general multiple linear regression for n data points with *m* independent variables.

$$y_i = \beta_0 + \sum_{k=1}^{m} \beta_k x_{k,i} + \varepsilon_i, i = 1,2 \ldots, n \quad (9)$$

y_i is i^{th} observation of dependent variable, β_k , $k=1,2,\ldots,m$, are the corresponding parameters, x_k, $k=1,2\ldots,m$, are independent variables, and ε_i is the error term for observation i. The population parameters are hence estimated by using the regression model below.

$$y_i = \hat{\beta}_0 + \sum_{k=1}^{m} \hat{\beta}_k x_{k,i} + \varepsilon_i \quad (10)$$

Where ε_i is the residual y_i - $\hat{y}_i$ = ε_i and $\hat{y}_i$ refers to estimated value of y_i. The residual ε_i is estimated by employing the ordinary least squares method (OLS) by finding the minimum of the sum of squared residuals (SSE).

$$SSE = \sum_{i=1}^{n} e_i^2 \quad (11)$$

The regression model above expects constant variance for the error terms. With selected data sample, this presumption is not probably to hold. It is possible that error terms can be correlated within industries, thus heteroskedastic data can end up in too good p-values. Therefore, heteroskedasticity-consistent standard errors are utilized to explain more reliable t-statistics for the regression coefficients.

Additionally, the firms with low ($q < 1$) or high ($q > 1$) Tobin's q are analyzed separately for each base year to find out likely differences in the relations to the factors impacting growth. Finally, the sample selection is done both with industry adjustment and without industry adjustment. As described below, with industry adjustment, Tobin's q is defined as $q < 0$ and $q > 0$.

In the industry-adjusted analysis the main intention is to control industry effects. In terms of industry adjustment, all variables are adjusted by the industry mean within the data sample. In the study, industries are drawn up based on SIC-codes in such a way that every industry included minimum of four firms. From each of those firms on the industry, the mean industry variable is deducted from comparable firm specific variable. Industry adjustments are executed to whole time span including years 2010-2018.

Furthermore, to gather more information about groups' behavior and assist to interpret the regression results, the subgroups of low-q and high-q firms are analyzed at the level of mean and median. The growth and leverage of the groups are compared using Mann-Whitney-Wilcoxon test (MWW). Mann-Whitney-Wilcoxon is a non-parametric test, and it does not demand normal distribution for the variables.

5 Empirical results

This chapter unveils the empirical findings derived from the regression analysis. Typically, these findings encompass coefficients and p-value statistics for leverage, controlled variables, and a constant. Furthermore, consistent with Lang et al. (1996), White adjustments are applied across all regressions to address heteroskedasticity, stemming from possible correlations among error terms of individual firms within the same industry.

Table 4. Regressions of growth measures on leverage including years 2010-2018

The data span from 2010 to 2018 and encompass firms with annual sales of $1 billion in 2010 dollars. Data were sourced from the Datastream database. Employment and capital expenditures growth represents the percentage change in employment and capital expenditures from years +1 to 0 and +3 to 0. Net investment growth is calculated as capital expenditures minus depreciation for year +1, divided by the book value of fixed assets for year 0. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is defined as sales for year +1 divided by sales for year 0. Tobin's q is calculated as the total market value of equity plus the book value of total debt, divided by the book value of total assets. Cash flow is computed before interest expenses. All figures are adjusted for inflation, and results are adjusted for heteroskedasticity.
T-values provided in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

2010-2018 Unadjusted regressions	1-year Employment Growth	3-year Employment Growth	1-year CapEx Growth	3-year CapEx Growth	Net Investment Growth
Leverage	-0.014 (-0.185)	-0.116 (-0.425)	0.184 (0.266)	3.538 (1.252)	0.111 (2.390)**
Tobin's q	-0.189 (-0.512)	-0.057 (-1.374)	-0.107 (-0.931)	0.463 (1.078)	-0.015 (-1.979)**
Sales Growth	0.728 (8.105)***	1.748 (6.164)***	3.561 (4.322)***	0.136 (0.046)	0.347 (6.252)***
Cashflow / Total Assets	0.184 (1.381)	0.218 (0.493)	2.406 (1.962)**	1.011 (0.220)	-0.063 (-0.760)
CapEx / Fixed Assets	0.066 (1.083)	1.748 (6.164)	-0.318 (-0.567)	-0.309 (-0.155)	0.801 (21.208)***
Constant	0.011 (0.276)	0.163 (1.257)	-0.212 (-0.601)	-1.386 (-1.030)	-0.074 (-3.132)
R-squared	0.062	0.049	0.021	0.003	0.307
# of Observations	1272	954	1272	954	1272

In all regression tables it is good to pay attention that growth can be high for each firm-year due to positive business cycle. Table 4 presents the regression outcomes for unadjusted data spanning from 2010 to 2018. Notably, leverage demonstrates a significant correlation only with net investment growth and the relation is positive in contrast to results by Lang et al. (1996). Leverage has negative relation with employment growth measures Cash flow has a positive effect on growth for all regressions except net investment growth.

Sales growth, utilized to capture the multiplier effect, exhibits positive significant coefficients with most of the growth measures, only 3-year Capex growth does not imply significance, but the coefficient is positive. Lastly, capital expenditures are linked to subsequent declines in 1-year and 3-year capital expenditures growth and rises in employment and net investment growth. However, this estimate may be slightly biased due to the relatively high average annual capital expenditures growth in this dataset.

Table 4 does not account for industry effects, whereas Table 5 includes regressions with adjustments for industry effects across all variables. Industries were delineated from the sample based on two- or three-digit SIC codes, ensuring a minimum of five companies within each industry category. Upon controlling for industry effects, the regression outcomes remain largely consistent with those of the unadjusted regressions in Table 4. Notable changes include the greater negative association between leverage and growth measures however those are not significant either in this regression. Additionally, no significant relationship between cash flow and three-year capital expenditures is observed, which aligns with the findings of the regression in Table 4. Furthermore, capital expenditures continue to exhibit clear relationship only with net investment growth. The multiplier effect captured by Sales growth in industry adjusted regressions is significant in all regression except 3-year Capex growth, in the same manner as in unadjusted regressions in Table 4.

Table 5. Regressions of growth measures on leverage including years 2010-2018

The data span from 2010 to 2018 and encompass firms with annual sales of $1 billion in 2010 dollars. Data were sourced from the Datastream database. Employment and capital expenditures growth represents the percentage change in employment and capital expenditures from years +1 to 0 and +3 to 0. Net investment growth is calculated as capital expenditures minus depreciation for year +1, divided by the book value of fixed assets for year 0. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is defined as sales for year +1 divided by sales for year 0. Tobin's q is calculated as the total market value of equity plus the book value of total debt, divided by the book value of total assets. Cash flow is computed before interest expenses. All figures are adjusted for inflation, and results are adjusted for heteroskedasticity. All variables are industry-adjusted.
T-values provided in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

2010-2018 Industry-adjusted Regressions	**1-year Employment Growth**	**3-year Employment Growth**	**1-year CapEx Growth**	**3-year CapEx Growth**	**Net Investment Growth**
Leverage	-0.086	-0.336	-0.549	-2.770	0.046
	(-0.059)	(-1.109)	(-0.621)	(-0.896)	(0.843)
Tobin's q	-0.012	-0.020	0.151	-0.102	-0.018
	(-0.907)	(-0.398)	(1.262)	(-0.200)	(0.025)**
Sales Growth	0.701	0.1540	3.308	-2.094	-0.007
	(7.843)***	(0.539	(4.053)***	(-0.719)	(-0.121)
Cashflow / Total Assets	0.065	0.644	2.053	3.702	-0.068
	(0.516)	(1.469)	(1.789)*	(0.829)	(-0.880)
CapEx / Fixed Assets	0.005	0.190	-0.743	0.809	0.836
	(0.084)	(0.825)	(-1.322)	(0.344)	(22.106)***
Constant	-0.001	-0.002	0.074	-0.011	-0.000
	(-0.059)	(-0.042)	(0.621)	(-0.026)	(-0.034)
R-squared	0.051	0.005	0.022	0.002	0.280
# of Observations	1272	954	1272	954	1272

Lang et al. (1996) discovered that low-q firms exhibit a notable and negative correlation between leverage and growth, thereby rendering the overall negative and significant findings for the entire sample largely inconclusive. In their analysis, high-q firms demonstrate only one significant and negative correlation out of five. Moreover, for other growth metrics among high-q firms, the results range from negative to positive, with none achieving statistical significance. To investigate this further, the sample is divided

into two subgroups based on Tobin's q. Tobin's q is utilized to gauge a firm's growth prospects by assuming that capital markets recognize these opportunities, which can be reflected in the firm's market value. If a firm's Tobin's q exceeds one, it is inferred to possess high growth prospects, and vice versa. Table 6 and 7 displays the unadjusted regression outcomes for the subgroups categorized by high and low Tobin's q.

Table 6. Regressions of growth measures on leverage including years 2010-2018, Tobin's q > 1

The data span from 2010 to 2018 and encompass firms with annual sales of $1 billion in 2010 dollars. Data were sourced from the Datastream database. Employment and capital expenditures growth represents the percentage change in employment and capital expenditures from years +1 to 0 and +3 to 0. Net investment growth is calculated as capital expenditures minus depreciation for year +1, divided by the book value of fixed assets for year 0. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is defined as sales for year +1 divided by sales for year 0. Tobin's q is calculated as the total market value of equity plus the book value of total debt, divided by the book value of total assets. Cash flow is computed before interest expenses. All figures are adjusted for inflation, and results are adjusted for heteroskedasticity. All variables are industry-adjusted.
T-values provided in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

2010-2018 Tobin's q > 1	**1-year Employment Growth**	**3-year Employment Growth**	**1-year CapEx Growth**	**3-year CapEx Growth**	**Net Investment Growth**
Leverage	-0.023	-0.045	0.2343	3.538	0.167
	(-0.807)	(-0.513)	(0.2777)	(1.252)	(2.912)***
Tobin's q	-0.010	-0.001	-0.109	0.463	-0.017
	(-2.226)**	(-0.067)	(-0.789)	(1.078)	(-1.836)*
Sales Growth	0.629	0.986	4.022	0.136	0.213
	(17.540)***	(10.483)***	(3.795)***	(0.046)	(3.001)***
Cashflow / Total Assets	0.316	0.740	1.891	1.011	-0.161
	(6.198)***	(5.208)***	(1.256)	(0.220)	(-1.594)
CapEx / Fixed Assets	-0.048	0.192	-0.716	-0.309	1.249
	(-1.556)	(2.257)	(-0.787)	(-0.155)	(20.489)***
Constant	-0.012	-0.060	-0.050	-1.386	-0.139
	(-0.738)	(-1.324)	(-0.106)	(-1.030)	(-4.401)***
R-squared	0.062	0.243	0.020	0.004	0.346
# of Observations	899	648	899	648	899

When growth opportunities are factored into the relationship between growth and leverage, some differences between the subgroups become apparent. Nevertheless, the coefficient results of relationship between leverage and growth are once again mostly inverse compared to results by Lang et al. (1996) In high-q subgroup, leverage appears to exert a negative impact on only employment growth metrics, other growth metrics appear to be positive. For low-q firms, leverage exhibits a positive relationship with all growth measures while Lang et al. (1996) only finds negative relation between leverage and growth in both subgroups. Overall, leverage appears to not be linked to firm growth for high-q firms in this sample period. Nevertheless, these relationships are not particularly robust, leaving room for more targeted research.

In both subgroups sales growth exhibits positive relation between all growth measures and all of those are statistically significant except 3-year Capex growth. The greatest differences between the two subgroups emerge through the cash flow metric. In the high-q group, the relationship between cash flow and growth variables is positive, with the exception of net investment growth. The employment metrics are furthermore statistically significant. In the lower subgroup, the cash flow variable exhibits a negative relationship with both employee growth and three-year capex growth. Capital expenditures obtain positive coefficients in low-q subgroup but mostly negative coefficients in high-q subgroup.

Table 7. Regressions of growth measures on leverage including years 2010-2018, Tobin's q < 1

The data span from 2010 to 2018 and encompass firms with annual sales of $1 billion in 2010 dollars. Data were sourced from the Datastream database. Employment and capital expenditures growth represents the percentage change in employment and capital expenditures from years +1 to 0 and +3 to 0. Net investment growth is calculated as capital expenditures minus depreciation for year +1, divided by the book value of fixed assets for year 0. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is defined as sales for year +1 divided by sales for year 0. Tobin's q is calculated as the total market value of equity plus the book value of total debt, divided by the book value of total assets. Cash flow is computed before interest expenses. All figures are adjusted for inflation, and results are adjusted for heteroskedasticity. All variables are industry-adjusted.
T-values provided in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

2010-2018 Tobin's q < 1	1-year Employ-ment Growth	3-year Em-ployment Growth	1-year CapEx Growth	3-year CapEx Growth	Net Investment Growth
Leverage	0.076 (1.442)	0.358 (0.407)	0.021 (0.016)	1.649 (0.342)	0.110 (1.609)
Tobin's q	-0.385 (-1.425)	-2.132 (-2.682)***	-0.375 (-0.314)	3.714 (0.852)	-0.080 (-1.244)
Sales Growth	0.949 (3.352)***	2.938 (-0.284)***	2.613 (2.085)**	1.307 (0.244)	0.511 (7.578)***
Cashflow / Total Assets	-0.115 (-0.245)	-0.791 (-0.566)	3.929 (1.895)*	-2.263 (-0.295)	0.139 (1.241)
CapEx / Fixed Assets	0.136 (0.951)	0.247 (0.601)	0.001 (0.002)	1.589 (0.704)	0.467 (13.690)***
Constant	0.298 (1.442)	1.762 (2.827)***	-0.237 (-0.259)	-3.479 (-1.016)	-0.009 (-0.192)
R-squared	0.045	0.076	0.029	0.006	0.460
# of Observations	373	306	373	306	373

Table 8 and Table 9 presents the industry-adjusted regression outcomes for high- and low-q firms. While most of the results appear consistent with the unadjusted regression findings, there is a convergence in the sizes of coefficients between high and low-q firms. In low-q firms, leverage is negatively related to all growth metrics except net investment growth. Specifically, leverage and capital expenditures (Capex) exhibit strong negative coefficients. Conversely, in high-q firms, leverage shows mostly positive relationships,

particularly with Capex metrics. However, these positive correlations are not statistically significant.

Table 8. Industry Adjusted regressions of growth measures on leverage including years 2010-2018, Tobin's q > 1

The data span from 2010 to 2018 and encompass firms with annual sales of $1 billion in 2010 dollars. Data were sourced from the Datastream database. Employment and capital expenditures growth represents the percentage change in employment and capital expenditures from years +1 to 0 and +3 to 0. Net investment growth is calculated as capital expenditures minus depreciation for year +1, divided by the book value of fixed assets for year 0. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is defined as sales for year +1 divided by sales for year 0. Tobin's q is calculated as the total market value of equity plus the book value of total debt, divided by the book value of total assets. Cash flow is computed before interest expenses. All figures are adjusted for inflation, and results are adjusted for heteroskedasticity. All variables are industry-adjusted.
T-values provided in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

2010-2018 Industry Adj. Regressions Tobin's q > 1	**1-year Employment Growth**	**3-year Employment Growth**	**1-year CapEx Growth**	**3-year CapEx Growth**	**Net Investment Growth**
Leverage	-0.061	0.132	0.2343	2.091	-0.024
	(-0.711)	(0.644)	(0.2777)	(1.591)	(-0.502)
Tobin's q	0.002	0.058	-0.109	-0.106	-0.016
	(0.119)	(1.631)	(-0.789)	(-0.465)	(-2.124)
Sales Growth	0.195	-0.157	4.022	0.069	0.187
	(1.468)	(-0.445)	(3.795)***	(0.031)	(3.001)***
Cashflow / Total Assets	0.078	0.164	1.891	-2.043	0.014
	(0.627)	(0.414)	(1.256)	(-0.804)	(0.198)
CapEx / Fixed Assets	0.204	-0.389	-0.716	-1.497	0.916
	(1.864)*	(-1.281)	(-0.787)	(-0.770)	(15.093)***
Constant	-0.022	-0.204	-0.050	-0.240	-0.002
	(-0.687)	(-2.590)**	(-0.106)	(-0.476)	(-0.107)
R-squared	0.085	0.052	0.020	0.111	0.717
# of Observations	116	67	116	67	116

In high-q group firms, sales growth is once again statistically significant with both 1-year Capex growth and net investment growth. In low-q group firms, sales growth is also statistically significant with 1-year Capex growth. Cash flow generally shows positive coefficients with growth metrics, except for 3-year Capex growth in high-quality firms and net

investment in low-quality firms. Capex receives a statistically significant high positive coefficient in both subgroups when related to net investment growth.

Table 9. Industry adjusted regressions of growth measures on leverage including years 2010-2018, Tobin's q < 1

The data span from 2010 to 2018 and encompass firms with annual sales of $1 billion in 2010 dollars. Data were sourced from the Datastream database. Employment and capital expenditures growth represents the percentage change in employment and capital expenditures from years +1 to 0 and +3 to 0. Net investment growth is calculated as capital expenditures minus depreciation for year +1, divided by the book value of fixed assets for year 0. Leverage is determined by dividing the book value of total debt by the book value of total assets. Sales growth is defined as sales for year +1 divided by sales for year 0. Tobin's q is calculated as the total market value of equity plus the book value of total debt, divided by the book value of total assets. Cash flow is computed before interest expenses. All figures are adjusted for inflation, and results are adjusted for heteroskedasticity. All variables are industry-adjusted.
T-values provided in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

2010-2018 Industry Adj. Regressions Tobin's q < 1	**1-year Employment Growth**	**3-year Employment Growth**	**1-year CapEx Growth**	**3-year CapEx Growth**	**Net Investment Growth**
Leverage	-0.064	-0.425	-0.988	-3.911	0.077
	(-0.630)	(-1.249)	(-1.090)	(-1.127)	(1.229)
Tobin's q	-0.036	0.035	0.049	0.564	-0.037
	(-1.446)	(0.400)	(0.223)	(0.634)	(-2.431)**
Sales Growth	0.727	0.163	3.177	-2.158	-0.018
	(7.567)***	(0.539)	(3.724)***	(-0.698)	(-0.299)
Cashflow / Total Assets	0.062	0.680	2.382	4.154	-0.074
	(0.445)	(1.441)	(1.915)*	(0.863)	(-0.856)
CapEx / Fixed Assets	-0.004	0.216	-0.887	0.992	0.830
	(-0.059)	(0.887)	(-1.525)	(0.340)	(20.598)***
Constant	-0.009	0.015	0.051	0.161	-0.006
	(-0.562)	(0.310)	(0.370)	(0.327)	(-0.670)
R-squared	0.053	0.006	0.022	0.003	0.273
# of Observations	1156	887	1156	887	1156

Table 10. Mann-Whitney U-test among high-q and low-q subgroups

The mean and median values of the growth measures and leverage are contrasted between the high-q and low-q subgroups. The disparity has been examined using the Mann-Whitney U-test, a non-parametric statistical test.

2010-2018		Tobin's Q >1	Tobin's Q<1	Mann-Whitney U-test	
				Z-value	Pr > |Z|
1-year Employment Growth	Mean	5.04%	8.43%	-14.5719	<0.0001
	Median	1.92%	1.15%		
3-year Employment Growth	Mean	16.20%	36.76%	-11.9611	<0.0001
	Median	7.44%	6.52%		
1-year CapEx Growth	Mean	29.15%	14.17%	-28.6785	<0.0001
	Median	7.96%	-2.62%		
3-year CapEx Growth	Mean	101.79%	-34.09%	-17.3726	<0.0001
	Median	14.93%	2.38%		
Net Investment Growth	Mean	7.79%	7.65%	-4.3633	<0.0001
	Median	3.37%	3.55%		
Leverage	Mean	33.28%	31.79%	-11.4377	<0.0001
	Median	32.10%	30.71%		

Table 10 illustrates the average and median growth rates and leverage levels for both high-q and low-q firms throughout the entire period from 2010 to 2018. The findings in Mann-Whitney U-test are contradictory as earlier regression results. Both employment growth measurements indicate that low-q has greater growth in employment and only median 3-year growth is slightly greater in high-q group compared to low-q group. On the contrary Capex growth for high-q group has been significantly higher than low-q group. Net investment growth and the leverage levels for both low-q and high-q groups have remained around at the same level during the whole sample period. Across Capex growth metrics, low-q firms demonstrate negative growth in 1-year median and 3-year mean values, but high-q firms experience positive growth across all measures. Thus, on average, firms behave in accordance with their expected growth prospects.

6 Conclusions

In the imperfect real world, capital structure holds significance contrary to the prevailing consensus in financial theory. However, its precise impact on various aspects of a firm's operations remains elusive. One such aspect that lacks clear understanding is the correlation between firm leverage and growth. According to capital structure theories and empirical evidence, this relationship is expected to be negative. This thesis aims to contribute to this discourse by replicating the research framework established by Lang et al. (1996) and extending it to encompass data from the last decade (2010-2018).

The study focuses on companies based and operating in the U.S., specifically large-sized industrial firms, spanning the years 2010 to 2018. Large-sized industrial firms are those categorized under SIC codes 2000-3999 and with annual sales of at least $1 billion in 2010 dollars during the base year when included in the sample. The final sample comprises 1,431 firm-years. Growth is assessed through measures such as net investment, one-year and three-year employment growth, and capital expenditures growth.

In this study, leverage is subjected to regression analysis against five growth variables to ascertain the presence of any significant relationships. Both raw, unadjusted data and industry-adjusted data are utilized in the regressions to account for industry effects.

The time period included a robust economic upturn and stock indexes gathered substantial returns during the sample period. Figure 4 represents well the financial conditions of the companies involved in the study during 2010s. A positive economic climate and low interest rates have encouraged companies to take more debt while simultaneously making investments and increasing the number of employees.

The paper revealed a mix of negative and positive relationships between leverage and growth, contingent upon the growth variable and subgroup analyzed. The prevailing economic upswing and low-interest-rate environment largely account for the contrasting

findings compared to earlier studies. While companies have increased their level of leverage during the sample time period they have been able to focus on growth.

The contradictory findings of this study indicate the necessity for additional investigation into the impact of capital structure on firm performance in extended timeframe, as it does not appear to have statistically significant impact in positive economical cycle. Moreover, these results could offer valuable guidance to companies when making decisions regarding their capital structure.

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