# Master thesis

# *The impact of leverage and the maturity of debt on firm growth: Evidence from West-European high-technology firms*


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| Student name: | S.M. Lage Venterink |
| Student number: | s2420430 |
| Faculty: | Behavioural, Management and Social Sciences |
| Study: | Master Business Administration |
| Institution: | University of Twente (NL) |
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| Supervisors: | Prof.dr.ir. A. Bruggink |
| | ir. E.J. Sempel |


UNIVERSITY OF TWENTE.

**Abstract**

This study investigates the impact of capital structure, measured by leverage and maturity of debt, on firm growth among an unstudied sample of West-European high-technology firms. High-tech firms have a greater need for financial capital because they rely more on investing heavily in technological innovation activities. Besides, high-tech firms have other unique characteristics, such as high levels of intangible assets, leading to different financing strategies. Limited research has been conducted on this relationship and scholars disagree on the role of capital structure in influencing firm growth. Therefore, this study demonstrates whether capital structure has a positive impact on firm growth as supported by the trade-off theory, agency theory and market-timing theory or has a negative impact on firm growth as supported by the agency theory and pecking-order theory. To examine this relationship, a fixed effect panel regression is performed on a sample of 3918 unlisted Western-European high-tech firms over the period 2013-2019 in this study. The results show a positive and significant impact of leverage, in particular short-term debt, on firm growth. Meanwhile, long-term debt showed an insignificant effect, suggesting that shorter debt maturities could stimulate firm growth among high-tech firms in Western Europe. We also find that size, age, profitability and liquidity are determinants of firm growth. These results highlight that high-tech firms with high leverage, which mainly use short-term debt, grow faster than lower leveraged firms during the period examined.

**Keywords:** *Capital structure, High-tech firms, Firm growth, Leverage, Maturity of debt, After crisis period, Western-Europe*

# Content

# 1 Introduction

Over the last decade, plenty of research has been conducted about firm characteristics influencing the capital structure and investment decisions of a firm. Capital structure is an important topic in financial literature as financial capital is necessary for firms to operate as a business. Besides, as the capital structure represents the financial decisions of a firm, it contains a lot of information regarding the financial decision-making process.

This stream of research is in line with well-known capital structure theories, arguing the firm's value is determined by its real assets regardless of the nature of the claims against it. One of the first scholars to theorize about capital structure were Modigliani and Miller (1958), They have created one of the most well-known capital structure theories, also known as the irrelevance theory or Miller and Modigliani theorem. Modigliani and Miller (1958) argue the market value of any firm is independent of its capital structure in a frictionless world without imperfections. They created the starting point for many other scholars to theorize about firm value using the irrelevance theory as the basis for the modern theory of capital structure. Subsequently, the trade-off theory, pecking order theory, agency theory and market-timing theory have emerged as other well-known theories dominating the capital structure debate.

Scholars have challenged these theories and concluded that capital structure is relevant for firm value. To a lesser extent, scholars have investigated the impact of capital structure on firm growth. Investigating capital structure as a driver of firm growth is an important aspect of the financial decision-making process. The existing empirical evidence shows mixed results regarding the sign of the relationship (Aivazian, Ge, & Qiu, 2005; Anton, 2016; Anton, 2019; Hamouri, Al-Rdaydeh, & Ghazalet, 2018; Heshmati, 2001; Honjo & Harada, 2006; Huynh & Petrunia, 2010; Lang, Ofek, & Stulz, 1996; Rahaman, 2011; Tsuruta, 2015). Overall, empirical evidence demonstrates the existence and relevance of the relationship between capital structure and firm growth in contrast to the well-known propositions by Modigliani and Miller (1958).

## 1.1 Research problem

Nowadays one can no longer imagine a world without technology. Technology is becoming increasingly important and high-technology firms are presenting a larger share every year. Over the last decade, technology-based firms have been a major source of job creation, innovation and economic growth.

As these high-technology firms are developing rapidly, their financial construction becomes an interesting aspect. High-tech firms have a bigger need for financial capital because they rely more on investing heavily in technology innovation activities. If they do not keep up with their innovation activities, the concern that their rivals may surpass them could arise (Khan, He, Akram, Zulfiqar, & Usman, 2018). The development of these technologies plays an important role in the global competitive advantage of high-tech firms (Tseng, Chiu, & Chen, 2009). Besides, high-tech firms have other unique characteristics that might affect their capital structure. These unique characteristics are high levels of intangibles assets, lack of tangible assets that can be used as collateral, the complexity of the technology and the development of new technologies increasing market and technological uncertainty. Recent papers have addressed some of these unique characteristics in relation to capital structure (Grinstein & Goldman, 2006; Hogan & Hutson, 2005; Hyytinen & Pajarinen, 2005).

These unique features could lead to different financing strategies of high-tech firms, in which they could become extremely levered or unlevered. Also, it could make high-tech firms vulnerable to asymmetric information problems, risk problems and probability of default (Coleman & Robb, 2012; Hogan & Hutson, 2005; Serrasqueiro, Nunes, & Armada, 2012). As a result, high-tech firms are more likely to be severely affected by firm characteristics influencing capital structure and growth. For these reasons, high-tech firms are an interesting group to explore the relationship between capital structure and growth to determine the optimal capital structure for these types of firms.

To summarize, This study aims to assess the impact of leverage and the maturity of debt, which are components of capital structure, on the growth of high-technology firms. This corresponds to the following research question that will be investigated:

*What is the effect of capital structure on the firm growth of high-tech firms?*

To address this question, a quantitative, cross-sectional study is performed. Firm-level data is collected from the Orbis database and analysed to formulate an answer to the research question. In this study, capital structure theory is used as a lens through which the ratio of leverage and debt maturity can be viewed as influential determinants for firm growth. Proposition 1 by Modigliani and Miller (1958) will form the base from which this research is developed, further elaborated by the trade-off theory, pecking order theory, agency theory and market-timing theory. The main research question is separated into the following sub-questions:

*(1) What is the influence of leverage on the firm growth of high-tech firms?*
*(2) What is the influence of the maturity of debt on the firm growth of high-tech firms?*

## 1.2 Scientific and social contribution

This study mainly contributes to the literature for several reasons. First of all, this study provides scientific insight into the influence of leverage and maturity of debt on firm growth. Specifically, it aims to provide recommendations concerning the effect of capital structure on growth, which could contribute to the financing decisions made by high-tech firms. It highlights the importance of the consequences financial decisions, made by financial managers, have on the future development of the firm.

Besides that, most studies use different measurements of firm growth. In this study, three firm growth measurements are used, as mostly depicted in the literature. These growth measures are asset growth, sales growth and employment growth (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006;). Measuring growth by these three components together extents literature by providing a more widespread view of growth. In addition, Only a small amount of research has also investigated the effect of other components of capital structure on firm growth (Aivazian et al., 2005; Molinari, Giannageli, & Fagiolo, 2016; Schiantarelli & Sembenelli, 1997). Therefore, this study will extent literature by not only looking towards the amount of leverage, but also to the effect of the maturity of debt on firm growth.

Moreover, this study contributes to the existing literature on the relationship between capital structure and growth as there is, to the best knowledge of the author, no evidence specifically from non-listed West-European high-tech firms in the period 2013-2019. Besides, The findings of this study will add value to the practical relevance as recent data (after the global financial crisis of 2008) is used, compared to other studies as is mentioned earlier. Therefore, the insights of this study could be used by other researchers and students to further investigate this topic. Owing to this, this research aims to make recommendations for future research.

Furthermore, this research contributes to the existing literature on different factors influencing capital structure. Prior research illustrates how firm characteristics affect the financial decisions made on the amount of leverage and debt maturity (Cassar, 2004; Chittenden, Hall, & Hutchinson, 1996; Daskalakis & Psillaki, 2008; Degryse, Goeij, & Kappert, 2012; Frank & Goyal, 2009; Gaud, Jani, Hoesli, & Bender, 2005; La Rocca, La Rocca, & Cariola, 2011; Sogorb-Mira, 2005). However, the results of this study can contribute to the importance of these different factors influencing the capital structure. If a causal relationship between capital structure and firm growth is established, these factors become more important as they do not only influence the capital structure but also indirectly influence firm growth. For instance, when high-tech firms are faced with financial constraints because of their intangible assets that might serve as poor collateral, making them dependent on alternative funding sources. This could become problematic if capital structure affects firm growth.

## 1.3 Thesis outline

The remainder of the thesis contains a theoretical background on capital structure, leverage and maturity of debt in chapter two to provide an understanding of these concepts. Chapter two concludes with the development of the hypotheses. Next, the research methodology and the measurements of the variables are described in chapter three, in which empirical evidence on existing research methods is presented to investigate the impact of capital structure on firm growth. This is followed by a description of the research methodology applied in this study in order to test the hypotheses. Moreover, chapter four discusses the sampling criteria of this study and the data resources used to collect the data. The results of the analysis of the collected data are described in the fifth chapter of this thesis. Finally, in the sixth chapter, a conclusion and discussion are drawn, followed by the limitations of this study and recommendations for future research in chapter seven.

# 2. Literature review

This chapter describes a comprehensive literature review on the relationship between capital structure and firm growth. To begin with, the main capital structure theories that are the most accepted and used in previous literature are described. These consist of the irrelevance theory, trade-off theory, pecking order theory, agency theory and market-timing theory. Secondly, empirical evidence is given and reviewed on the impact of capital structure on firm growth. Finally, in the last section hypotheses for each sub question are formulated.

## 2.1 Capital Structure theories

Does it matter how firms are financed and what is the optimal capital structure of a firm are intriguing questions interesting many scholars over the last decade. Several theories considering the capital structure are developed. The five most well-known theories will be discussed in this section in chronological order.

### 2.1.1 The irrelevance theory

Modigliani and Miller were one of the first scholars to theorize about capital structure. Before the publishment of their paper, there was no generally accepted theory on capital structure. Hence, their research was a breakthrough in the capital structure literature and is nowadays one of the most well-known capital structure theories. According to Modigliani and Miller (1958) are both the firm's value and cost of capital independent of its capital structure, assuming a market without imperfections in a frictionless world (proposition I). This perfect capital market can only exist under the assumptions that there are I) no taxes, II) no transactions costs and III) no bankruptcy costs involved. In addition, IV) Individual investors and corporations must be able to borrow at the same rate. The last assumption allows individual investors to undo the effect of any changes in the capital structure of the firm by adjusting their portfolios. This is also referred to as homemade leverage (Brealey, Myers & Allen, 2019).

In other words, the capital structure of a firm is irrelevant to its firm value and cost of capital if these assumptions are met. For this reason, The Modigliani and Miller theorem is also known as the irrelevance theory. However, These assumptions cannot be fulfilled in the real world as proposition I only holds in a world without taxes. Consequently, Modigliani and Miller (1963) made a correction acknowledging that taxes, as a matter of fact, are relevant for capital structure decisions. They correct their theorem by arguing how the use of tax shields can be beneficial for the interest payments made increasing the value of a levered firm compared to the value of an unlevered firm.

To maximize the benefit of a tax shield, companies should increase their leverage to 100%. However, no company would finance the entire organization with debt. As a result, alternative theories of capital structure have emerged following the criticism on the irrelevance theory. Researchers have tried to extend the irrelevance theory by explaining capital structure decisions in the real world. As a result, several new theories have been developed building on Modigliani and Miller's famous propositions. The four most extensively discussed alternative capital structure theories in literature are considered in this thesis. These theories are the trade-off theory, pecking order theory, agency theory and market-timing theory. Each theory is discussed below.

### 2.1.2 Trade-off theory

In 1973, Kraus and Litzenberger developed a new theory derived from the discussion about the irrelevance theory. Kraus and Litzenberger (1973) agree with Modigliani and Miller (1958) that in perfect capital markets the firm's market value is independent of its capital structure. However, the existence of bankruptcy costs and corporate tax rates are market imperfections that must be considered in the real world. These two imperfections are central in the development of a new theory about the optimal capital structure.

Baxter (1967) postulates, within the existence of corporate tax, that costs of financial distress counteract the savings from tax shields. Once these tax savings are surpassed by the costs of financial distress, it may cause the costs of capital of the firm to rise. Subsequently, Kraus and Litzenberger (1973) developed a state-preference model of optimal leverage which became central to the trade-off theory. This model proposes the market value of a levered firm is equal to the market value of an unlevered firm, plus the corporate tax rate times the market value of the firm, minus the present value of the costs of financial distress (Kraus & Litzenberger, 1973). As can be seen in figure 1, a theoretical optimum is reached when the present value of the tax savings due to increasing debt is just offset by increases in the costs of financial distress. By the same, Scott (1976) presented a model implying the existence of an optimal capital structure, under the assumptions of imperfect markets for physical assets and investors being indifferent to risk.

Over the years, scholars have questioned the relevance of the trade-off theory. Kim (1978) criticizes these existing studies, because she finds the models too complex to implement and the model proposed by Scott ignores risk aversion in the capital market. Myers and Pogue (1974) argue risk aversion by the lender, managers and/or shareholders could cause debt capacity constraints which makes borrowing the optimal amount of debt not obtainable. Moreover, the benefits of increasing debt may be complicated by the existence of non-debt tax shields (DeAngelo & Masulis, 1980) and the effect of personal income taxes (Miller, 1977). Following the criticism of scholars on the existence of an optimal amount of debt, Myers (1984) argued that the trade-off theory should be seen as a framework for firms to set up a target debt-to-value ratio and gradually move towards it.

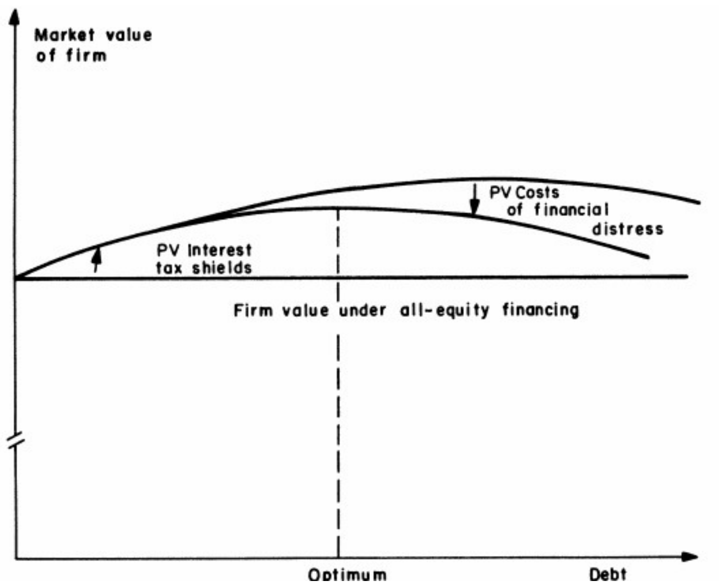


**Figure 1.** The static trade-off theory of capital structure (Myers, 1984)

Furthermore, building on Myers argument a distinction could be made in the trade-off theory. Frank and Goyal (2005) have split the trade-off theory into two parts, namely the static trade-off theory and the dynamic trade-off theory. The difference lies in the ability to operate in a dynamic environment adjusting the target debt-to-value ratio, taking into account endogenous and exogenous factors that change over time influencing the optimal debt-to-value ratio. Provided that, the static trade-off theory sets a fixed debt-to-value ratio in a perfect environment, restricted to a single period. Whereas, the dynamic trade-off theory changes its debt-to-value ratio over time operating in a dynamic environment. Graham and Harvey (2001) found empirical evidence supporting both forms of the trade-off theory. Their survey evidence shows that 44% of the investigated firms have strict or somewhat strict debt-to-value targets, while 37% of the investigated firms have flexible debt-to-value targets. In either case, it shows moderate support for the trade-off theory.  In addition, Frank and Goyal (2009) find empirical evidence how median industry leverage, tangibility, firm size and expected inflation have a positive relationship and market-to-book ratio has a negative relationship with market leverage as predicted by the static trade-off theory. Only the relationship to profit appears to be inconsistent with the relationship predicted by the static trade-off theory, but is instead consistent with the relationship predicted by the dynamic trade-off theory.

To summarize, Attracting debt increases the tax deductibility which decreases the weighted average costs of capital (WACC). However, the savings from the tax shield can be surpassed by the costs of financial distress. As a result, the trade-off theory searches for the firm's optimal debt ratio which is usually defined as a trade-off between the costs and benefits of borrowing, under the assumptions that the firm's assets and investment plans are held constant to maximize the firm value. (Myers, 1984).

### 2.1.3 Pecking order theory

In 1984, The trade-off theory is followed by the introduction of the pecking order theory developed by Myers (1984) and Myers and Majluf (1984). In contrast to the Trade-off theory, there is no target debt-to-value ratio. In fact, the pecking order theory states there is a hierarchical order in which firms prefer a financial source. Therefore, the debt-to-value ratio is a result of hierarchical financial decisions over time. Moreover, Shyam-Sunder and Myers (1999) argue the pecking order model explains the time-series variance in debt ratios more than the static trade-off theory, as this model is better able to account for changes over time.

Meyers (1984) defines the pecking order as a '' framework, in which the firm prefers internal to external financing, and debt to equity if it issues securities.'' (p. 576). The key assumptions behind this hierarchical order of financial preferences are that 1) internal funds prevent firms from relying on external finance and the costs involved and 2) the asymmetric information problem. The general rule of obtaining external finance is to issue safe securities before risky ones, which seeks the firms to issue debt securities over equity securities if possible (Myers, 1984). To be more precise, asymmetric information between managers and outside investors could cause moral hazard problems and adverse selection. Particularly, managers of the firm are better informed knowing the true value of the firm's assets and NPV projects, whereas outside investors can only guess the true values from the public information available. The existence of this information asymmetry causes uncertainty for the investor, which lowers the share price when equity is issued. Therefore, the decision to issue equity reveals pessimism of the financial manager, because it will force the stock price to fall (Brealey et al., 2019). For this reason, financial managers use the reverse order of information asymmetry for their financial decisions, which is the pecking order.

Shyam-Sunder and Myers (1999) found empirical evidence of the pecking order model being an excellent first-order descriptor of corporate financing behaviour. However, their sample only includes large mature firms. As a matter of fact, according to Frank and Goyal (2003), large firms are most supportive of the pecking order theory while smaller firms, on the contrary, are less likely to follow the pecking order. Moreover, Graham and Harvey (2001) Find financial flexibility and equity undervaluation are consistent with the pecking order, however, they show very little evidence that information asymmetry could be a cause for the capital structure choice. Furthermore, Frank and Goyal (2009) discuss the pecking order theory offers a good explanation of why profitable firms tend to have lower leverage. In contrast, Fama and French (2005) show empirical evidence rejecting central predictions of the pecking order. Instead, they argue that the pecking order theory only carries some elements of the truth explaining financial decisions. This is consistent with empirical evidence found by Leary and Roberts (2010).

### 2.1.4 Agency theory

The Agency cost theory is founded by Jensen and Meckling in 1976. They describe how the principal-agent relationship can lead to agency costs. As follows, the principal (stockholders) and agent (firm managers) might have different interests and goals, but the principal relies on the agent to act in his interest. When managers fail to make decisions that are most fruitful for the organization and, instead, make decisions suiting their own preference, that is when agency costs arise. Agency costs are defined as the sum of 1) the monitoring costs by the principal, 2) the bonding expenditures by the agents and 3) the residual loss (Jensen & Meckling, 1976). All costs involved to reduce the divergence of interest and to ensure the behaviour of the firm's managers maximize the shareholders' value are called agency monitoring costs. For example, the costs of having a board of directors acting on behalf of the shareholders. Jensen and Meckling (1976) consider bond expenditures as costs to contractual obligations limiting the manager's activities and decision making power. The residual loss is the sum of the reduction in welfare experienced by the shareholders in the principal-agent relationship (Jensen & Meckling, 1976).

The agency cost theory has three main forms of potential agency problems. To begin with, the underinvestment problem, elaborated by Myers (1977), is induced by risky debt giving firms a rational explanation for limiting debt capacity. Myers (1977) postulates that firms with risky debt outstanding and firms with risk-free debt or no debt outstanding, acting in the interest of shareholders, make different financial decisions. Firms with risky debt outstanding will sometimes pass up valuable investment opportunities, even if the investment opportunity is a positive-NPV project increasing the market value of the firm. This is caused by the shareholders who bear full risk of the investments, but only partially gain from the generated benefits. By forgoing valuable investment opportunities, the firm will ultimately lower its market value. Hence, the availability of secured debt could mitigate the underinvestment problem (Stulz and Johnson, 1985).

The second problem is known as the asset substitution problem. Shareholders might prefer to invest in risky projects knowing the payoff, if successful, is high even though the probability of success is low (Jensen and Meckling, 1976). If the risky project turns out to be unsuccessful, the bondholders will bear most of the costs when the debt-to-equity ratio is high. The loss in equity value resulting from the poor investment can be more than offset through a gain in equity value captured at the expense of the bondholders (Harris & Raviv, 1991). This is also known as the risk-shifting game (Brealey et al., 2019). As borrowing increases, the temptation to play games by the shareholders becomes larger. Financial managers acting on behalf of these shareholders will result in poor investment decisions, ultimately lowering the market value of the firm (Brealey et al., 2019). This is the agency costs of borrowing.

The final problem is the free cash flow problem which is an overinvestment problem that occurs when free cash flows are generated. Jensen (1986) argues conflicts of interest between shareholders and financial managers become more severe when firms generate free cash flows. Specifically, when a firm has plenty of cash but limited positive-NPV projects, managers will be tempted to overinvest in poor or even negative investment opportunities rather than paying out funds to the shareholders (Brealey et al., 2019; Lang, Stulz, & Walkling, 1991). These poor financial decisions are not in the interest of shareholders. Therefore, shareholders need to reduce this divergence of interest by establishing appropriate incentives and/ or by incurring monitoring costs.

### 2.1.5 Market-timing theory

The final theory that is discussed in this thesis is the market-timing theory, recently introduced by Baker and Wurgler (2002). They postulate that ‘’capital structure is the cumulative outcome of attempts to time the equity market’’(p. 3). So, the idea of this theory is that the decision to issue equity depends on the market performance, primarily assumed by Lucas and McDonald (1990) and Loughran and Ritter (1995). Specifically, Lucas and McDonald (1990) argue variations in volumes of equity issues over time are caused by increases in the market performance. They postulate that firms who notice stock price increases resulting in overvalued stocks are more likely to issue equity. According to Lucas and McDonald (1990), this so-called ''opportunity window'' is most important to firms suffering from information asymmetry. Therefore, firms are likely to postpone their equity issues when they are anticipating on market developments.  This is supported by Myers (1984) who suggest undervalued equity is not likely to be issued by financial managers. In addition, Loughran and Ritter (1995) agree with Lucas and McDonald on firms taking advantage of opportunity windows when stocks are overpriced due to current market rises. Although, they disagree on the view that firms are willing to postpone equity issues.

Meanwhile, Baker and Wurgler (2002) have found empirical evidence for this market timing behaviour, claiming market timing has a large and permanent effect on the capital structure of a firm. Their main findings are that low leveraged firms tend to issue equity when their stocks are overvalued, while high leveraged firms tend to issue equity when their stocks are undervalued. This theory is consistent with the findings of Graham and Harvey (2001) who present survey evidence on equity issue decisions. They present that 60 to 70 percent of the CFOs of firms consider earnings per share dilution, the magnitude of undervaluation or overvaluation and stock price increases as an important factor in the financial decision-making process to issue equity. In addition, Alti (2006 )investigates hot markets as opportunity windows finding evidence that hot-market firms are underleveraged compared to cold-market firms, which is in line with the market-timing theory. Although, Alti (2006) underlines the influence of market timing on leverage has only a short term impact on the capital structure and not a permanent impact as proposed by Baker and Wurgler (2002).

## 2.2 Determinants of capital structure

The majority of the capital structure literature is focused on identifying firm-specific determinants of capital structure. The most investigated firm-specific determinants in previous literature are described in this section. Because each of these determinants affects the financial decision-making process, this section is used to emphasize the importance of using these determinants as control variables for this study which is affirmed in chapter three.

### 2.2.1 firm-specific determinants of capital structure

***Firms Size***

Modigliani and Miller (1958, 1963) make no distinction between different firm sizes in their capital structure theory, but there is empirical evidence that the size of a firm does matter to its capital structure. Especially, asymmetric information and costs of financial distress are argued to reflect the relationship between size and capital structure. It could be relatively more costly for small firms to resolve information asymmetry problems compared to their larger counterparts (Cassar, 2004). Most studies find size is positively related to leverage (Cassar, 2004; Daskalakis & Psillaki, 2008; Fama & French, 2002; Frank & Goyal, 2009; Gaud et al., 2005; La Rocca et al., 2011; Sogorb-Mira, 2005). Hence, larger firms tend to rely more heavily on debt than smaller firms. However, Chittenden et al. (1996) argue there is no significant relationship between size and total debt. They only indicate a significant effect when total debt is separated into long-term debt and short-term debt. Particularly, size is demonstrated to have a positive effect on long-term debt (Chittenden et al., 1996; Degryse et al., 2012; Sogorb-Mira, 2005).

These findings are in line with theories about capital structure. As follows, larger firms tend to be more diversified, facing less volatile cash flows and probability of default (Daskalakis & Psillaki, 2008; Fama & French, 2002; Gaud et al., 2005). The trade-off theory builds on this reasoning behind the positive relationship. As large firms face fewer costs of financial distress than smaller firms, their theoretical optimum of debt is higher when this optimum is determined by offsetting the present value of tax savings against the costs of financial distress (Kraus & Litzenberger, 1973). Moreover, less volatile cash flows reduce information asymmetry costs and larger firms are more likely to access the debt market at lower costs than small firms (Daskalakis & Psillaki, 2008; Fama & French, 2002). This reasoning behind the positive relationship is supported by the pecking order theory. As a matter of fact, according to Frank and Goyal (2003), large firms are most supportive of the pecking order theory while smaller firms, on the contrary, are less likely to follow the pecking order.

***Age***

The second determinant which is tested by several scholars is age. Chittenden et al. (1996), Hall, Hutchinson and Michaelas (2004), and Michaelas, Chittenden and Poutziouris (1999) discover age is negatively related to leverage, especially with short-term debt. A shared explanation for these findings is that younger firms have a greater need for external financing to fund their operations, as they cannot yet rely on internally generated funds, while older firms are more likely to be able to accumulate retained earnings (Chittenden et al., 1996; Hall et al., 2004; Michaelas et al., 1999). This negative relationship provides support for the pecking order theory, because as firms age they prefer internally generated funds over external finance. The pecking order theory is especially applicable to unlisted small firms, as listed firms have other resources of finance available (Chittenden et al., 1996).

***Firms profitability***

The next determinant of capital structure that has been widely tested in previous research is profitability. The results are conclusive showing that profitability is negatively related to leverage. (Chittenden et al., 1996; Daskalakis & Psillaki, 2008; Degryse et al., 2012; Fama & French, 2002; Frank & Goyal, 2009; Gaud et al., 2005; La Rocca et al., 2011; Sogorb-Mira, 2005). Provided that, the pecking order theory offers a good explanation why profitable firms tend to have lower leverage. As mentioned, Meyers (1984) defines the pecking order as a framework in which the firm prefers internal to external financing. Profitable firms are able to use their retained earnings which serves as internal funds to finance their operations and investments. Therefore, they are expected to borrow less compared to less profitable firms. Furthermore, Chittenden et al. (1996) and Degryse et al. (2012) emphasize that short-term debt appears to have a stronger negative relationship with profitability than long-term debt. To illustrate, Degryse et al. (2012) argue high interest rates and the ease of short-term debt amortization compared to long-term debt could explain this stronger relation of profitability on short-term debt.

***Asset structure***

The asset structure of a firm is an important determinant of leverage. Especially, tangible assets are considered of great importance as these are often used as collateral in acquiring external finance. Thus, creditors prefer lending to companies with high levels of tangible assets as it lowers their risk. This explanation suggests a positive relationship between tangible assets and leverage. Consequently, several studies find consistent evidence that asset tangibility is positively related to leverage (Chittenden et al., 1996; Degryse et al., 2012; Frank & Goyal, 2009; Gaud et al., 2005; Sogorb-Mira, 2005). This empirical evidence is corresponding to the trade-off theory and agency theory.

From the trade-off perspective, firms are expected to borrow as much debt till the theoretical optimum is reached (Kraus & Litzenberger, 1973). Having high levels of tangible assets as collateral enables the firm to borrow more from the lender. Accordingly, excessive borrowing will increase the tax shield advantage. Besides, the costs of financial distress are lower for firms relying on tangible assets (Daskalakis & Psillaki, 2008). Furthermore, the positive relation is consistent with the agency theory as offering tangible assets as collateral reduces agency conflicts (Degryse et al., 2012; Gaud et al., 2005). To illustrate, the collateralized debt prevents the firm's management to sell valuable assets to pay dividends to shareholders. In addition, it sends a positive signal to the creditors who can request the selling of these assets in case of default, which reduces moral hazard risks (Gaud et al., 2005).

In contrast, Chittenden et al. (1996), Degryse et al. (2012) and Sogorb-Mira (2005) indicate a negative relationship between short-term debt and asset tangibility. However, there are two good possible explanations for this negative relationship that do not contradict the empirical evidence on the positive relationship between asset tangibility and total debt. First, firms with low levels of tangible assets have less collateral and, therefore, are more dependent on short-term finance (Chittenden et al., 1996). Second, the negative relation could also induce that current assets, often considered as poor collateral, are more likely to be financed with current liabilities (Sogorb-Mira, 2005).

Nonetheless, Daskalakis and Psillaki (2008) find a negative relationship between total debt and asset tangibility. They offer an explanation consistent with the pecking order theory for this relationship. They argue firms with lots of tangible assets might already have a stable source of return. This provides firms with more internally generated funds, discouraging them from using external finance (Daskalakis & Psillaki, 2008).

***Growth opportunities***

The determinant of the capital structure last discussed is growth opportunities. Empirical evidence shows inconclusive results about the sign of the relationship between growth opportunities and leverage. To begin with, Daskalakis and Psillaki (2008), Degryse et al. (2012), La Rocca et al. (2011) and Sogorb-Mira (2005) indicate growth opportunities are positively related to leverage. The pecking order theory offers a good explanation for this positive relationship. Exploring growth opportunities requires higher demands of finance. Therefore, when retained earnings are exhausted, external funds are needed to gain additional capital.

On the contrary, from the agency cost, trade-off and market timing perspective, a negative relationship is expected. This relationship is supported by Frank and Goyal (2009) and Gaud et al. (2005) who find empirical evidence that growth opportunities are negatively related to leverage. Gaud et al. (2005) argue the negative relation could be explained by the market timing of firms. Listed firms are more likely to issue equity when stock price increases result in overvalued stocks (Lucas & McDonald, 1990). Accordingly, Hovakimian, Opler and Titman (2001) postulate these stock price increases are associated with improved growth opportunities. Thus, listed firms with growth opportunities are more likely to issue equity resulting in a decrease in leverage. In addition, agency theory discusses the underinvestment problem in which Myers (1977) elaborates that firms might pass up positive NPV projects when gains are to be shared with debtholders, but the full risk is born by the equity holders. Moreover, Frank and Goyal (2009) offer an explanation in line with the trade-off theory, by arguing that growth opportunities increase the costs of financial distress. For example, the assets needed for exploring growth opportunities are often poor collateral. So, the increase in risk increases the costs of financial distress.

## 2.3 Empirical evidence on the relationship between capital structure and firm growth.

This section will discuss the empirical evidence of previous studies on the relationship between capital structure and firm growth. Many studies have investigated the impact of capital structure on firm performance. Whereas only a minority of studies is focused on different aspects of capital structure influencing firm growth. Therefore, the impact of capital structure on firm growth is key for this study. First, the effect of leverage on firm growth is discussed. Next, the effect of maturity of debt on firm growth is described.

### 2.3.1 The impact of leverage on firm growth

The impact of capital structure on firm growth has been studied by multiple researchers. These studies emerged following the criticism on the irrelevance theory as a starting point. Obviously, the impact of capital structure on firm growth is key for this study to execute the empirical tests.

One of the first and most well-known pieces of research on the direct relation between capital structure and firm growth is written by Lang et al. (1996). They discover a negative impact of leverage on future growth for firms with a low Tobin's Q ratio. They relate Tobin's Q ratio to good investment opportunities. Aivazian et al. (2005) demonstrated similar results when relating leverage to the level of investment. This suggests that the negative effect of leverage affects only those firms with no good growth opportunities or firms with growth opportunities that the market doesn't recognize (Lang et al., 1996).

In line with this result, Anton (2019) found a negative impact of leverage on firm growth for high growth firms, also known as ''gazelles'', using data from 2006 to 2014 in CESEE countries. These gazelles are known for their debt overhang, which implies that high levels of leverage are a big drag on firm growth. Likewise, Honjo and Harada (2006) also found a significant negative impact of leverage on firm growth in the employment and asset growth models for older SMEs in Japan. By contrast, the sales growth model showed a significant positive relationship for both younger and older SMEs in Japan, which is in line with the findings of Tsuruta (2015). The mixed findings in the asset and sales growth models are also consistent with the findings of Heshmati (2001), who employed a sample of Swedish SMEs over the period 1993-1998.

Relative to these mixed and negative findings, several studies show only positive relationships between leverage and firm growth. As follows, Anton (2016) discovered a positive effect of leverage on firm growth using a sample of Romanian listed firms over a period of economic growth and economic uncertainty. Similarly, Huynh and Petrunia (2010) found a positive and nonlinear relationship between firm growth and leverage for young public and private firms in the Canadian manufacturing industry from 1985 to 1997. In addition, Hamouri et al. (2018) and Rahaman (2011) illustrated a positive effect of leverage upon firm growth within the employment and sales growth models in the United Kingdom and the emerging market of Jordan.

### 2.3.2 The impact of maturity of debt on firm growth

Previous empirical literature has barely investigated how the maturity of debt may affect firm growth. According to Myers (1977), a shortened maturity of debt can be used to solve agency problems, such as the underinvestment problem. This is especially relevant when firms have good growth opportunities. If debt matures before exercising growth options, the manager's incentive to deviate from making investments that are most fruitful for the organization is eliminated. Short-term debt provides the setting for frequent renegotiations where the firm can easily switch to a different type of finance. This could also reduce the monitoring costs implied by the agency theory, although it must be recognized that renegotiations entail certain costs (Myers, 1977).

In line with Myers argument, Aivazian, Ge and Qiu (2005) discover long-term debt is associated with fewer investments for firms with good growth opportunities. In addition, Molinari et al. (2016) empirically test this relationship, but they only find weak evidence that this relationship might hold. Whereas, Schiantarelli and Sembenelli (1997) find no support for the positive impact of short-term debt on firm growth. Instead, their empirical results show that the opposite may be true. One reason for the negative impact of debt with a short maturity is that fear of liquidation may limit the investment horizon of firms. This will induce firms to choose investments with an immediate payoff, rather than those characterized by a higher present value accruing further into the future (Schiantarelli & Sembenelli, 1997).

## 2.4 Hypotheses development

In the previous paragraphs, the main theories and determinants of capital structure and empirical evidence were elaborated. This paragraph will use these different theories, determinants and empirical evidence to develop hypotheses that are examined in this study. The hypotheses developed will eventually help to answer the research question: *‘’What is the effect of capital structure on firm growth of high-tech firms?’’*. In the first subparagraph, the hypotheses are focused on answering the first sub-question about the influence of leverage on firm growth. In the second subparagraph, the hypothesis is focused on answering the second sub-question about the influence of the maturity of debt on firm growth.

### 2.4.1 The influence of leverage on firm growth of high-tech firms

Five main theories are fundamental in this research, each predicting a certain relationship between leverage and firm growth. In addition, empirical research has provided mixed results regarding the impact of leverage on firm growth. To begin with, the irrelevance theory proposes the capital structure of a firm is irrelevant to firm growth, assuming a market without imperfections in a frictionless world (Modigliani & Miller, 1958). However, the assumptions cannot be fulfilled in the real world full of imperfections. As a result, several new theories have been developed building on Modigliani and Miller’s famous propositions. The four alternative capital structure theories considered in this thesis are the trade-off theory, pecking order theory, agency theory and market-timing theory.

According to the trade-off theory, there is a theoretical optimum of debt suggesting a trade-off between the benefits and costs of debt (Kraus & Litzenberger, 1973). Firms should seek to reach this optimum debt level to maximize their firm value. Therefore, the trade-off theory predicts a positive impact of leverage on firm growth.

Moreover, the agency theory elaborates on the costs entailed by external finance by defining the principal-agent relationship and its potential agency problems. Jensen and Meckling (1976) describe how the principal-agent relationship can lead to agency costs. An increase in leverage could reduce the free cash flow problem in which firms tend to overinvest in poor investment projects, slowing firm growth. Therefore, an increase in contractual obligations with bondholders could limit the manager’s activities and decision making power to overinvest in these poor projects(Jensen & Meckling, 1976).

Nevertheless, attaining too much debt could outweigh the benefit of reduced agency costs, due to an increase in the costs of financial distress. Besides, the conflicts of interest between equity- and bondholders could become more severe when too much debt is used. This could lead to an underinvestment problem, which slows firm growth, as the equity holders bear the full risk of the investment but only partially gain from the generated benefits as these need to be shared with the debtholders (Myers, 1977).

As a result, The agency theory has mixed predictions about the optimal level of leverage. However, increasing leverage to a point where there are still no severe financial distress costs, the reduction in agency costs of equity could outweigh the costs attached to increased debt. For this reason, a positive impact of leverage on firm growth is expected from the agency theory.

In line with expectations from the trade-off theory and agency theory, Anton (2016), Hamouri et al. (2018), Huynh and Petrunia (2010) and Rahaman (2011) find positive effects of leverage on firm growth. Considering the trade-off theory and agency theory, combined with these empirical findings, a positive impact of leverage on firm growth can be expected. Therefore, it is hypothesized that:

***Hypothesis 1a: ''Leverage has a positive impact on firm growth of high-tech firms''***

In contrast, the pecking order theory seems to predict a negative impact of leverage on firm growth. The pecking order theory suggests firms should prefer internal finance over external finance and debt over equity. Firms should finance their operations and investments in this hierarchical order to optimize firm value. Obtaining external funding entails costs associated with the source of external finance and information asymmetries. In particular, information asymmetries due to external financing can play an important role in slowing firm growth. Because this could cause conflicts of interest resulting in, for example, underinvestment problems, as elaborated in the agency theory.

In line with the pecking order theory and agency theory, Aivazian et al. (2005), Anton (2019), Heshmati (2001) Honjo and Harada (2006), and Lang et al. (1996) discover a negative effect of leverage on firm growth. For instance, Anton (2019) examined high growth firms known for their debt overhang and argued the costs associated with high levels of leverage are a big drag on the firm, slowing firm growth. However, Frank and Goyal (2003) discover smaller firms are less likely to follow the pecking order. Larger firms face fewer costs of financial distress and are more likely to access the debt market at lower costs than smaller firms (Daskalakis & Psillaki, 2008; Fama & French, 2002).

Considering the pecking order theory and agency theory, combined with the empirical findings, a negative impact of leverage on firm growth can be expected. Therefore, it is hypothesized that:

***Hypothesis 1b: ''Leverage has a negative impact on firm growth of high-tech firms''***

### 2.4.2 The influence of maturity of debt on firm growth of high-tech firms

The agency theory and market-timing theory are most relevant for studying the maturity of debt. As discussed earlier, Myers (1977) elaborates shortening the maturity of debt can be used to solve agency problems as short-term debt provides the setting for frequent renegotiations where the firm can easily switch to another type of finance. The market-timing theory postulates that decisions to issue equity depend on the market performance (Baker & Wurgler, 2002; Lucas & McDonald, 1990; Loughran & Ritter, 1995). Firms anticipate their financial structure to market developments, taking advantage of ''opportunity windows'' that occur when overall stock price increases are resulting in overvalued stocks. (Lucas & McDonald, 1990). Therefore, debt with a short maturity could increase the firm's ability to time the market.

Aivazian et al. (2005) and Molinari et al. (2016) find empirical evidence supporting a negative impact of the maturity of debt on firm growth. However, Schiantarelli and Sembenelli (1997) find no support for this relationship and argue the opposite may be true.

Considering the agency theory and market-timing theory, combined with the empirical findings, a negative impact of the maturity of debt on firm growth is expected. Therefore, it is hypothesized that:

***Hypothesis 2: ''The maturity of debt has a negative impact on firm growth of high-tech firms''***

# 3. methodology

This chapter is focused on the methodological part of this study. Over the past years, many scholars have used different techniques investigating determinants of firm growth. The goal of this study is to explore the effect of the determinant capital structure on firm growth for high-tech firms in Western Europe. The first section will briefly explain the research methods used in previous literature, which results in the research method used in this study. This is followed by the definition and measurement scale of all variables. Finally, a short overview will be given of the data investigated in this study.

## 3.1 Research methods

As mentioned, the purpose of this research is to investigate the effect of capital structure on the growth of West-European high-tech firms. The most applied research method in the empirical literature used to analyze this relationship is the multiple ordinary least squares regression (OLS). This type of linear regression is very common and most suitable when examining panel data. A linear regression analysis employs a set of independent variables to predict a continuous dependent variable. The most used panel data OLS regression techniques in previous literature are pooled OLS regression, fixed effects regression and random effects regression (Aivazian et al., 2005; Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006; Huynh & Petrunia, 2010; Lang et al., 1996; Rahaman, 2011; Tsuruta, 2015).

### 3.1.1 Regression models

Lang et al. (1996) have used pooled OLS regression for all regressions in their study. They assume the unobservable individual effects are zero. However, most studies expect these unobservable time-specific and firm-specific effects to occur and differ from zero. When using other panel data regression techniques as well, the robustness of the regression methods can be tested. For this reason, Aivazian et al. (2005), Anton (2016), Anton (2019), Hamouri et al. (2018), Heshmati (2001), Huynh and Petrunia (2010), and Tsuruta (2015) use statistical tests, such as the Hausman test and the Lagrangian Multiplier test, to reveal which regression method is preferred to use.

For instance, Heshmati (2001) employs a pooled OLS regression, fixed effect regression and random effect regression. The fixed effect model is a regression model where the parameters are either non-random or fixed quantities. This implies that the variables are constant across individuals and do not change over time. Specifically, the model assumes each firm has their specific characteristics that affect the relationship between the variables. The fixed-effect model can take this individuality into account, by allowing the intercept to vary across firms, while the coefficients of the slope are held constant across these firms. In contrast, the random-effects model is a regression model where the parameters are random quantities. The intercept and the slope do not differ across firms, but differences are still captured through individual-specific error terms.

Heshmati (2001) discusses the advantage of the random effects model as time-invariant, firm-specific characteristics can be included in the model specification, but they are also in favor of the fixed effects model as this model can capture the unobserved effects. Ignoring the unobserved time-specific and firm-specific effects could lead to lower coefficients estimated from the pooled OLS regression compared to the fixed effects and random effects model, which could cause under-/ overestimation of the impact the independent variables have on the dependent variable (Aivazian et al., 2005; Heshmati, 2001). Therefore, the pooled OLS regression is mainly used as a starting point from which the other regressions are developed in most studies. Heshmathi's (2001) statistical tests results indicate to mainly focus on the random effect model as the unobserved firm-specific effects are omitted in the pooled OLS-regression and the firm-specific effects are not related to the explanatory variables in their growth models.

Nevertheless, The outcomes of the statistical tests in most studies reveal that the fixed effects model is preferred over the pooled OLS-regression and random effects model (Aivazian et al., 2005; Anton, 2016; Anton, 2019; Hamouri et al., 2018; Honjo & Harada, 2006; Huynh & Petrunia, 2010; Rahaman, 2011; Tsuruta, 2015). They emphasize the advantage of the fixed effects model as it controls for the unobserved time-specific and firm-specific characteristics, as these are not captured by the control variables, but affect firm growth.

### 3.1.2 method used in this research

To test the hypotheses, the fixed effects regression model as mostly pronounced in the existing empirical studies is used in this study. By performing a fixed effects regression, the unobserved individual effects of the different countries and different years in which this study is conducted are captured. These effects are not captured in the OLS regression model, but affect firm growth according to previous studies mentioned above. In addition, the statistical tests in most previous studies show evidence that the fixed effects model is preferred over the random-effects model. However, these statistical tests cannot be performed in the statistical program SPSS. Therefore, the decision to choose between the random-effects or fixed-effects model is made upon these previous statistical findings in the literature. Consequently, the fixed-effects regression model is chosen and set up with the following equation:

$$\boldsymbol{Firm\ growth_{i,t}} = \boldsymbol{\beta 0} + \boldsymbol{\beta 1} * \boldsymbol{LEVE_{i,t-1}} + \boldsymbol{\beta 2} * \boldsymbol{AGE_{i,t-1}} + \boldsymbol{\beta 3} * \boldsymbol{SIZE_{i,t-1}} + \boldsymbol{\beta 4} * \boldsymbol{PROF_{i,t-1}} + \boldsymbol{\beta 5} * \boldsymbol{TANG_{i,t-1}} + \boldsymbol{\beta 6} * \boldsymbol{LIQUID_{i,t-1}} + \boldsymbol{\varepsilon_{i,t}}$$

In this equation firm growth is the dependent variable for firm *i* in year *t*. The independent variable in this equation is leverage. Age, size, profitability, tangibility and liquidity are used as control variables. β1 to β8 are the regression coefficients for the independent and control variables. In line with Heshmati's (2001) and Rahaman's (2011) model specification, it is assumed that the error term is $\varepsilon_{i,t} = \alpha_{i,} + \mu_{i,t}$, where $\alpha_{i,}$ denotes the unobservable time-invariant firm-specific effects and $\mu_{i,t}$ denotes the random error term. To capture the time- and country-specific effects, a least squared dummy variable approach is used by adding year dummies and country dummies as unobservable fixed effects. A potential endogeneity problem could arise when a reverse causality among the variables is expected. To ensure robustness and avoid that firm growth might proxy for capital structure all independent and control variables are 1-year lagged (Aivazian et al., 2005; Anton, 2019; Honjo & Harada, 2006; Rahaman, 2011; Tsuruta, 2015).

To test whether maturity of debt has an impact on firm growth, the same regression as in equation (1) is used, the independent variables are now short-term debt and long-term debt.

## 3.2 Measurement of variables

The empirical model of this research consists of three sets of variables. This section will define these dependent, independent and control variables**.** To most variables, more than one definition is given to check for robustness. An overview of all variables and their measurement is given in table 1.

### 3.2.1 dependent variables

The dependent variable in this study will be firm growth. Firm growth is a broad concept that can be determined in many ways. Therefore, in line with earlier research, this study will measure firm growth by using a total of three proxies for firm growth which are mostly depicted in literature. These measures are sales growth, asset growth and employee growth (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006;). By employing several measures of firm growth, the robustness of the findings can be tested. As a result, firm growth can be defined and measured as the logarithmic difference in the number of sales, total assets and employees in two consecutive years. The advantage of sales growth is that it can be used as a proxy for product/service acceptance in the market (Anton, 2019). Besides, it is a more stable indicator compared to the profitability of a firm to measure its growth. Moreover, employee growth is the most appealing measure of firm growth for policymakers as they are interested in the creation of new jobs (Anton, 2019; Molinari et al., 2016). Next to that, employee growth has the advantage that it is not affected by inflation and is less likely to be affected by measurement errors (Anton, 2019; Molinari et al., 2016).

### 3.2.2 independent variables

This section elaborates on the independent variables used in this study. The main independent variables in this study are related to the debt structure as the objective is to investigate the influence of leverage and maturity of debt on firm growth. The ratio of the book value of short-term, long-term and total debt to the book value of the total assets are used to define leverage and the maturity of debt (Aivazian et al., 2005; Anton, 2016; Anton; 2019; Hamouri et al., 2018). Total debt comprises all debt components on the firm's balance sheet. Measuring long-term and short-term debt may screen the importance of potential differences in the impact of debt maturity on firm growth (Sogorb-Mira, 2005). Short-term debt is the firm's financial obligations payable within 12 months, whereas long-term debt is the firm's financial obligations with a maturity of 12 months or longer.

There are several reasons why book values are used rather than market values. To begin with, Lang et al. (1996) and Opler and Titman (1994) discuss the use of market values would give too much importance to recent changes in equity values. These changes, for instance, reflected in the stock price, could regress growth based on the market's expectation of growth. Thus, using book values avoids the problem that the market values might forecast firm growth. Besides, book values are accurate measures as they are based on real firm data, rather than on market speculations. Furthermore, Tsuruta (2015) discusses using book value rather than market values, because market values for small firms might be unavailable.

### 3.2.3 control variables

The relationship between capital structure and firm growth is not solely influenced by leverage and the maturity of debt. To gain a thorough understanding of the hypothesized relationships, several control variables are included in this study. These control variables can have a systematic impact on both the dependent and independent variables. Following the stream of literature examining the aforementioned relationship and the sections devoted to firm-specific determinants in chapter two, this study examines the firm-specific control variables age, size, tangibility, profitability, liquidity and growth opportunities (Aivazian et al., 2005; Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006; Lang et al., 1996; Rahaman, 2011; Tsuruta, 2015). In addition, each of the control variables is measured in the same fashion as in the prior studies.

The size of a firm will be measured by the natural logarithm total assets (Anton, 2016; Anton, 2019; Cassar, 2004; Chittenden et al., 1996; Degryse et al., 2012; Hamouri et al., 2018; La Rocca et al., 2009; Sogorb-Mira, 2005), the natural logarithm of totals sales (Anton, 2016; Anton, 2019; Daskalakis & Psillaki, 2008; Huynh & Petrunia, 2010) and the natural logarithm of the number of employees (Anton, 2016; Anton, 2019; Heshmati, 2001). These three measures are the most common proxies for size. The logarithm is used to avoid marginal effect in the variables. This way, differences that arise out of large variations in size among firms can be smoothed.

According to Gibrat's law of ''proportionate growth'', the growth rate of a firm is independent of its size. Gibrat's law is generally defined as ''The probability of a given proportionate change in size during a specified period is the same for all firms in a given industry – regardless of their size at the beginning of the period'' (Mansfield, 1962, pp. 1030-1031). However, most previous studies investigating this relationship indicate Gibrats law does not hold for small- and medium-sized firms (Audretsch, Santarelli & Vivarelli, 1999; Bechetti & Trovato, 2001; Calvo, 2006; Evans, 1987; Lotti, Santarelli & Vivarelli, 2009; Viriyam & Kraybill, 1992; Yasuda, 2005). In particular, smaller firms are expected to grow higher than their larger counterparts. In general, small surviving firms have greater growth potential than larger firms. However, their potential may be limited due to financial constraints and/or the scarce availability of external financing (Bechetti & Trovato, 2001).

Age will be measured as the logarithm of the firm age in years since its incorporation year (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Huynh & Petrunia, 2010). Jovanovic (1982) proposes a firm-growth model in which firms learn over time about their efficiency while operating in the industry. As a result, Jovanovic's passive-learning model predicts a negative impact of age on firm growth. The likelihood of firm growth decreases as firms age. Calvo (2006), Evans (1987), Huynh and Petrunia (2010), Variyam and Kraybill (1992), and Yasuda (2005) find empirical evidence pointing to a negative relationship between age and firm growth consistent with Jovanovic's passive-learning model. Therefore a negative impact of age on firm growth is expected. The logarithm is used to overcome outliers in the regression analysis.

Profitability is measured by the earnings before taxes divided by total assets, also known as the return on assets (ROA) (Anton, 2016; Daskalakis & Psillaki, 2008; Hamouri et al., 2018; Sogorb-Mira, 2005). In fact, according to Hamouri et al. (2018), profitability can be seen as an important firm growth pointer. In addition, the pecking order theory provides a good explanation of why profitable firms are expected to have lower leverage. Profitable firms can use their retained earnings which serves as internal funds to finance their operations and investments. Therefore, they are expected to borrow less compared to less profitable firms.

The tangibility of the firm's assets is measured as the tangible asset ratio. This ratio includes the tangible fixed assets divided by the total assets (Chittenden et al., 1996; Daskalakis & Psillaki, 2008; Degryse et al., 2012; La Rocca et al., 2009). PPE are fixed tangible assets that are considered of great importance as they can be used as collateral in the credit request. Whereas inventories and short-term assets can be viewed as poor collateral and therefore not taken into account (Degryse et al., 2012).

Liquidity is measured by the current ratio. The purpose of the current ratio is to measure the firm's ability to meet its short-term obligations (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Tsuruta, 2015). Sufficient liquidity implies that firms face less severe funding constraints and have more possibilities to undertake investment opportunities (Anton, 2019).

Table 1 Definitions of dependent, independent and control variables

| ***Variable definitions*** | | | |
|---|---|---|---|
| **Name** | **Abbreviations** | **Measurement** | **References** |
| ***Dependent variables*** | | | |
| Asset growth | AS_GR | Log(Total Assets i,t) - Log(Total Assets i,t-1) | (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006) |
| Sales growth | SA_GR | Log(Total Sales i,t) - Log(Total Sales i,t-1) | (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006) |
| Employee growth | EMP_GR | Log(Nr. of Employees i,t) - Log(Nr. of Employees i,t-1) | (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006) |
| ***Independent variables*** | | | |
| Leverage | LEVE | Book value of Total Liabilities / Book value of Total Assets | (Aivazian et al., 2005; Anton, 2016; Anton, 2019; Hamouri et al., 2018; Honjo & Harada, 2006; Huynh & Petrunia, 2010; Lang et al., 1996; Sogorb-Mira, 2005; Tsuruta, 2015) |
| Long-term debt | LTDR | Book value of Total Short-Term Liabilities / Book value of Total Assets | (Aivazian et al., 2005; Chittenden et al., 1996; Degryse et al., 2012; Sogorb-Mira, 2005) |
| Short-term debt | STDR | Book value of Total Long-Term Liabilities / Book value of Total Assets | (Chittenden et al., 1996; Degryse et al., 2012; Sogorb-Mira, 2005) |
| ***Control variables*** | | | |
| Size | SIZE | 1. Log of Total Sales<br>2. Log of Total Assets<br>3. Log of Nr. of Employees | (Anton, 2016; Anton, 2019; Cassar, 2004; Daskalis & Psikalli, 2008; Gaud et al., 2005; Hamouri et al., 2018; Heshmati, 2001; Huynh & Petrunia, 2010). |
| Age | AGE | Log of firm Age | (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Huynh & Petrunia, 2010) |
| Profitability | PROF | ROA = Earnings Before Taxes (EBT) / Total Assets | (Anton, 2016; Daskalis & Psikalli, 2008; Hamouri et al., 2018; Sogorb-Mira, 2005) |
| Tangibility | TANG | Tangible Fixed Assets / Total Assets | (Chittenden et al., 1996; Daskalis & Psikalli, 2008; Degryse et al., 2012; La Rocca et al., 2009; Sogorb-Mira, 2005) |
| Liquidity | LIQUID | Current Ratio = Current Assets / Current Liabilities | (Anton, 2016; Anton, 2019; Hamouri et al., 2018; Tsuruta, 2015) |

# 4. Sample construction and data collection

This section discusses how the sample is constructed and how the necessary data for the sample in this research is gathered. To analyse the hypotheses, firm-level data of West-European high-tech firms is collected from Orbis. The first section describes how the sample of West-European high-tech firms is selected and discusses the industry classification. The second section describes the collection of data from Orbis and the use of panel data. This study uses panel data so that changes of a parameter can be measured between different entities within a certain time period. Table 2 shows an overview of the sample selection process.

## 4.1 Sample

Five sampling criteria have been drawn up to construct the final sample. Also, the high-tech industries used in this study are defined and elaborated.

### 4.1.1 Sample construction

As mentioned earlier, the sample is drawn from high-tech firms in Western Europe. To the best of the author's knowledge, there is no empirical evidence specifically for West-European high-tech firms. To select the final sample, several sampling criteria are applied which are illustrated in table 2.

First, active firms are selected, resulting in Orbis's initial dataset consisting of 2.646.966 active firms. The geographical focus of this research is on Western Europe, so the second step is to select only firms registered in Western Europe. Thirdly, The European Commission's definition of high-tech industries is used as a criterion for selecting high-tech firms. As a result, this study covers several high-tech industries which are elaborated in section 4.1.2. Moreover, the analysis is narrowed to unlisted firms. Listed firms were excluded from the sample due to differences in capital structure and access to different sources of capital. Furthermore, only firms that have available accounts in the sampling period 2013-2019 were selected.

Applying these five criteria results in a sample of 10.926 non-listed West-European high-tech firms in the Orbis database. Nevertheless, the dataset needs to contain data for all variables of interest in this study (dependent, independent and control variables) during the entire sampling period. Therefore, firms with one or more missing data points were excluded from the final sample. As a result, the final sample is comprised of 3.943 non-listed West-European high-tech firms which is sufficient to acquire valid results.

***Table 2 Data Sampling Strategy***

| Criteria | *No. of firms excluded* | No. of firms in the sample |
|---|---|---|
| **Initital sample size** | | 2.646.966 |
| Selected World region: | | |
| Western Europe | *2.109.534* | 537.432 |
| Industry classification: | | |
| High-Technology Industries | *515.413* | 22.019 |
| Listed/Unlisted companies: | | |
| Unlisted companies | *1.696* | 20.323 |
| Years with available accounts: | | |
| 2013, 2014, 2015, 2016, 2017, 2018, 2019 | *9.397* | 10.926 |
| Missing values | | |
| Excluding firms with missing values | *7.008* | |
| **Final sample of High-Tech West-European firms** | | **3.918** |

### 4.1.1 Industry classification

The selection of high-tech firms is based on the definition of Eurostat, the statistical office of the European Union[1]. They have divided industries into high-tech industries, medium-high-tech industries, medium-low-tech industries and low-tech industries, based on the level of R&D intensity[2]. The classification of the different high-tech industries is based on the NACE Rev. 2 classifications[3]. Besides, care is taken to exclude any possible high-tech firms operating in the financial sector as their financial structure might be affected by other factors, such as industry-specific regulations. This is consistent with other studies investigating the capital structure and firm growth (Aivazian, 2005; Anton, 2016; Anton 2019; Hamouri et al., 2018).

According to the Eurostat indicators on High-tech industries, the following industries are classified as high-tech industries and therefore included in the sample:

[1] https://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm
[2] https://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm
[3]https://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_REV2&StrLanguageCode=EN&IntPcKey=&StrLayoutCode=HIERARCHIC

- Sector 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations;
- Sector 26 Manufacture of computer, electronic and optical products;
- Sector 59 Motion picture, video and television programme production, sound recording and music publish activities;
- Sector 60 Programming and broadcasting activities;
- Sector 61 Telecommunications;
- Sector 62 Computer programming, consultancy and related activities;
- Sector 63 Information service activities;
- Sector 72 Scientific research and development are high-tech knowledge-intensive services.

Table 3 shows the industry distribution of all sample firms after applying all the aforementioned criteria. The manufacturing industry of basic pharmaceutical products and pharmaceutical preparations (14,3%), the manufacturing industry of computer, electronic and optical products (20,3%) and the service industry of computer programming, consultancy and related activities (36,3) are the largest industry groups in this sample.

***Table 3 Industry Classification***

| NACE Rev 2. Code | Description of Statistical Classification of Economic Activities in the European Community | No. of firms | % of total |
|---|---|---|---|
| ***High-Technology Manufacturing Industries*** | | | ***34,6%*** |
| 21 | Manufacture of basic pharmaceutical products and pharmaceutical preparations | 562 | *14,3%* |
| 26 | Manufacture of computer, electronic and optical products | 795 | *20,3%* |
| ***High-Technology Knowledge-Intensive Services*** | | | ***65,4%*** |
| 59 | Motion picture, video and television programme production, sound recording and music publish activities | 265 | *6,8%* |
| 60 | Programming and broadcasting activities | 96 | *2,5%* |
| 61 | Telecomunnications | 300 | *7,7%* |
| 62 | Computer programming, consultancy and related activities | 1421 | *36,3%* |
| 63 | Information service activities | 230 | *5,9%* |
| 72 | Scientific research and development | 249 | *6,4%* |

## 4.2 Data

The data is collected using the Orbis database. Orbis is a global database containing financial data of more than 275 million firms, both publicly quoted and privately held, around the world[4]. The Orbis database was accessible through a license from the University of Twente.

The collected data in this research covers the period 2013-2019. This period is chosen because of a couple of reasons. First of all, it covers a period of economic security so that the global financial crisis and its aftermath do not affect a firm's financial structure and performance. Second, choosing a recent time period contributes to the applicability of this study. Third, to the best of the author's knowledge, there is no empirical evidence specifically for this period yet. Moreover, comparable studies use a time period of at least 5 years, which will contribute to the validity of the results (Aivazian et al., 2005; Anton, 2016; Anton, 2019; Hamouri et al., 2018; Heshmati, 2001; Honjo & Harada, 2006; Huynh & Petrunia, 2010; Lang et al., 1996; Rahaman, 2011; Tsuruta, 2015). Finally, the sampling period is selected based on the data availability in Orbis.

As discussed, this study only selects firms with data available for all variables of interest in all consecutive years. Therefore, the firm must be alive for the whole sample period. This resulted in the exclusion of firms with one or more missing data points as shown in table 2. This makes the sample data longitudinal and/or balanced panel data set. Because this study uses balanced panel data, each panel member (N) is observed every year (T). Therefore the total amount of observations (n) is equal to:

$$n = N \times T$$

The final dataset collected from Orbis after making the industry adjustments and applying the other criteria resulted in 3.918 non-listed West-European high-tech firms Since the variables are lagged (measured in year t-1), data is ultimately presented as a six-year period. As a result, 3.918 panel members are observed in seven consecutive years. Resulting in a total number of observations of 23.508.

23.508 *(n)* = 3.918 *(N)* x 6 *(T)*

[4] https://orbis-bvdinfo-com.ezproxy2.utwente.nl/version-202156/orbis/1/Companies/Search

# 5. Results

The following chapter presents the results of the empirical analyses. First, the summary statistics of the variables of the sample are shown. Second, a Pearson correlation analysis is performed to control for the existence of multicollinearity between the variables. Hereafter, the regression results are presented to test the hypotheses followed by the robustness tests to increase the validity of the results.

## 5.1 Univariate Analysis

Table 4 displays the descriptive statistics for the sample of non-listed West-European high-tech firms over the time period 2013 - 2019. The table contains the descriptive statistics of the dependent, independent and control variables included in the regression analyses. These summary statistics describe the basic characteristics of the data.

Before performing the analysis, outliers were identified and addressed to resolve any issues. Outliers are extreme values in an observation that differ significantly from the other observations in the data set. To avoid problems caused by these outliers, some variables are winsorized at the 5 percent level on both sides of the distribution. All variables that have a natural log transformation do not need to be winsorized, as the use of natural logarithms overcomes possible outliers in the regression analysis (Hamouri et al., 2018). Accordingly, the following variables in our dataset remain to be winsorized: leverage, short-term debt, long-term debt, profitability, liquidity and tangibility. Data winsorization is a commonly used method by scholars to deal with outliers. To illustrate, Anton (2016), Anton (2019) and Rahaman (2011) winsorize variables with the default winsorization value of 1%, meaning that the variables are winsorized at the $1^{st}$ and $99^{th}$ percentiles of the distribution. In this study, however, a standard winsorization value of 5% is used. This means that values above the $95^{th}$ percentile were set at the $95^{th}$ percentile and values below the $5^{th}$ percentile were set at the $5^{th}$ percentile. The reason for choosing this winsorization level is that some values, such as the ratio of leverage, short-term debt and long-term debt, would exceed the value 1 at the 1% level. Therefore, this level would not have eliminated all extreme outliers in these variables. To ensure consistency, it was decided to winsorize all six variables at the 5% level. The descriptive statistics are presented after winsorizing the data.

Table 4: Descriptive Statistics

***Table 4: descriptive statistics on key variables for the sample of non-listed high-tech firms in Western-Europe.***

| | N | Mean | Std. Dev. | Min | 25th | Median | 75th | Max |
|---|---|---|---|---|---|---|---|---|
| **Dependent variables(t)** | | | | | | | | |
| AS_GR | 23508 | 0,0788 | 0,27596 | -6,95 | -0,0326 | 0,0570 | 0,1684 | 5,40 |
| SA_GR | 23508 | 0,0787 | 0,35202 | -7,13 | -0,0223 | 0,0579 | 0,1523 | 7,72 |
| EMP_GR | 23508 | 0,0575 | 0,32505 | -7,16 | -0,0190 | 0,0275 | 0,1054 | 7,25 |
| **Independent variables (t-1)** | | | | | | | | |
| LEVE | 23508 | 0,6113 | 0,24008 | 0,08 | 0,4311 | 0,6325 | 0,8105 | 0,97 |
| LTDR | 23508 | 0,1431 | 0,14995 | 0,00 | 0,0221 | 0,0925 | 0,2141 | 0,52 |
| STDR | 23508 | 0,4636 | 0,23613 | 0,09 | 0,2718 | 0,4490 | 0,6502 | 0,89 |
| **Control variables (t-1)** | | | | | | | | |
| SIZE 1 (Log sales) | 23508 | 10,1768 | 1,45280 | 0,00 | 9,3054 | 9,9566 | 10,9681 | 17,40 |
| SIZE 2 (Log Assets) | 23508 | 10,1508 | 1,50459 | 3,72 | 9,1389 | 9,9358 | 10,9940 | 17,05 |
| SIZE 3 (Log Employees) | 23508 | 4,7021 | 1,39622 | 0,00 | 3,8712 | 4,6821 | 5,5175 | 11,69 |
| AGE | 23508 | 2,9621 | 0,72776 | 0,00 | 2,5649 | 2,9957 | 3,4012 | 5,14 |
| PROF | 23508 | 0,0805 | 0,10621 | -0,11 | 0,0139 | 0,0595 | 0,1336 | 0,33 |
| TANG | 23508 | 0,1303 | 0,15738 | 0,00 | 0,0153 | 0,0574 | 0,1935 | 0,54 |
| LIQUID | 23508 | 2,01541 | 1,493820 | 0,233 | 1,09525 | 1,50100 | 2,34200 | 6,493 |

*Notes: this table shows the descriptive statistics on the key variables used in this study. It reports the number of observations (N), mean, standard deviation (Std.Dev), minimum (Min), 25th percentile (25th), median, 75th percentile (75th), and the maximum (Max) of the dependent, independent and control variables. The variables leverage, long-term debt, short-term debt, profitability, tangibility and liquidity are winsorized at 5% (the 5th and 95th percentile) . The variables Asset growth, Employee growth, sales growth, age and size are displayed after the logarithmic transformation. Definitions of the variables can be found in table 1.*

The full sample consists of 3.918 firms with 23.508 observations using a 1-year lag over a seven-year period. The mean of the different variables is compared with those of similar studies. Firm growth indicators are presented by asset growth, sales growth and employee growth. The three dependent variables display a wide variety of growth percentages across firms over time. Besides, the large dispersion measured as the standard deviation compared to the means in the growth models is an indication of heterogeneous growth patterns. The mean asset growth and sales growth in this sample are almost equal and have a value of respectively 7,88% and 7.87%. The mean employee growth shows a slightly lower mean with a value of 5,75%. These results correspond with the findings of Hamouri et al. (2018) who reported a mean asset growth of 7,49% and a mean employee growth of 6,7%. Nevertheless, The studies by Anton (2016) and Anton (2019) reports higher ratios of respectively 13.1% and 15,8% for asset growth and 8,4% and 12% for sales growth. Also, Anton (2019) shows a higher ratio for the employee growth model (8,4%). The higher mean values in the growth models found by Anton (2019) are probably caused by the fact that he investigates a group of high growth firms, also known as ‘’gazelles’’. Also, Anton (2016) investigates firm growth in Romanian countries during the expansion phase recorded by the Romanian economy during the period 2001-2008.

In contrast to these higher values, Heshmati (2001) and Rahaman (2011) report lower mean values than the mean in this study. Heshmati (2001) reports average asset growth of 4,3%, average sales growth of 3,8% and average employment growth of 2.1% over the period 1993-1998, while Rahaman (2011) reports comparable results in his sales growth model (5.2%) and his employee growth model (1.6%) over the period 1991-2001. Notably, both scholars are investigating a similar time period for their sample. Their time period studied is relatively old compared to the time period studied in this study (2013-2019) and could therefore explain the differences in mean values in the growth models. In addition, Honjo and Harada (2006) even show negative mean values for asset growth (-0,7%), sales growth (-1,3%) and employee growth (-1,9%). These results can be explained by the fact that the surveyed sample period (1994-1999) corresponds to the stagnated Japanese economy at the time (Honjo & Harada, 2006).

To examine the impact of financial leverage on firm growth, the ratio of total liabilities to total assets (LEVE) was calculated. The descriptive statistics show that the average leverage ratio for high-tech firms in our sample is approximately 0.61. This ratio indicates that on average 61% of the firm is financed with debt, suggesting that high-tech firms have, on average, more debt financing than equity financing in their capital structure. The average leverage ratio in some comparable studies exceeds the average in this study. To begin with, Honjo and Harada (2006) and Tsuruta (2015) show average leverage ratios of 0.74 and 0.90, respectively. Both studies examine a group of Japanese SME's in a comparable period. These higher values can be explained by the fact that the Japanese credit market is regarded as a bank-based financial system that allows small firms to access bank loans more easily than in other developed countries (Tsuruta, 2015). In addition, Anton (2019) found an average leverage ratio of 0.82 for gazelles, while Huynh and Petrunia (2010) showed an average leverage ratio of 0.87 for new firms in the Canadian manufacturing industry. Since relatively young firms are more reliant on debt, this could be a possible explanation why the results of Anton (2019) and Huynh and Petrunia (2010) are higher than the average leverage value in our sample. In contrast, Aivazian et al. (2005) investigate a group of listed Canadian industrial firms with an average leverage ratio of 0.48, which is similar to the leverage ratio of 0.52 found by Hamouri et al. (2018) for a group of listed Jordanian firms. Likewise, Anton (2016) researched a group of listed Romanian firms and discovered an average leverage ratio of 0.41. The difference found in the leverage ratio between this study and these three other studies might be explained by the legal form of the various entities. All three studies examine a group of listed firms rather than the unlisted firms examined in this study. To be precise, the average leverage ratio of 0.61 shows that high-tech firms rely on external financing as their main source of financing, while listed firms have more access to financing sources other than debt.

Furthermore, to examine the impact of maturity of debt on firm growth, the ratios of short-term debt (STDR) and long-term debt(LTDR) were calculated. Long-term debt has an average ratio of 0.14, while short-term debt has a much higher ratio of 0.46. Next to that, the maximum value of short-term debt (0,89) is much higher than the maximum of long-term debt (0,52). This means that no firm in our sample has a financial structure with more than 52% of long-term debt. Hence, high-tech firms in our sample are funded more with short-term debt than with long-term debt. These results are in line with the findings of Aivazian et al. (2005) who shows an average long-term debt ratio of 0.18 and Rahaman (2011) who shows an average long-term debt ratio of 0.08. Also, Molinari et al. (2016) argue that the maturity structure for their sample of firms mainly consists of short-term liabilities.

Firm size is measured by the natural logarithm of total sales (SIZE 1), total assets (SIZE 2) and the total number of employees (SIZE 3). The mean value of SIZE 1 is 10.18, the mean value of SIZE 2 is 10.15, and the mean value of SIZE 3 is 4.70. Given the median of these three size proxies (SIZE1 9.96; SIZE2 9.94; SIZE3 4.68), it is evident that size is normally distributed. Anton (2016), Anton (2019), Honjo and Harada (2006), and Rahaman (2011) use similar measurements for size. Despite this, the results of their findings differ in these different studies as they investigate different types of firms in different periods. Furthermore, age (AGE) is also measured as the natural logarithm of the incorporation year. The mean age value in our sample is 2.96. The median of 2.99 shows a similar value indicating a normal distribution. Anton (2019) shows an average age value of 3.35 for a group of Romanian listed firms. Similarly, Rahaman (2011) shows an average age value of 3.21 for a group of British and Irish firms. Hamouri et al. (2018) also show an average age value of 2.50 for Jordan firms that is quite comparable to our sample. Only the mean value of 1.52 found by Anton (2019) is quite different. This is because he is researching a group of gazelle which he defines, among other things, as a firm less than 5 years old.

Profitability(PROF) is the third control variable in our study and is measured as the earnings before tax divided by total assets (ROA). The high-tech firms in our sample have an average ROA ratio of 0.08. The least profitable firm in our sample measured by the ROA has a negative ratio of -0.11 (Min), while the most profitable firm has a ratio of 0.33 (Max.). Although the ROA ratio does not seem high, it is comparable to the results of similar studies and normally distributed according to the median (0.06) which is almost equal to the mean. As mentioned, both Hamouri et al. (2018) and Rahaman (2011) show comparable results, with mean ROA ratios of 0.02 and 0.06, respectively. Anton (2016), on the other hand, illustrates a much higher average ROA ratio of 3.255 for Romanian listed firms. However, this ratio can be explained by the expansion phase recorded by the Romanian economy at the time.

Furthermore, Tangibility (TANG) is measured as the ratio of tangible fixed assets divided by total assets. The average tangibility ratio in this study has a value of 0.13, which means that on average 13% of the total assets of non-listed West-European high-tech firms consists of tangible fixed assets. Moreover, the maximum tangibility ratio has a value of 0.54, which indicates that no more than 54% of the total assets of these high-tech firms are made up of tangible fixed assets. These low tangibility ratios make sense, as high-tech firms are considered to have few tangible assets. The difference between high-tech firms and normal firms in tangibility ratios is well illustrated by Tsuruta (2015) who indicates an average tangibility ratio of 0.79 for a sample of Japanese SME's.

The last control variable in this study is liquidity (LIQUID), measured as the current ratio (CR). The current ratio has a mean of 2.02 which is relatively high. It shows that on average the firms in our sample can cover their short-term liabilities twice. These findings are comparable to the studies of Anton (2016) who reported an average CR of 2.17, Anton (2019) who reported an average CR of 2.09, Hamouri et al. (2018) who reported an average CR of 2.23, and Rahaman (2011) who reported an average CR of 1.67.

## 5.2 Bivariate Analysis and assumptions

### 5.2.1 Pearson correlation analysis

In this section, a bivariate analysis is performed using the Pearson's correlation matrix to test whether there is a statistically significant relationship between the dependent, independent and control variables, and to determine the direction and strength of the association. Also, Pearson's R is useful to check for multicollinearity. The bivariate analysis measures the correlation between two variables. The correlation coefficients between two variables always range between -1 and +1, where -1 implies a perfect negative linear correlation, 0 implies no correlation, and +1 implies a perfect positive linear correlation. This analysis is mainly performed to avoid multicollinearity between the independent variables in the regression analysis. Namely, multicollinearity can distort the results of a regression analysis when there are high correlations between two explanatory variables. An overview of the correlation coefficients between the variables is presented in Table 5.

The first three columns in Table 5 present the correlation between the dependent and explanatory variables. As can be seen in the table, all explanatory variables are significantly correlated with the dependent variables at the 0.01 or 0.05 level. This implies that there are significant associations between the dependent, independent and control variables. Moreover, the three growth models are positively correlated with each other at the 0.01 level, supporting the prediction that all three dependent variables measure the same concept.

Furthermore, we see that leverage is positively correlated with the dependent variables asset growth (r = 0,020**), sales growth (r = 0,044) and employee growth (0,026). The positive significant correlation is in line with the expectation from hypothesis 1a that leverage has a positive impact on firm growth, but in contrast with the expectation from hypothesis 1b. Despite this, it must be noted that the strength of the coefficients, although significant at the 0.01 level, are rather low, indicating a weak relationship. Also, short-term debt is positively correlated to all three growth models, with a slightly higher statistically significant coefficient than the independent variable leverage had. In contrast long-term debt ratio shows to be statistically negatively correlated with the dependent variables asset growth (r = -0.031**), sales growth (r = -0.17**) and employment growth (r = -0.034**). Similar to the association of leverage with the dependent variables, the strength of the independent variables short-term debt ratio and long-term debt ratio with the dependent variables are quite low indicating a weak relationship. However, these results are in line with the expectations from hypothesis 2.

In addition, significant negative correlations can be found between the different measures of size and the growth models, having strong relationships (r < -0.100**), rejecting the central predictions by Gibrat's law that a company's growth rate is independent of its size. The negative correlations could imply that smaller firms have greater growth potential than their larger counterparts. Also, age is negatively correlated with firm growth, which is in line with Jovanovic's passive-learning model that the probability of firm growth decreases with firm age (Jovanovic, 1982). Profitability shows mixed results in relation to the dependent variables. Profitability is positively correlated to asset growth (r =0.093**) and employment growth (r =0.044**), while there is a negative correlation with sales growth (r = -0.037**). One possible explanation is that profitability is measured as return on assets (ROA) and therefore has no direct relationship with sales. However, the strength of the association of profitability on firm growth is rather low. The last control variables tangibility and liquidity are both significantly negatively correlated with the different forms of firm growth, however, the strength of the associations is again rather low, indicating a weak relationship.

Significant correlations can also be found between the explanatory variables at the 0.05 and 0.01 levels. To begin with, there is a positive correlation between the independent variable leverage and the two measures of debt maturity, namely the short-term debt ratio (r =0.759**) and the long-term debt ratio (r =0.349**). As expected, the short-term debt ratio and the long-term debt ratio are negatively correlated with each other (r = -0.320**) as they often balance each other out. This means that as long-term debt increases, short-term debt is likely to decrease and vice versa.

Liquidity (r = -0.604**) and profitability (r = -0.289**) are strongly negatively correlated with leverage supporting the central predictions of the pecking order theory. As mentioned, Meyers (1984) defines the pecking order as a framework in which the firm prefers internal to external financing. Therefore, they are expected to borrow less compared to less profitable and liquid firms. Furthermore, tangibility is positively correlated with long-term debt (r =0.212**) and negatively correlated with short-term debt (r = -0.267**) showing strong relationships. Tangibility is expected to be positively correlated with debt as it serves as collateral in the credit application. However, there are two good possible explanations for the negative relationship with short-term debt that do not contradict the central predictions about the positive relationship between asset tangibility and debt. First, firms with low levels of tangible assets have less collateral and, therefore, are more dependent on short-term finance (Chittenden et al., 1996). Second, the negative relation could also induce that current assets, often considered as poor collateral, are more likely to be financed with current liabilities

(Sogorb-Mira, 2005). Besides, since short-term accounts for the majority of debt as can be seen in the descriptive in Table 4, this could explain the negative correlation between tangibility and leverage (r = -0.125**).

Concerning correlations between the control variables, it is noted that there is high collinearity between the different measures of size. However, these high correlations were expected because these variables are all trying to measure size. Also, age and size are positively correlated with each other (r > 0.249**). This strong association implies that the older the firm, the larger the size of the firm and vice versa.

Overall, the correlation matrix shows that many of the explanatory variables are significantly correlated with each other. This may suggest that multicollinearity is present. When multicollinearity arises the explanatory variables become less able to explain the dependent variable. For this reason, this study also checks the Variance Inflation Factors (VIF) in addition to the Pearson correlation to test for multicollinearity. If VIF is higher than 10, it might be an indication that multicollinearity is present. As can be seen in Table 5, all VIF factors are lower than 3 suggesting that multicollinearity is not present in this study. Although the correlation between the independent variables and between the three size variables is high, the VIF values of these variables are relatively low. This is due to separate calculations made for these variables, because they are not included together in the regression models.

### 5.2.2 Multiple Regression - Assumptions and conditions

To conduct a multiple regression analysis, we need to check the linearity assumption, independence assumption, equal variance assumption, normality assumption and multicollinearity assumption (De Veaux, Velleman, & Bock, 2016 ). For the sake of brevity, tables and graphs are not presented in this study.

First, to meet the linearity assumption, we must confirm that there is a linear relationship between the dependent and independent variables (De Veaux et al., 2016). Therefore, we will check for each of the predictors that they are reasonably straight. The scatterplots of our data show that there is almost a straight line, satisfying the condition that it is straight enough. Second, we will check the independence assumption. This alleviates the assumption that the errors in the underlying regression model must be independent of each other (De Veaux et al., 2016). To satisfy this assumption, we will check the randomization condition. This condition states that data must come from a random sample to ensure that the data is representative of a particular population. Our data for our sample are collected randomly. Next, De Veaux et al. (2016) write that the equal variance assumption, also known as the homoscedasticity assumption, states that the variability of the errors must be the same for all values of each predictor. This assumption can be checked by plotting the residuals and predicted values to see if the plot thickens. The plots in our study show no pattern, indicating that the variance around the line is more or less evenly distributed across the values of the independent variables. Furthermore, we need to check whether the residuals are normally distributed to meet the normality assumption (De Veaux et al., 2016). By looking at the histograms of the residuals, we can see an almost normal distribution. Lastly, we need to check the multicollinearity assumption. However, we have already checked this assumption in section 5.2.1 using Pearson correlation and the VIF values. The results in that section indicated that multicollinearity is not present in this study.

Table 5: Pearson's correlation matrix

***Pearson's R correlation matrix***

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | *VIF-score* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 AS_GR** | 1,000 | | | | | | | | | | | | | |
| **2 SA_GR** | 0,333** | 1,000 | | | | | | | | | | | | |
| **3 EMP_GR** | 0,232** | 0,275** | 1,000 | | | | | | | | | | | |
| **4 LEVE** | 0,020** | 0,044** | 0,026** | 1,000 | | | | | | | | | | *1,746* |
| **5 LTDR** | -0,031** | -0,17** | -0,034** | 0,349** | 1,000 | | | | | | | | | *1,250* |
| **6 STDR** | 0,043** | 0,056** | 0,050** | 0,759** | -0,320** | 1,000 | | | | | | | | *2,642* |
| **7 SIZE 1 (ln_Sales)** | -0,148** | -0,224** | -0,127** | -0,009 | 0,069** | -0,057** | 1,000 | | | | | | | *1,178* |
| **8 SIZE 2 (ln_Assets)** | -0,110** | -0,104** | -0,168** | -0,018** | 0,126** | -0,095** | 0,708** | 1,000 | | | | | | *1,110* |
| **9 SIZE 3 (ln_Employees)** | -0,206** | -0,129** | -0,124** | -0,108** | 0,151** | -0,219** | 0,814** | 0,607** | 1,000 | | | | | *1,136* |
| **10 AGE** | -0,135** | -0,129** | -0,120** | -0,170** | 0,018** | -0,179** | 0,293** | 0,249** | 0,300** | 1,000 | | | | *1,138* |
| **11 PROF** | 0,093** | -0,037** | 0,044* | -0,289** | -0,206** | -0,153** | 0,055** | -0,023** | -0,100** | 0,014* | 1,000 | | | *1,142* |
| **12 TANG** | -0,019** | -0,026** | -0,025** | -0,125** | 0,212** | -0,267** | 0,091** | 0,142** | 0,169** | 0,106** | -0,084** | 1,000 | | *1,252* |
| **13 LIQUID** | -0,026** | -0,046** | -0,037** | -0,604** | 0,091** | -0,686** | 0,034** | 0,026** | 0,060** | 0,129** | 0,232** | -0,059** | 1,000 | *2,252* |

*Notes: This table presents the Pearson correlation coefficients including their statisticial significance level on the key variables used in this study.*
*Variable definitions are described in Table 1.*

** *Correlation is significant at the 0.01 level (2-tailed).*

* *Correlation is significant at the 0.05 level (2-tailed).*

## 5.3 Regression Analyses

This section aims to provide empirical evidence for this study by testing the hypotheses formulated in Chapter 2.4. As discussed, a fixed effect regression analysis is performed to test the hypotheses. The firsts subsection describes the results regarding the impact of leverage on firm growth (H1a & H1b). In addition, the second subsection describes the results regarding the impact of the maturity of debt on firm growth (H2). The results of the regressions for total debt, long-term debt and short-term debt are presented in tables 6 to 10.

### 5.3.1 Results hypotheses 1a and 1b: impact of leverage on firm growth

Tables 6 to 8 show the results of the fixed effect panel regression model used to test if leverage has an impact on firm growth. The fixed effect regression is carried out in SPSS using the least squares dummy variable approach. The dependent variables are measured in time t, while the independent variables and control variables are measured in time t-1. The table shows the results of nine different regression models. Model 1 presents the effect of leverage on firm growth, while controlling for the year fixed effect and country fixed effect, without controlling for the other control variables. Models 2 to 7 in Tables 6 to 8 examine one control variable at the time, while controlling for the independent variable leverage, the year fixed effect and the country fixed effect. Because The control variables can have a systematic impact on both the dependent and independent variables, the models examine the impact of each control variable on the dependent variable separately. Model 8 and 9 are the full regression models, where models 8 and 9 each control for a different size measure. The size measure calculated as the lognormal distribution of the dependent variable in the corresponding table has not been processed. Moreover, the adjusted R-squared is shown at the bottom of each model, explaining how much of the variation in the dependent variable can be explained by the independent variables. Also, when analysing tables 6 to 8 the F-statistics are shown for each model. All models report F-statistics that are significant at the 0.01 level, indicating that the models themselves are meaningful.

#### 5.3.1.1 impact leverage on asset growth

To begin with, Table 6 presents the results of the fixed effect regression with asset growth as the dependent variable and leverage as the independent variable. Model 8 and 9 with all control variables included report a significant positive impact of leverage on asset growth at the 0.01 level. The coefficient of leverage in model 8 (model 9) denotes that an increase of 1% in leverage leads to an increase of approximately 0,030% (0,027%) in asset growth, all other variables in model 8 (model 9) held constant. This positive impact is in line with the findings of Anton (2016) who reports a significant positive impact of leverage on asset growth at the 5% level for a group of Romanian listed firms. Therefore, when a firm increases its leverage it will increase its firm growth in terms of asset growth. Although it should be noted that the explained variability in the models is quite low. Models 8 and 9 in Table 6 show the highest R-squared and are therefore best to explain the model. Still, this means that only 4.4% of the variation in asset growth can be explained by the independent variables in model 8 and only 3.6% of the variation in asset growth can be explained by the independent variables in model 9. The Adjusted R-squared percentages are not high, nevertheless, they are still meaningful. Besides the F-statistics of the models are significant, implying that the models themselves are also meaningful.

Moreover, In all models, leverage has a significant impact at the 0.01 level, except for model 4 in which leverage is insignificant. Model 4 shows that when age is included the impact of leverage on asset growth is influenced. The coefficient changes from 0.030***(0.027***) in model 8 (model 9) to -0.005 in model 4. This means that the correlation between age and leverage influences the regression results of leverage on asset growth. Nevertheless, when age is included in the full model the impact of leverage on asset growth remains significant at the 0.01 level. Therefore, the correlation between age and leverage is of no concern to results in this table.

According to the empirical evidence presented in Table 6 for the dependent variable asset growth, hypothesis 1a is supported and hypothesis 1b is rejected. These results indicate that the positive impact of leverage on firm growth applies for West-European high-tech firms. This positive relationship is consistent with the expectations of the trade-off theory and agency theory. The trade-off theory expects a positive effect, as firms must seek to reach the theoretically optimal level of debt to maximize firm value. Next to that, An increase in leverage could alleviate the free cash flow problem in which firms tend to overinvest in poor investment projects according to the agency theory.

Regarding the control variables, both size measured in sales and size measured in employees are negatively and significantly related to asset growth. This contradicts Gibrat's law of 'proportionate growth', but is in line with previous studies examining this relationship. The negative coefficients in Table 6 imply that smaller firms are expected to grow higher than their larger counterparts. These results are in line with the findings of Anton (2016), Anton (2019), Heshmati (2001) and Honjo and Harada (2006). Similarly, age has a significant and negative impact on asset growth, as can be seen in Table 6. These findings are consistent with the results of Anton (2019), Hamouri et al. (2018) and Honjo and Harada (2006). The empirical evidence pointing to a negative impact of age on firm growth is consistent with the expectations of Jovanovic's passive-learning model.

Profitability, on the other hand, has a positive and significant impact on asset growth, as reported in Table 6. These findings are consistent with Anton (2016), Hamouri et al. (2018) and Heshmati (2001) indicating that profitability can be seen as an important firm growth pointer.

Tangibility shows a significant positive effect on asset growth at the 0.05 level in models 8 and 9 of Table 6. However, the signs in models 8 and 9 are different compared to the negative sign in model 6. Consequently, tangibility suffers probably from omitted variable bias. Since the full models may contain the omitted variable(s), tangibility is more likely to show its real effect in these full models. Therefore, tangibility is positively related to asset growth, which is in line with the previous findings of Tsuruta (2015). It indicates that firms with more tangible assets have higher asset growth.

Finally, liquidity does not significantly affect asset growth in model 7, but has a significant negative effect on asset growth in model 8 at the 0,05 level and in model 9 at the 0,10 level. This may be caused by omitted variable bias. It has been found that when one of the measures of size is excluded from the full model, the liquidity coefficient becomes insignificant and less powerful. However, the direction of the coefficient remains the same. This would imply that size acts as a mediating factor through which the variable liquidity has a significant and more powerful effect on the dependent variable asset growth. Yet there is still a genuine relationship between liquidity and asset growth. The mediating variable simply clarifies the process through which the relationship between liquidity and asset growth functions. It does not deny the validity of the causal relationship between liquidity and asset growth (Babbie, 2017). Thus, by including both variables in the full model, the different size measures will amplify the effect of liquidity on asset growth. As a result, liquidity is found to have a negative significant effect on asset growth, which is in line with the findings of Anton (2019).

#### 5.3.1.2 impact leverage on sales growth

Table 7 presents the results of the fixed effect regression with sales growth as the dependent variable and leverage as the independent variable. The regression table again presents the results of 9 different regressions. Models 8 and 9 report the highest R-squared and are therefore best to explain the model, although the percentages are rather low. Still, this means that 3.0% of the variation in sales growth can be explained by the independent variables in model 8 and 2.7% of the variation in sales growth can be explained by the independent variables in model 9. As mentioned, the Adjusted R-squared percentages are not high, but still meaningful. Thus, models 8 and 9 are the full regressions with all control variables included and illustrate insignificant statistics of the independent variable leverage on the dependent variable sales growth. However, the models examining the impact of each control variable on the dependent variable separately make clear that leverage is significant and positively related to sales growth at the 0.01 level. This means that the significant correlations of leverage with the other variables influence the impact of leverage on sales growth across the full models and a bias with omitted variables may be present. It reduces the impact of leverage to a point where it is no longer significant. But when the regressions are estimated with each correlated variable separately, leverage becomes significant at the 1% level. It seems that specifically age and size have a strong influence on the impact of leverage on sales growth. Namely, when age and size are excluded from model 8, leverage gets a positive coefficient of 0.034**, which is significant at the 0.05 level. In addition, when age is excluded from model 9, leverage shows a positive coefficient of 0.030** which is significant at the 0.05 level as well. Nevertheless, the explained variability in model 8 decreases to 0,009 and in model 9 to 0,019. The results of these regressions are not reported for the sake of brevity and consistency among the tables.

Consequently, the insignificant results in the full models are inconsistent with previous findings of other scientists mentioned in this study. However, when age and/or size are disregarded, the independent variable leverage becomes significant and positive. This would have been consistent with the findings of Anton (2016), Heshmati (2001), Honjo and Harada (2006), and Huynh and Petrunia (2010) whom all find positive coefficients significant at the 0.05 or 0.01 level.

Notwithstanding, the insignificant impact of leverage in the full fixed effects regression models in Table 7 provides sufficient evidence to reject hypotheses 1a and 1b for the independent variable leverage and the dependent variable sales growth. The insignificant impact of leverage on sales growth is consistent with the irrelevance theorem in which a firm's capital structure is irrelevant to its firm growth.

Concerning the control variables, size is again significantly negatively related to sales growth at the 0.01 level, as reported in Table 7. Anton (2016), Heshmati (2001), and Honjo and Harada (2006) found similar results. This again suggests that Gibrat's law does not apply to this sample of firms. Furthermore, models 4, 8 and 9 in Table 7 shows that age is significantly negatively related to sales growth at the 0.01 level. Similar results are reported by Anton (2019), Hamouri et al. (2018), Honjo and Harada (2006) and Tsuruta (2015). The empirical results are consistent with the expectations of Jovanovic's passive-learning model.

In contrast to the positive significant impact of profitability on asset growth at the 0.01 level in model 5 Table 6, the impact of profitability on sales growth appears to be significantly negative at the 0.01 level, as can be seen in model 5 of Table 7. Nevertheless, this negative relationship is not found by other scholars discussed in this study.

Tangibility shows a significant negative effect on sales growth at the 0.01 level in model 6 of Table 7. However, Tangibility loses its significance in the full regression models in Table 7. This may be due to omitted variable bias, as in the asset growth models of Table 6. Since the full models may contain the omitted variable(s), tangibility is more likely to show its true effect in these full models. For this reason, tangibility is not significantly related to sales growth. This insignificant relationship is also reported by Tsuruta (2015).

Lastly, Liquidity in the single model (model 7) again appears to be insignificant, but significant at the 0.01 and 0.05 levels in the full regression models (models 8 and 9). This is also caused by omitted variables bias, with each of the size measures again acting as a mediating variable. By including both variables in the full models, the different size metrics will amplify the effect of liquidity on sales growth. Thus, it appears liquidity has a significant negative effect on sales growth. This result is in line with the findings of Anton (2016) and Tsuruta (2015).

#### 5.3.1.1 impact leverage on employee growth

Table 8 presents the results of the fixed effect regression with employee growth as the dependent variable and leverage as the independent variable, respectively. The regression table presents the results of the nine different regressions performed described above. In all models, leverage appears to be statistically significant at one of the significance levels, except for models 4 and 9. Models 8 and 9 in Table 8 report the highest R-squared and are therefore the best to explain the model. Yet this means that only 2.8% of the variation in employee growth can be explained by the independent variables in model 8 and only 2.6% of the variation in employee growth can be explained by the independent variables in model 9. The Adjusted R-squared percentages are not high, but still meaningful. As follows, model 8 with all control variables included reports a significant positive effect of leverage on employee growth at the 0.10 level. The coefficients in this model illustrate that a 1% increase in leverage leads to an approximately 0.020% increase in employee growth, all other variables in model 8 held constant. This significant positive finding is in line with Anton (2016) and Rahaman (2011), both of which report a positive significant finding of leverage on employee growth at the 0.05 level. Hamouri et al. (2018) also found that leverage is positively and significantly related to employee growth at the 0.10 level. However, model 9 with all control variables included, just an alternative size measure, reports an insignificant impact of leverage on employee growth. This finding is consistent with Heshmati (2001) who also discovers an insignificant relationship between leverage and employee growth.

The different significance levels and magnitudes of the leverage coefficients in Table 8 make it clear that the significant correlations of leverage with the other variables influence the impact of leverage on employee growth in the full models and that there may be a bias with omitted variables. Especially, the control variables size, measured in assets, and age seem to have a large influence on the strength of the leverage coefficients in Table 8. Model 4 in particular shows that age has a big impact on the leverage coefficient because it becomes insignificant in that model (0.009), while in the other individual models the leverage coefficient is significant. To be precise, when age is excluded from model 8 in Table 8, the leverage coefficient remains positive and becomes statistically significant at the 0.01 level (0.038***). In addition, when age and size (in assets) are excluded from model 9, the leverage coefficient increases and becomes statistically significant at the 0.01 level (0.039***). The results of these additional regressions are not reported for the sake of brevity and consistency among the tables.

According to the empirical evidence presented in Table 8 for the dependent variable employee growth, hypothesis 1a is supported and hypothesis 1b is rejected. The table shows empirical evidence that there is a positive and statistically significant impact of leverage on employee growth. This positive relationship is consistent with the expectations of the trade-off theory and agency theory. Hence, this follows the same explanation as to the impact of leverage on asset growth.

As for the control variables, size measured as assets and sales, are both significantly negatively related to employee growth at the 0.01 level in Table 8. The negative impact of size on employee growth indicates that larger firms in terms of assets and sales have lower employee growth. Thus, the expectations from Gibrat's law do not apply to this sample of firms. Similar results in the employee growth model are reported by Anton (2016), Anton (2019), Honjo and Harada (2006) and Rahaman (2011). Also, age is negatively and significantly related to employee growth at the 0.01 level in Table 8. The expectations of Jovanovic's passive-learning model are consistent with these findings. This negative significant impact was also found by Anton (2016), Anton (2019), Hamouri et al. (2018), Heshmati (2001), Honjo and Harada (2006) and

Rahaman (2011),

Furthermore, unlike the negative coefficient in the sales growth model, but in line with the asset growth model is profitability positively related to employee growth and significant at the 0.01 level. Anton (2016) and Hamouri et al. (2018) found similar results for their sample of firms.

Tangibility shows a significant negative effect on employee growth at the 0.01 level in model 6 in Table 8. However, Tangibility loses its significance in the full regression models of Table 8. Again, this may be due to omitted variable bias, as in the asset growth models of Table 6 and sales growth models of Table 7. Since the full models may contain the omitted variable(s), tangibility is more likely to show its true effect in models 8 and 9. For this reason, tangibility is not significantly related to employee growth.

Finally, liquidity is not significant in the single model of Table 8 (model 7), but significant at the 0.01 and 0.05 levels in the full regression models (model 8 and 9). As mentioned before, it is caused by omitted variable bias, where both size measures act as a mediating variable. The different size metrics amplify the effect of liquidity on employee growth when included in the full models. Because there is still a genuine relationship, liquidity has a negative significant effect on employee growth. Hamouri et al. (2018) found similar results for a group of Jordan firms in the period 2006-2015.

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Table 6: FE regressions for the impact of leverage on firm growth (Asset growth)

*FE Panel Regression results hypotheses 1A and 1B*

| **ASSET GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,021*** | 0,021*** | 0,022*** | -0,005 | 0,059*** | 0,019** | 0,017* | 0,030*** | 0,027*** |
| | (2,775) | (2,836) | (2,860) | (-0,632) | (7,486) | (2,460) | (1,782) | (2,969) | (2,634) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,027*** | | | | | | -0,024*** | |
| | | (-21,084) | | | | | | (-17,691) | |
| SIZE 3 (ln_Employees) | | | -0,021*** | | | | | | -0,015*** |
| | | | (-15,479) | | | | | | (-11,005) |
| AGE | | | | -0,049*** | | | | -0,035*** | -0,041*** |
| | | | | (-19,389) | | | | (-13,233) | (-15,647) |
| PROF | | | | | 0,294*** | | | 0,302*** | 0,278*** |
| | | | | | (16,637) | | | (17,137) | (15,724) |
| TANG | | | | | | -0,028** | | 0,024** | 0,024** |
| | | | | | | (-2,387) | | (2,048) | (2,043) |
| LIQUID | | | | | | | -0,001 | -0,004** | -0,003* |
| | | | | | | | (-0,569) | (-2,157) | (-1,703) |
| (Constant) | 0,005 | 0,291*** | 0,101*** | 0,175*** | -0,048** | 0,009 | 0,009 | 0,330*** | 0,173*** |
| | (0,256) | (12,627) | (5,126) | (8,475) | (-2,524) | (0,484) | (0,429) | (13,343) | (7,760) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,005 | 0,024 | 0,015 | 0,021 | 0,017 | 0,006 | 0,005 | 0,044 | 0,036 |
| F-statistic (overall) | 2,649*** | 8,292*** | 5,675*** | 7,416*** | 6,15*** | 2,688*** | 2,262*** | 14,091*** | 11,969*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable asset growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 7: FE regressions for the impact of leverage on firm growth (Sales growth)

*FE Panel Regression results hypotheses 1A and 1B*

| **SALES GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,068*** | 0,050*** | 0,068*** | 0,038*** | 0,058*** | 0,064*** | 0,055*** | -0,012 | 0,008 |
| | (7,010) | (5,143) | (7,110) | -3,881 | (5,766) | (6,576) | (4,415) | (-0,928) | (0,604) |
| **Control variables** | | | | | | | | | |
| SIZE 2 (ln_Assets) | | -0,028*** | | | | | | -0,024*** | |
| | | (-17,534) | | | | | | (-14,151) | |
| SIZE 3 (ln_Employees) | | | -0,026*** | | | | | | -0,020*** |
| | | | (-15,075) | | | | | | (-11,314) |
| AGE | | | | -0,057*** | | | | -0,045*** | -0,048*** |
| | | | | (-17,502) | | | | (-13,292) | (-14,331) |
| PROF | | | | | -0,074*** | | | -0,141*** | -0,103*** |
| | | | | | (-3,261) | | | (-6,195) | (-4,569) |
| TANG | | | | | | -0,046*** | | -0,015 | -0,023 |
| | | | | | | (-3,103) | | (-0,975) | (-1,472) |
| LIQUID | | | | | | | -0,003 | -0,006*** | -0,005** |
| | | | | | | | (-1,575) | (-2,681) | (-2,451) |
| (Constant) | -0,037*** | 0,259*** | 0,082*** | 0,159*** | -0,024 | -0,30 | -0,024 | 0,419*** | 0,264*** |
| | (-1,546) | (8,881) | (3,282) | (6,035) | (-0,980) | (-1,241) | (-0,941) | (13,072) | (9,204) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,008 | 0,021 | 0,018 | 0,021 | 0,009 | 0,008 | 0,008 | 0,030 | 0,027 |
| F-statistic (overall) | 3,465*** | 7,358*** | 6,331*** | 7,343*** | 3,557*** | 3,544*** | 3,453*** | 9,779*** | 8,886*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable sales growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 8: FE regressions for the impact of leverage on firm growth (Employee growth)

*FE Panel Regression results hypotheses 1A and 1B*

| **EMPLOYEE GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,035*** | 0,035*** | 0,019** | 0,009 | 0,059*** | 0,031*** | 0,026** | 0,020* | 0,002 |
| | (3,894) | (3,947) | (2,093) | (0,952) | (6,341) | (3,488) | (2,238) | (1,686) | (0,132) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,026*** | | | | | | -0,022*** | |
| | | (-17,246) | | | | | | (-13,837) | |
| SIZE 2 (ln_Assets) | | | -0,025*** | | | | | | -0,018*** |
| | | | (-16,896) | | | | | | (-12,024) |
| AGE | | | | -0,050*** | | | | -0,036*** | -0,039*** |
| | | | | (-16,630) | | | | (-11,714) | (-12,513) |
| PROF | | | | | 0,188*** | | | 0,190*** | 0,138*** |
| | | | | | (9,009) | | | (9,092) | (6,524) |
| TANG | | | | | | -0,042*** | | -0,003 | 0,005 |
| | | | | | | (-3,069) | | (-0,192) | (0,324) |
| LIQUID | | | | | | | -0,002 | -0,005*** | -0,005** |
| | | | | | | | (-1,213) | (-2,630) | (-2,517) |
| (Constant) | 0,004 | 0,280*** | 0,268*** | 0,176*** | -0,030 | 0,010 | 0,013 | 0,348*** | 0,330*** |
| | (0,171) | (10,298) | (9,920) | (7,224) | (-1,335) | (0,466) | (-0,002) | (11,852) | (11,130) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,005 | 0,018 | 0,017 | 0,017 | 0,009 | 0,006 | 0,005 | 0,028 | 0,026 |
| F-statistic (overall) | 2,616*** | 6,381*** | 6,228*** | 6,114*** | 3,619*** | 2,703*** | 2,602*** | 9,062*** | 8,483*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable employee growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

### 5.3.2 Results hypothesis 2: impact of maturity of debt on firm growth

Tables 9 and 10 show the results of the fixed effect regression model used to test whether maturity of debt has an impact on firm growth. The fixed effect regression is performed in SPSS using the least squares dummy variable approach. The dependent variables are measured in time t, while the independent variables and control variables are measured in time t-1. The table shows the results of nine different regression models. Two variables are used to measure the maturity of debt, the short-term debt ratio and the long-term debt ratio.

In Tables 9 and 10, models 1-3 report the regression results with sales growth as the dependent variable, models 4-6 report the regression results with asset growth as the dependent variable, and models 7-9 report the regression results for the dependent variable employee growth. So, for each dependent variable, three different models are presented. The first of the three models for each dependent variable reports the impact of the long-term debt ratio on the dependent variable. The second model reports the impact of the short-term debt ratio on the dependent variable. In addition, the third model reports the impact of both short-term debt ratio and long-term debt ratio on the dependent variable.

Moreover, The difference between Table 9 and 10 is that each table controls for a different size measure. The size measure calculated as the lognormal distribution of the dependent variable in one of the corresponding tables has not been processed. Moreover, the adjusted R-squared is shown at the bottom of each model, which explains how much of the variation in the dependent variable can be explained by the independent variables. Also, when analyzing Tables 9 and 10, the F-statistics are shown for each model. All models report F-statistics that are significant at the 0.01 level, indicating that the models themselves are meaningful.

To begin with, models 1 to 3 in Table 9 and models 1 to 3 in Table 10 show the results of the fixed effects regression with sales growth as the dependent variable using short-term debt ratio and long-term debt ratio as the independent variables. The results of these six regressions show that in models 2 and 3 of Table 10, the short-term debt ratio is statistically significant at the 0.05 level in model 2 and the 0.10 level in model 3. The positive coefficients for the short-term debt ratio in these two models indicate that short-term debt has a positive impact on sales growth. The coefficient of short-term debt ratio in model 2 (model 3) denotes that an increase of 1% in short-term debt ratio leads to an increase of approximately 0,033% (0,028%) in sales growth, all other variables in model 2 (model 3) held constant.

Furthermore, the results of the fixed effects regression with asset growth as the dependent variable and short-term debt ratio and long-term debt ratio as the independent variables are reported in models 4 to 6 in Table 9 and models 4 to 6 in Table 10. Both Table 9 and 10 shows positive significant coefficients for the impact of short-term debt ratio on asset growth at the 0.01 level. The STDR coefficients in models 5 and 6 in Table 9 indicate that a 1% increase in short-term debt ratio leads to an increase of approximately 0,040% (0,047%) in asset growth, all other variables in model 5 (model 6) held constant. In addition, The STDR coefficients in models 5 and 6 in Table 10 report that an increase of 1% in short-term debt ratio leads to an increase of approximately 0,035% (0,042%) in asset growth, all other variables in model 5 (model 6) held constant.

It should be noted that the asset growth models in both tables have the highest explained variability of 4.4% and 3.7% respectively. this means that 4.4% of the variation in asset growth can be explained by the independent and control variables in Table 9 and 3.7% of the variation in asset growth can be explained by the independent and control variables in Table 10. As mentioned before, the explained variability in this study is not high, yet still meaningful.

Finally, models 7 to 9 in Table 9 and models 7 to 9 in Table 10 present the results of the fixed effects regression with employee growth as the dependent variable and short-term debt ratio and long-term debt ratio as the independent variables, respectively. The results in the employment growth model are comparable to the results in the sales growth model. Table 9 shows insignificant coefficients for the independent variables, while Table 10 presents significant results for the independent variable short-term debt ratio at the 0.01 level in models 8 and 9. When the size measure in sales is applied instead of the size measure in assets, the short-term debt ratio becomes significant. The coefficients of short-term debt ratio in Table 10 denotes that an increase of 1% in short-term debt ratio leads to an increase of approximately 0,043% (0,042%) in employee growth, all other variables in model 8 (model 9) held constant.

Overall, based on the findings in Tables 9 and 10, there is sufficient evidence to support hypothesis 2 that the maturity of debt has a negative impact on the firm growth of high-tech firms. These results are in line with the findings of Aivazian et al. (2005) who discover long-term debt is associated with fewer investments for firms with good growth opportunities and Molinari et al. (2016) who also finds some evidence that this relationship might hold. Moreover, this negative relationship is supported by the market-timing theory and agency theory. Myers (1977) argues shortening the maturity of debt can be used to solve agency problems, such as the underinvestment problem. Also, the market-timing theory postulates that short-term debt provides the setting for frequent renegotiations where the firm can easily switch to a different type of financing to take advantage of the so-called ‘’opportunity windows’’ (Lucas & McDonald, 1990). The results concerning the control variables follow the same explanation as discussed in section 5.3.1 and are therefore not further elaborated in this section.

Table 9: FE regressions for the impact of maturity of debt on firm growth

*FE Panel Regression results hypothesis 2*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,019 | | -0,023 | 0,002 | | 0,021 | -0,011 | | -0,009 |
| | (-1,130) | | (-1,292) | (0,169) | | (1,501) | (-0,717) | | (-0,513) |
| STDR | | -0,004 | -0,011 | | 0,040*** | 0,047*** | | 0,009 | 0,007 |
| | | (-0,235) | (-0,669) | | () | (3,790) | | (0,681) | (0,461) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | -0,024*** | -0,024*** | -0,024*** | | | |
| | | | | (-17,619) | (-17,657) | (-17,686) | | | |
| SIZE 2 (ln_Assets) | -0,023*** | -0,023*** | -0,023*** | | | | -0,018*** | -0,018*** | -0,018*** |
| | (-14,003) | (-13,905) | (-13,895) | | | | (-12,009) | (-11,735) | (-11,730) |
| AGE | -0,044*** | -0,044*** | -0,045*** | -0,036*** | -0,035*** | -0,034*** | -0,039*** | -0,039*** | -0,039*** |
| | (-13,301) | (-13,260) | (-13,317) | (-13,673) | (-13,299) | (-13,160) | (-12,593) | (-12,534) | (-12,540) |
| PROF | -0,142*** | -0,137*** | -0,144*** | 0,291*** | 0,292*** | 0,299*** | 0,134*** | 0,138*** | 0,135*** |
| | (-6,244) | (-6,152) | (-6,278) | (16,465) | (16,982) | (16,794) | (6,342) | (6,700) | (6,347) |
| TANG | -0,009 | -0,013 | -0,013 | 0,015 | 0,034*** | 0,033*** | 0,006 | 0,008 | 0,008 |
| | (-0,581) | (-0,809) | (-0,785) | (1,303) | (2,667) | (2,640) | (0,417) | (0,546) | (0,556) |
| LIQUID | -0,004*** | -0,005** | -0,006** | -0,007*** | -0,002 | -0,002 | -0,005*** | -0,004* | -0,004* |
| | (-2,626) | (-2,075) | (-2,302) | (-5,135) | (-1,241) | (-0,893) | (-3,293) | (-1,885) | (-1,951) |
| (Constant) | 0,407*** | 0,410*** | 0,418*** | 0,357*** | 0,325*** | 0,318*** | 0,332** | 0,322*** | 0,325*** |
| | (14,079) | (12,566) | (12,576) | (15,579) | (13,179) | (12,636) | (12,420) | (10,683) | (10,578) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,030 | 0,030 | 0,030 | 0,044 | 0,044 | 0,044 | 0,026 | 0,026 | 0,026 |
| F-statistic (overall) | 9,784*** | 9,769*** | 9,673*** | 13,980*** | 14,133*** | 13,993*** | 8,490*** | 8,489*** | 8,391*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR). The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variables are measured in time t and the independent and control variables are measured in time t-1.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 10: FE regressions for the impact of maturity of debt on firm growth (Using alternative size measures)

*FE Panel Regression results hypothesis 2*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,027 | | -0,016 | 0,006 | | 0,023 | -0,022 | | -0,005 |
| | (-1,609) | | (-0,875) | (0,443) | | (1,616) | (-1,400) | | (-0,299) |
| STDR | | 0,033** | 0,028* | | 0,035*** | 0,042*** | | 0,043*** | 0,042*** |
| | | (2,234) | (1,780) | | (3,025) | (3,401) | | (3,163) | (2,851) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | | | | -0,022*** | -0,022*** | -0,022*** |
| | | | | | | | (-13,774) | (-13,833) | (-13,823) |
| SIZE 3 (ln_Employees) | -0,020*** | -0,020*** | -0,020*** | -0,015*** | -0,015*** | -0,015*** | | | |
| | (-11,211) | (-11,251) | (-11,199) | (-10,983) | (-10,900) | (-10,963) | | | |
| AGE | -0,048*** | -0,047*** | -0,048*** | -0,041*** | -0,041*** | -0,041*** | -0,037*** | -0,036*** | -0,036*** |
| | (-14,557) | (-14,253) | (-14,278) | (-16,032) | (-15,742) | (-15,574) | (-12,043) | (-11,653) | (-11,645) |
| PROF | -0,115*** | -0,105*** | -0,110*** | 0,269*** | 0,269*** | 0,276*** | 0,176*** | 0,184*** | 0,182*** |
| | (-5,067) | (-4,768) | (-4,833) | (15,198) | (15,596) | (15,488) | (8,362) | (9,017) | (8,634) |
| TANG | -0,021 | -0,010 | -0,010 | 0,016 | 0,032** | 0,032** | -0,005 | 0,011 | 0,011 |
| | (-1,372) | (-0,614) | (-0,601) | (1,338) | (2,546) | (2,520) | (-0,374) | (0,726) | (0,732) |
| LIQUID | -0,006*** | -0,002 | -0,003 | -0,006*** | -0,002 | -0,001 | -0,007*** | -0,003 | -0,003 |
| | (-3,519) | (-1,025) | (-1,188) | (-4,314) | (-0,949) | (-0,586) | (-4,621) | (-1,165) | (-1,202) |
| (Constant) | 0,274*** | 0,244*** | 0,249*** | 0,198*** | 0,170*** | 0,162*** | 0,369*** | 0,332*** | 0,334*** |
| | (10,564) | (8,530) | (8,517) | (9,800) | (7,620) | (7,089) | (13,541) | (11,322) | (11,164) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,027 | 0,027 | 0,027 | 0,036 | 0,036 | 0,037 | 0,028 | 0,028 | 0,028 |
| F-statistic (overall) | 8,913*** | 8,943*** | 8,846*** | 11,612*** | 11,724*** | 11,616*** | 9,051*** | 9,151*** | 9,043*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR). The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variables are measured in time t and the independent and control variables are measured in time t-1.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

## 5.4 Robustness checks

In addition to the regular regression analysis presented in section 5.3, several robustness tests were performed to increase the validity and reliability of the fixed-effect regression results. Tables 11 to 25 in appendices I to III show the results of these robustness checks. The first robustness test is an Ordinary Least Squares regression performed on the full sample. Secondly, a fixed-effects regression analysis is performed without the one-year lagged independent and control variables. Thirdly, the sample is split to conduct a fixed effects regression analysis based on a subsample.

### 5.4.1 Robustness check by OLS regression

As mentioned earlier, some scholars have performed pooled OLS regression to examine the impact of capital structure on firm growth in earlier studies. For example, Lang et al. (1996) have used pooled OLS regression for all regressions in their study. They assume the unobservable individual effects are zero. However, most studies expect these unobservable time-specific and firm-specific effects to occur and differ from zero. Therefore, we perform a pooled OLS regression in this first robustness check to see whether there are unobservable individual effects. If the results differ from the main results in the fixed effects regression, we can assume that unobservable individual effects are present. The results of the first robustness check are presented in Tables 11 to 15 in appendix I.

The main results of the fixed effects regression for hypotheses 1a & 1b showed that leverage has a significant positive impact on asset growth at the 0.01 level, an insignificant impact on sales growth and a significant negative impact on employee growth at the 0.1 level. The results of this robustness check show similar results in the asset growth and sales growth models, only model 9 in Table 11 is now significant at the 0.05 level instead of the 0.01 level in model 9 of Table 6. The leverage coefficient in the employee growth model, however, has become insignificant in both models 8 and 9 in Table 11.

With regard to the second hypothesis, we can also discover some minor changes. Compared with the main results in Tables 9 and 10, the short-term debt coefficient lost one significant level in the employment growth model in model 9 in Table 15. In addition, in models 2 and 3 of Table 15, the short-term debt coefficient became insignificant. These minor changes in the results could indicate that there is some presence of the unobservable individual effects.

### 5.4.2 Robustness check by FE regression without one-year lagged variables

In the regular fixed effects regression analysis, the independent and control variables are 1 year lagged to preserve for the endogeneity problem. A potential endogeneity problem could arise when a reverse causality among the variables is expected. In the robustness check, a fixed effect regression without lagged variables is performed to see if the endogeneity problem exists in this study. When the main results and the results of this robustness check are similar, it can be assumed that endogeneity does not play a role in this study. The results of this second robustness check are shown in Tables 16 to 20 in appendix II.

As mentioned before, The main results for hypotheses 1a & 1b showed that leverage has a significant positive impact on asset growth at the 0.01 level, an insignificant impact on sales growth and a significant negative impact on employee growth at the 0.1 level. On the contrary, the robustness check results show that the leverage coefficients in the asset growth model are insignificant in the full models as can be seen in Table 16. Besides, the leverage coefficients in the full models with sales growth as dependent variables became significant at the 0.01 level (Table 17) and in the full models with employee growth as dependent variable significant at the 0.05 level (Table 18).

The robustness check results for the second hypothesis show more differences compared to the main results. In Table 19, in the first three models with the dependent variable sales growth, we can see that the coefficients for the independent variables have become significant where they are not significant in the fixed effects regressions with lagged variables as seen in Table 9. Moreover, we see in the same table that the short-term debt ratio has lost one level of significance in models 5 and 6 with the dependent variable asset growth. Besides, the short-term debt ratio has become significant at the 0.01 level in models 8 and 9 with the dependent variable employee growth, while Table 9 shows no significance for these variables in these models. Furthermore, when looking at Table 20 with the alternative size measures, we also see the same differences in the results as stated above compared to Table 10.

Overall, it can be assumed that endogeneity plays a role in this study, as the results of both the fixed-effects regression with and without lagged variables are quite different. This indicates that reversed causality might be present when not taken care of. As a result, the use of one-year lagged independent and control variables influence the results of this study and prevent the presence of endogeneity.

### 5.4.3 Robustness check by FE regression on a subsample of manufacturing high-tech firms.

The third robustness check executed is a fixed effects regression performed on a subsample of the 3918 high-tech West-European firms included in the full sample. The high-tech firms in our sample are split into two groups of either high-tech manufacturing firms or high-tech knowledge-intensive services. The group of 1357 high-tech manufacturing firms were our subsample. This group represents 34.6% of the total sample and is large enough to perform a fixed-effect regression. The results of this third robustness check are shown in Tables 21 to 25 in appendix III.

The main results for hypotheses 1a & 1b showed that leverage has a significant positive impact on asset growth at the 0.01 level, an insignificant impact on sales growth and a significant negative impact on employee growth at the 0.1 level. The coefficients in the asset growth model of the subsample remain positive and significant, only the significance level is reduced to 0.05 in model 8 and 0.1 in model 9 of Table 21. In addition, the coefficients in the sales growth model remain insignificant. The largest change can be spotted in the employee growth model. First, the sign of the leverage coefficients changed from positive to negative. Second, the coefficients of model 9 in Table 23 changed from insignificant in Table 8 to significant at the 0.05 level in table 23.

Concerning the second hypothesis, we have seen significant results for short-term debt in the fixed effects regression on the full sample. However, as can be seen in tables 24 and 25, the significance disappears for short-term debt in the different growth models of the subsample analysis. Besides, the adjusted R-squared is 0.4-1.1% lower than in the main regressions.

# 6. Conclusion

Financial capital is necessary for any firm to operate as a business. Nevertheless, one of the earliest and best-known theories of capital structure holds that the financial structure is irrelevant to its firm value. This ''irrelevance theory'' has led to many debates as to whether the financial decision-making process regarding the design of the capital structure is of any importance to a firm. Over the years, several scholars have challenged the irrelevance theory by developing new capital structure theories such as trade-off theory, pecking order theory, agency theory and market timing theory, whereby capital structure design could affect firm value.

Owing to this, the purpose of this study is to offer empirical evidence on the impact of capital structure on firm growth among high-tech firms in Western Europe by answering the following research question: *What is the effect of capital structure on firm growth of high-tech firms?* To provide a clear answer to the research question, the research question is divided into two sub-questions with corresponding hypotheses to assess the impact of leverage and the maturity of debt on the growth of West-European high-tech firms. These relationships are investigated by performing a fixed-effect regression analysis on a dataset of 3918 West-European high-tech firms over the period 2013 – 2019, resulting in 23508 observations.

The results of the fixed-effect regression provide evidence of a significant positive impact of leverage on firm growth. Therefore, hypothesis 1a is supported, which states that leverage has a positive impact on the firm growth of high-tech firms. These results are consistent with some of the central predictions surrounding the trade-off theory and agency theory. As such, an increase in leverage could alleviate the free cash flow problem, where firms tend to overinvest in poor investment projects, resulting in less firm growth. Moreover, the trade-off theory suggests a theoretical optimum of debt should be reached to maximize firm value. However, these results are in contrast to some of the predictions by the pecking order theory that suggests a negative impact of leverage on firm growth. Obtaining external financing entails costs associated with the source of external finance and information asymmetries. Firms should therefore fund operations and investments in the hierarchical order in which internal financing is preferred over external financing. Nevertheless, no evidence is found supporting hypothesis 1b suggesting a negative association between leverage and firm growth.

Furthermore, significant evidence has been found that the short-term debt ratio has a positive impact on firm growth. This is in line with the expectations from hypothesis 2, which states that the maturity of debt has a negative impact on the firm growth of high-tech firms. Thus, having debt with a short maturity has a positive effect on the growth of a firm. This significant relationship is supported by the agency and market timing theory. Short-term debt provides the setting for frequent renegotiations where the firm can easily switch to another type of finance to take advantage of investment opportunities. Besides, shortening the maturity of debt can be used to solve agency problems, such as the underinvestment problem.

In conclusion, to answer the research question, it is concluded that leverage has a positive effect on firm growth (measured in assets and employees) for high-tech firms in Western Europe, as predicted by the agency and trade-off theory. In addition, debt maturity has a negative effect on firm growth (measured in sales, assets and employees) for high-tech firms in Western Europe, as predicted by the agency and market-timing theory. This infers that unlisted high-tech firms in Western Europe can improve their firm growth by increasing leverage, especially short-term debt.

# 7. Limitations and future research

This final chapter begins by acknowledging the limitations of this study. This is followed by a discussion of the theoretical and practical contributions based on the results. Moreover, recommendations are given for future research regarding this topic.

## 7.1 Limitations

Nearly every study has some limitations, this study is certainly no exception, although it tried to test the impact of capital structure on firm growth as thoroughly as possible. For this reason, this section discusses the limitations of this study which can be used as a basis for future research on this relationship.

To begin with, the results of this study are aimed at high-tech firms in Western Europe. Consequently, this does not make the results generalizable to high-tech firms operating in other parts of the world and to firms operating in different industries. This is because the country- and industry-specific characteristics, such as corporate governance practices, can affect the results. Although it is aimed to add industry-specific knowledge about the relationship between capital structure and firm growth to the literature, these two limitations have a negative impact on the external validity of this study. Therefore, caution should be exercised when generalizing the results.

Secondly, existing literature on the impact of capital structure on firm growth is scarce. This made it difficult to set a benchmark since positive, negative and non-significant relationships between capital structure and firm growth were found in earlier studies. As a result, the relationship remains elusive. It was, therefore, difficult to compare our findings with those of other studies, making the results more difficult to interpret.

Furthermore, only active non-listed firms were included in the sample The reason behind only using active firms is that including firms that have gone bankrupt could disturb the analysis. For the same reason, firms with missing data were removed from the sample. However, excluding non-active firms and firms with missing data could result in survival bias. Excluding bankrupt firms, in particular, can therefore lead to overly optimistic beliefs about a positive impact of leverage on firm growth, as these firms generally have a high degree of leverage with low firm growth.

Lastly, the decision to use a fixed effect panel regression model is based on the literature and not on a statistical test. The Hausman specification test normally used to choose between a fixed-effects or random-effects regression model could not be executed in the statistical program SPSS. For this reason, the decision to use the fixed effects model was made based on the statistical evidence of the Hausman test from comparable studies and their rationale. Still, there is no statistical evidence that the fixed effect regression model used is preferred over the random effects model in this study.

## 7.2 Theoretical and Practical contributions

Various theoretical and practical contributions can be made to this research. The first most prominent theoretical contribution is made by providing scientific insight into the influence of leverage and maturity of debt on firm growth. Specifically, this study supports the positive impact of leverage on firm growth and a negative impact of maturity of debt on firm growth. Accordingly, this evidence contributes to the scarce literature available on the relationship between capital structure and firm growth. In addition, by finding significant relationships of size, age, profitability and liquidity on firm growth, this study contributes to the literature regarding characteristics of firm growth. Besides, to the author's knowledge, there is no specific evidence of unlisted West-European high-tech firms in the time period 2013-2019. Moreover, by providing evidence for three different measures of firm growth (asset growth, sales growth, and employee growth) which are mostly depicted in literature, a more widespread view of growth is explored.

It is rather difficult to write down practical contributions, as only about 2-5% of the variation in firm growth can be explained by the independent variables used in this study. Still, some practical implications are noted for business owners of high-tech firms, the business sector itself and the banking sector in Western Europe. Given the potential for great diversity between the capital structures of high-tech firms, the amount of leverage can vary widely. The question arises as to whether firms should prefer high or low leverage. The results of the empirical analysis suggest that debt overhang, in particular short-term debt, increases the incentive of high-tech firms to explore good growth opportunities and thus drives their growth (in terms of assets and employment). The significant positive evidence for employee growth could imply that an increase in leverage, especially short-term debt, could contribute to job creation. Moreover, evidence has been found according to the trade-off theory that firms should trade off the benefits and costs of debt to maximize firm value and achieve firm growth. High-tech firms in Western Europe should therefore strive for optimal debt levels to stimulate firm growth. Short-term debt in particular appears to have a positive effect on firm growth. Furthermore, the positive findings from leverage could encourage banks and other stakeholders to offer more credit and thereby reduce potential financial constraints, as leverage, especially short-term debt, has a positive effect on firm growth.

## 7.3 Recommendations for future research

Based on the results, theoretical contributions and limitations, various recommendations are made for future research regarding the relationship between capital structure and firm growth. To begin with, since caution should be exercised in generalizing the results of this study, it is recommended to analyze the relationship between capital structure and firm growth in a different continent or for different industries. It would be interesting to see if the impact of capital structure on firm growth of high-tech firms differs in other countries outside Western Europe. Moreover, a more complete and in-depth analysis of all factors influencing firm growth and/or the use of other proxies for the dependent and independent variables will enhance the theoretical understanding of the influence of capital structure on firm growth. Accordingly, it can help to increase the explanatory power of the firm growth characteristics. Therefore, it is recommended for future research to conduct more extensive research on the impact of capital structure on firm growth. In final, by expanding the research on the relationship between capital structure and firm growth research gaps can be filled and the existence of a true relationship can become evident.

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# Appendices

## Appendix I Robustness checks: OLS regression

Table 11: OLS regressions for the impact of leverage on firm growth (Asset growth)

*OLS Regression results hypotheses 1A and 1B*

| ASSET GROWTH | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,023*** | 0,021*** | 0,021*** | -0,004 | 0,059*** | 0,020*** | 0,008 | 0,030*** | 0,021** |
| | (3,053) | (2,871) | (2,767) | (-0,466) | (7,555) | (2,709) | (0,844) | (3,109) | (2,206) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,028*** | | | | | | -0,024*** | |
| | | (-22,944) | | | | | | (-18,963) | |
| SIZE 3 (ln_Employees) | | | -0,022*** | | | | | | -0,016*** |
| | | | (-16,856) | | | | | | (-12,055) |
| AGE | | | | -0,051*** | | | | -0,036*** | -0,042*** |
| | | | | (-20,639) | | | | (-13,756) | (-16,616) |
| PROF | | | | | 0,281*** | | | 0,299*** | 0,272*** |
| | | | | | (15,955) | | | (17,024) | (15,454) |
| TANG | | | | | | -0,029** | | 0,025** | 0,025** |
| | | | | | | (-2,555) | | (2,160) | (2,114) |
| LIQUID | | | | | | | -0,004*** | -0,004** | -0,004*** |
| | | | | | | | (-2,635) | (-2,373) | (-2,600) |
| (Constant) | 0,065*** | 0,352*** | 0,168*** | 0,233*** | 0,020*** | 0,070*** | 0,082*** | 0,392*** | 0,249*** |
| | (13,158) | (26,207) | (21,431) | (24,528) | (3,577) | (13,116) | (10,036) | (25,355) | (19,972) |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| R | 0,020 | 0,149 | 0,111 | 0,135 | 0,105 | 0,026 | 0,026 | 0,207 | 0,185 |
| Adjusted R2 | 0,000 | 0,022 | 0,012 | 0,018 | 0,011 | 0,001 | 0,001 | 0,043 | 0,034 |
| F-statistic (overall) | 9,320*** | 267,968*** | 146,777*** | 217,739*** | 131,991*** | 7,926*** | 8,133*** | 175,919*** | 139,162*** |

*Notes: This table presents the ordinary least squares regression results on the relationship between the dependent variable asset growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 12: OLS regressions for the impact of leverage on firm growth (Sales growth)

*OLS Regression results hypotheses 1A and 1B*

| **SALES GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,065*** | 0,045*** | 0,062*** | 0,034*** | 0,054*** | 0,061*** | 0,038*** | -0,016 | 0,001 |
| | (6,796) | (4,724) | (6,539) | (3,496) | (5,383) | (6,349) | (3,184) | (-1,305) | (0,101) |
| **Control variables** | | | | | | | | | |
| SIZE 2 (ln_Assets) | | -0,029*** | | | | | | -0,024*** | |
| | | (-19,361) | | | | | | (-15,127) | |
| SIZE 3 (ln_Employees) | | | -0,026*** | | | | | | -0,019*** |
| | | | (-15,983) | | | | | | (-11,502) |
| AGE | | | | -0,061*** | | | | -0,046*** | -0,051*** |
| | | | | (-19,115) | | | | (-14,051) | (-15,639) |
| PROF | | | | | -0,087*** | | | -0,146*** | -0,108*** |
| | | | | | (-3,877) | | | (-6,458) | (-4,781) |
| TANG | | | | | | -0,046*** | | -0,010 | -0,017 |
| | | | | | | (-3,142) | | (-0,692) | (-1,135) |
| LIQUID | | | | | | | -0,007*** | -0,006*** | -0,005*** |
| | | | | | | | (-3,703) | (-2,920) | (-2,742) |
| (Constant) | 0,039*** | 0,350*** | 0,164*** | 0,238*** | 0,053*** | 0,047*** | 0,070*** | 0,497*** | 0,343*** |
| | (6,209) | (20,314) | (16,378) | (19,616) | (7,316) | (6,944) | (6,699) | (24,110) | (21,429) |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| R | 0,044 | 0,133 | 0,113 | 0,131 | 0,051 | 0,049 | 0,050 | 0,168 | 0,156 |
| Adjusted R2 | 0,002 | 0,018 | 0,013 | 0,017 | 0,003 | 0,002 | 0,002 | 0,028 | 0,024 |
| F-statistic (overall) | 46,186*** | 210,877*** | 151,069*** | 206,151*** | 30,622*** | 28,039*** | 29,961*** | 113,624*** | 97,228*** |

*Notes: This table presents the ordinary least squares regression results on the relationship between the dependent variable sales growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 13: OLS regressions for the impact of leverage on firm growth (Employee growth)

| *OLS Regression results hypotheses 1A and 1B* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **EMPLOYEE GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LEVE | 0,035*** | 0,033*** | 0,017*** | 0,008 | 0,057*** | 0,031*** | 0,007 | 0,012 | -0,011 |
| | (3,965) | (3,813) | (1,941) | (0,865) | (6,180) | (3,518) | (0,675) | (1,041) | (-0,915) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,028*** | | | | | | -0,023*** | |
| | | (-19,598) | | | | | | (-15,389) | |
| SIZE 2 (ln_Assets) | | | -0,027*** | | | | | | -0,020*** |
| | | | (-18,867) | | | | | | (-13,376) |
| AGE | | | | -0,053*** | | | | -0,038*** | -0,040*** |
| | | | | (-18,095) | | | | (-12,293) | (-13,145) |
| PROF | | | | | 0,171*** | | | 0,185*** | 0,127*** |
| | | | | | (8,221) | | | (8,875) | (6,072) |
| TANG | | | | | | -0,045*** | | -0,004 | 0,002 |
| | | | | | | (-3,320) | | (-0,292) | (0,130) |
| LIQUID | | | | | | | -0,007*** | -0,007*** | -0,007*** |
| | | | | | | | (-4,120) | (-3,822) | (-4,153) |
| (Constant) | 0,036*** | 0,326*** | 0,316*** | 0,210*** | 0,009 | 0,044*** | 0,068*** | 0,399*** | 0,389*** |
| | (6,224) | (20,540) | (19,858) | (18,744) | (1,336) | (7,026) | (7,040) | (21,724) | (20,405) |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| R | 0,026 | 0,129 | 0,125 | 0,120 | 0,059 | 0,034 | 0,037 | 0,166 | 0,158 |
| Adjusted R2 | 0,001 | 0,017 | 0,015 | 0,014 | 0,003 | 0,001 | 0,001 | 0,027 | 0,025 |
| F-statistic (overall) | 15,722*** | 200,036*** | 185,962*** | 171,678*** | 41,673*** | 13,374*** | 16,353*** | 110,491*** | 100,667*** |

*Notes: This table presents the ordinary least squares regression results on the relationship between the dependent variable employee growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

| | |
|---|---|
| * | *Statistical significance at the 10% level* |
| ** | *Statistical significance at the 5% level* |
| *** | *Statistical significance at the 1% level* |

Table 14: OLS regressions for the impact of maturity of debt on firm growth

*OLS Regression results hypothesis 2*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,017 | | -0,023 | 0,007 | | 0,023* | -0,019 | | -0,021 |
| | (-1,056) | | (-1,341) | (0,594) | | (1,771) | (-1,282) | | (-1,334) |
| STDR | | -0,011 | -0,017 | | 0,039*** | 0,046*** | | 0,000 | -0,005 |
| | | (-0,731) | (-1,103) | | (3,427) | (3,811) | | (0,035) | (-0,371) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | -0,024*** | -0,024*** | -0,024*** | | | |
| | | | | (-18,768) | (-18,838) | (-18,921) | | | |
| SIZE 2 (ln_Assets) | -0,024*** | -0,024*** | -0,024*** | | | | -0,020*** | -0,020*** | -0,020*** |
| | (-14,891) | (-14,964) | (-14,881) | | | | (-13,146) | (-13,123) | (-13,043) |
| AGE | -0,046*** | -0,046*** | -0,046*** | -0,036*** | -0,036*** | -0,035*** | -0,040*** | -0,040*** | -0,040*** |
| | (-14,027) | (-14,007) | (-14,064) | (-14,179) | (-13,867) | (-13,702) | (-13,162) | (-13,106) | (-13,164) |
| PROF | -0,145*** | -0,141*** | -0,148*** | 0,289*** | 0,288*** | 0,296*** | 0,126*** | 0,131*** | 0,125*** |
| | (-6,405) | (-6,352) | (-6,489) | (16,438) | (16,833) | (16,746) | (6,003) | (6,422) | (5,923) |
| TANG | -0,003 | -0,011 | -0,010 | 0,016 | 0,035*** | 0,034** | 0,008 | 0,005 | 0,006 |
| | (-0,224) | (-0,693) | (-0,606) | (1,372) | -2,814 | -2,701 | (0,564) | -0,308 | -0,393 |
| LIQUID | -0,004** | -0,005** | -0,006** | -0,006*** | -0,002 | -0,002 | -0,006*** | -0,006*** | -0,007*** |
| | (-2,461) | (-2,380) | (-2,515) | (-5,173) | (-1,164) | (-0,948) | (-4,197) | (-3,085) | (-3,215) |
| (Constant) | 0,482*** | 0,492*** | 0,499*** | 0,417*** | 0,387*** | 0,380*** | 0,379*** | 0,378*** | 0,385*** |
| | (29,158) | (22,483) | (22,180) | (31,770) | (24,413) | (23,324) | (24,829) | (18,705) | (18,505) |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| R | 0,168 | 0,168 | 0,168 | 0,206 | 0,208 | 0,208 | 0,158 | 0,158 | 0,158 |
| Adjusted R2 | 0,028 | 0,028 | 0,028 | 0,042 | 0,042 | 0,043 | 0,025 | 0,025 | 0,025 |
| F-statistic (overall) | 113,523*** | 113,424*** | 97,480*** | 174,298 | 176,281*** | 151,560 | 100,805 | 100,524*** | 86,421*** |

*Notes: This table presents the ordinary least squares regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR). The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variables are measured in time t and the independent and control variables are measured in time t-1.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 15: OLS regressions for the impact of maturity of debt on firm growth (Using alternative size measures)

*OLS Regression results hypothesis 2*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,023 | | -0,016 | 0,006 | | 0,018 | -0,023 | | -0,011 |
| | (-1,421) | | (-0,961) | (0,480) | | (1,394) | (-1,551) | | (-0,730) |
| STDR | | 0,024 | 0,019 | | 0,031*** | 0,036*** | | 0,037*** | 0,033** |
| | | (1,622) | (1,239) | | (2,696) | (2,997) | | (2,715) | (2,344) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | | | | -0,023*** | -0,023*** | -0,023*** |
| | | | | | | | (-15,206) | (-15,405) | (-15,295) |
| SIZE 3 (ln_Employees) | -0,019*** | -0,019*** | -0,019*** | -0,016*** | -0,016*** | -0,016*** | | | |
| | (-11,307) | (-11,455) | (-11,308) | (-11,947) | (-11,873) | (-11,952) | | | |
| AGE | -0,051*** | -0,051*** | -0,051*** | -0,043*** | -0,043*** | -0,042*** | -0,038*** | -0,037*** | -0,037*** |
| | (-15,791) | (-15,573) | (-15,602) | (-16,911) | (-16,699) | (-16,554) | (-12,555) | (-12,219) | (-12,239) |
| PROF | -0,115*** | -0,107*** | -0,113*** | 0,265*** | 0,265*** | 0,271*** | 0,173*** | 0,182*** | 0,178*** |
| | (-5,109) | (-4,873) | (-4,960) | (15,052) | (15,400) | (15,278) | (8,272) | (8,930) | (8,469) |
| TANG | -0,013 | -0,007 | -0,006 | 0,018 | 0,033*** | 0,032* | -0,003 | 0,010 | 0,010 |
| | (-0,881) | (-0,413) | -0,357 | (1,552) | (2,639) | (2,555) | (-0,200) | (0,650) | (-0,693) |
| LIQUID | -0,005*** | -0,003 | -0,003 | -0,006*** | -0,003 | -0,002 | -0,008*** | -0,004* | -0,004* |
| | (-3,176) | (-1,258) | (-1,361) | (-4,794) | (-1,426) | (-1,256) | (-5,128) | (-1,883) | (-1,956) |
| (Constant) | 0,346*** | 0,325*** | 0,330*** | 0,268*** | 0,243*** | 0,238*** | 0,410*** | 0,380*** | 0,383*** |
| | (30,497) | (19,799) | (19,091) | (30,299) | (19,054) | (17,644) | (26,335) | (20,202) | (19,814) |
| Observations | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 | 23508 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| R | 0,156 | 0,156 | 0,156 | 0,185 | 0,185 | 0,186 | 0,166 | 0,166 | 0,166 |
| Adjusted R2 | 0,024 | 0,024 | 0,024 | 0,034 | 0,034 | 0,034 | 0,027 | 0,027 | 0,027 |
| F-statistic (overall) | 97,571*** | 97,676*** | 83,854*** | 138,362*** | 139,577*** | 119,920*** | 110,718*** | 111,568*** | 95,704*** |

*Notes: This table presents the ordinary least squares regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR). The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variables are measured in time t and the independent and control variables are measured in time t-1.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

# Appendix II Robustness checks: FE regression without lagged variables

Table 16: FE regressions for the impact of leverage on firm growth (Asset growth) without lagged variables

*FE Panel Regression results hypotheses 1A and 1B without lagged variables*

| ASSET GROWTH | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,011** | 0,010* | 0,010** | -0,004 | 0,027*** | 0,007 | 0,011** | 0,009 | 0,008 |
| | (2,081) | (1,903) | (2,002) | (-0,691) | (5,047) | (1,411) | (1,974) | (1,578) | (1,505) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,011*** | | | | | | -0,006*** | |
| | | (-8,107) | | | | | | (-4,078) | |
| SIZE 3 (ln_Employees) | | | -0,009*** | | | | | | -0,003** |
| | | | (-6,989) | | | | | | (-2,232) |
| AGE | | | | -0,052*** | | | | -0,047*** | -0,049*** |
| | | | | (-19,162) | | | | (-16,894) | (-17,587) |
| PROF | | | | | 0,109*** | | | 0,103*** | 0,099*** |
| | | | | | (11,419) | | | (10,815) | (10,476) |
| TANG | | | | | | -0,082*** | | -0,057*** | -0,058*** |
| | | | | | | (-8,105) | | (-5,647) | (-5,662) |
| LIQUID | | | | | | | -5,741 | 0,000 | 0,000 |
| | | | | | | | (-0,129) | (-0,993) | (-0,855) |
| (Constant) | 0,011 | 0,126*** | 0,056*** | 0,186*** | -0,008 | 0,024 | 0,011 | 0,222*** | 0,182*** |
| | (0,595) | (5,397) | (2,849) | (9,058) | (-0,443) | (1,276) | (0,605) | (9,267) | (8,636) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,005 | 0,008 | 0,007 | 0,021 | 0,011 | 0,008 | 0,005 | 0,028 | 0,027 |
| F-statistic (overall) | 2,606*** | 3,412*** | 3,196*** | 7,261*** | 4,237*** | 3,411*** | 2,573*** | 9,054*** | 8,909*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable asset growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent, independent and control variables are measured in time t. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 17: FE regressions for the impact of leverage on firm growth (Sales growth) without lagged variables

*FE Panel Regression results hypotheses 1A and 1B without lagged variables*

| **SALES GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,034*** | 0,028*** | 0,033*** | 0,017** | 0,050*** | 0,032*** | 0,024*** | 0,021*** | 0,023*** |
| | (5,121) | (4,256) | (5,066) | (2,535) | (7,374) | (4,871) | (3,556) | (2,946) | (3,179) |
| **Control variables** | | | | | | | | | |
| SIZE 2 (ln_Assets) | | -0,013*** | | | | | | -0,005*** | |
| | | (-8,185) | | | | | | (-3,062) | |
| SIZE 3 (ln_Employees) | | | -0,008*** | | | | | | -0,002 |
| | | | (-4,913) | | | | | | (-1,171) |
| AGE | | | | -0,062*** | | | | -0,058*** | -0,059*** |
| | | | | (-17,743) | | | | (-16,085) | (-16,716) |
| PROF | | | | | 0,111*** | | | 0,103*** | 0,105*** |
| | | | | | (9,128) | | | (8,487) | (8,700) |
| TANG | | | | | | -0,037*** | | -0,012 | -0,016 |
| | | | | | | (-2,846) | | (-0,888) | (-1,228) |
| LIQUID | | | | | | | -0,003*** | -0,003*** | -0,003*** |
| | | | | | | | (-5,277) | (-5,368) | (-5,437) |
| (Constant) | -0,017 | 0,124*** | 0,024 | 0,190*** | -0,036 | -0,011 | -0,004 | 0,227*** | 0,189*** |
| | (-0,701) | (4,248) | (0,945) | (7,262) | (-1,529) | (-0,459) | (-0,179) | (7,527) | (7,000) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,007 | 0,010 | 0,008 | 0,020 | 0,011 | 0,007 | 0,008 | 0,025 | 0,025 |
| F-statistic (overall) | 3,169*** | 3,985*** | 3,437*** | 7,155*** | 4,194*** | 3,232*** | 3,484*** | 8,241*** | 8,142*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable sales growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent, independent and control variables are measured in time t. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 18: FE regressions for the impact of leverage on firm growth (Employee growth) without lagged variables

*FE Panel Regression results hypotheses 1A and 1B without lagged variables*

| **EMPLOYEE GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,030*** | 0,029*** | 0,024*** | 0,016** | 0,036*** | 0,029*** | 0,025*** | 0,017** | 0,013** |
| | (4,935) | (4,793) | (3,861) | (2,550) | (5,620) | (4,811) | (4,032) | (2,507) | (1,990) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,010*** | | | | | | -0,005*** | |
| | | (-6,539) | | | | | | (-3,010) | |
| SIZE 2 (ln_Assets) | | | -0,015*** | | | | | | -0,010*** |
| | | | (-10,262) | | | | | | (-6,226) |
| AGE | | | | -0,052*** | | | | -0,050*** | -0,047*** |
| | | | | (-16,360) | | | | (-14,955) | (-14,205) |
| PROF | | | | | 0,036*** | | | 0,035*** | 0,028** |
| | | | | | (3,238) | | | (3,142) | (2,463) |
| TANG | | | | | | -0,016 | | 0,000 | 0,009 |
| | | | | | | (-1,313) | | (0,026) | (0,733) |
| LIQUID | | | | | | | -0,001*** | -0,001*** | -0,001*** |
| | | | | | | | (-2,780) | (-2,847) | (-2,635) |
| (Constant) | 0,006 | 0,115*** | 0,169*** | 0,182*** | 5,723 | 0,009 | 0,012 | 0,225*** | 0,266*** |
| | (0,298) | (4,208) | (6,278) | (7,544) | (0,003) | (0,407) | (0,570) | (7,933) | (9,532) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,006 | 0,007 | 0,010 | 0,017 | 0,006 | 0,006 | 0,006 | 0,018 | 0,019 |
| F-statistic (overall) | 2,735*** | 3,246*** | 4,045*** | 6,119*** | 2,834*** | 2,722*** | 2,799*** | 6,124*** | 6,489*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable employee growth and the independent variable leverage. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent, independent and control variables are measured in time t. The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 19: FE regressions for the impact of maturity of debt on firm growth without lagged variables

*FE Panel Regression results hypothesis 2 without lagged variables*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,027*** | | -0,020* | -0,005 | | -0,003 | -0,010 | | -0,006 |
| | (-2,633) | | (-1,904) | (-0,644) | | (-0,320) | (-1,014) | | (-0,597) |
| STDR | | 0,051*** | 0,049*** | | 0,017** | 0,016** | | 0,027*** | 0,026*** |
| | | (5,835) | (5,543) | | (2,461) | (2,397) | | (3,293) | (3,189) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | -0,006*** | -0,006*** | -0,006*** | | | |
| | | | | (-4,057) | (-4,122) | (-4,123) | | | |
| SIZE 2 (ln_Assets) | -0,005*** | -0,004** | -0,004** | | | | -0,010*** | -0,009*** | -0,009*** |
| | (-3,160) | (-2,507) | (-2,448) | | | | (-6,335) | (-5,911) | (-5,890) |
| AGE | -0,059*** | -0,057*** | -0,057*** | -0,048*** | -0,047*** | -0,047*** | -0,048*** | -0,047*** | -0,047*** |
| | (-16,581) | (-15,868) | (-15,948) | (-17,247) | (-16,755) | (-16,753) | (-14,522) | (-14,120) | (-14,131) |
| PROF | 0,087*** | 0,105*** | 0,100*** | 0,098*** | 0,102*** | 0,102*** | 0,020* | 0,028** | 0,026** |
| | (7,322) | (8,852) | (8,238) | (10,439) | (11,033) | (10,702) | (1,770) | (2,524) | (2,337) |
| TANG | -0,012 | 0,001 | 0,003 | -0,058*** | -0,053*** | -0,053*** | 0,008 | 0,015 | 0,016 |
| | (-0,900) | (0,094) | (0,249) | (-5,751) | (-5,124) | (-5,078) | (0,639) | (1,231) | (1,276) |
| LIQUID | -0,003*** | -0,002*** | -0,002*** | -0,001 | 0,000 | 0,000 | -0,002*** | -0,001** | -0,001** |
| | (-6,225) | (-4,036) | (-4,054) | (-1,414) | (-0,551) | (-0,554) | (-3,208) | (-1,974) | (-1,979) |
| (Constant) | 0,252*** | 0,199*** | 0,203*** | 0,230*** | 0,217*** | 0,218*** | 0,281*** | 0,254*** | 0,255*** |
| | (8,620) | (6,546) | (6,654) | (9,821) | (9,088) | (9,084) | (10,395) | (9,013) | (9,033) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,025 | 0,026 | 0,026 | 0,028 | 0,028 | 0,028 | 0,019 | 0,019 | 0,019 |
| F-statistic (overall) | 8,219*** | 8,555*** | 8,497*** | 9,028*** | 9,098*** | 8,991*** | 6,453*** | 6,574*** | 6,500*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR). The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent, independent and control variables are measured in time t.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 20: FE regressions for the impact of maturity of debt on firm growth without lagged variables (Using alternative size measures)

*FE Panel Regression results hypothesis 2 without lagged variables*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,029*** | | -0,020** | -0,005 | | -0,002 | -0,013 | | -0,008 |
| | (-2,771) | | (-1,967) | (-0,577) | | (-0,273) | (-1,342) | | (-0,795) |
| STDR | | 0,054*** | 0,051*** | | 0,016** | 0,015** | | 0,034*** | 0,033*** |
| | | (6,198) | (5,882) | | (2,317) | (2,260) | | (4,179) | (4,037) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | | | | -0,005*** | -0,005*** | -0,005*** |
| | | | | | | | (-2,979) | (-3,089) | (-3,093) |
| SIZE 3 (ln_Employees) | -0,002 | -0,002 | -0,002 | -0,003** | -0,003** | -0,003** | | | |
| | (-1,141) | (-1,106) | (-1,085) | (-2,226) | (-2,208) | (-2,204) | | | |
| AGE | -0,061*** | -0,058*** | -0,058*** | -0,049*** | -0,049*** | -0,049*** | -0,051*** | -0,049*** | -0,049*** |
| | (-17,325) | (-16,343) | (-16,420) | (-17,922) | (-17,484) | (-17,476) | (-15,429) | (-14,709) | (-14,730) |
| PROF | 0,089*** | 0,107*** | 0,102*** | 0,094*** | 0,099*** | 0,098*** | 0,025** | 0,035*** | 0,033*** |
| | (7,443) | (9,033) | (8,392) | (10,124) | (10,680) | (10,367) | (2,261) | (3,208) | (2,960) |
| TANG | -0,016 | -0,002 | 0,001 | -0,059*** | -0,054*** | -0,053*** | -0,001 | 0,009 | 0,010 |
| | (-1,266) | (-0,113) | (0,054) | (-5,765) | (-5,171) | (-5,129) | (-0,104) | (0,726) | -0,792 |
| LIQUID | -0,003*** | -0,002*** | -0,002*** | -0,001 | 0,000 | 0,000 | -0,002*** | -0,001** | -0,001** |
| | (-6,349) | (-4,046) | (-4,063) | (-1,257) | (-0,441) | (-0,443) | (-3,547) | (-2,027) | (-2,035) |
| (Constant) | 0,214*** | 0,168*** | 0,172*** | 0,191*** | 0,178*** | 0,178*** | 0,241*** | 0,215*** | 0,217*** |
| | (8,153) | (6,204) | (6,351) | (9,298) | (8,402) | (8,394) | (8,693) | (7,594) | (7,634) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 | 27426 |
| Number of firms | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 | 3918 |
| Adjusted R2 | 0,024 | 0,026 | 0,026 | 0,027 | 0,027 | 0,027 | 0,018 | 0,018 | 0,018 |
| F-statistic (overall) | 8,112*** | 8,492*** | 8,438*** | 8,885*** | 8,948*** | 8,842*** | 6,068*** | 6,261*** | 6,194*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR). The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent, independent and control variables are measured in time t.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

# Appendix III Robustness checks: FE regression of subsample

Table 21: FE regressions for the impact of leverage on firm growth (Asset growth) on a subsample

*FE Panel Regression results hypotheses 1A and 1B based on a subsample*

| ASSET GROWTH | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | -0,003 | -0,002 | -0,003 | -0,014 | 0,031*** | -0,003 | 0,001 | 0,030** | 0,027* |
| | (-0,315) | (-0,243) | (-0,316) | (-1,428) | (2,951) | (-0,285) | (0,053) | (2,092) | (1,879) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,016*** | | | | | | -0,015*** | |
| | | (-8,703) | | | | | | (-8,161) | |
| SIZE 3 (ln_Employees) | | | -0,017*** | | | | | | -0,015*** |
| | | | (-8,786) | | | | | | (-7,554) |
| AGE | | | | -0,023*** | | | | -0,019*** | -0,019*** |
| | | | | (-7,243) | | | | (-5,657) | (-5,810) |
| PROF | | | | | 0,239*** | | | 0,270*** | 0,247*** |
| | | | | | (9,585) | | | (10,818) | (9,899) |
| TANG | | | | | | 0,016 | | 0,034** | 0,058* |
| | | | | | | (1,045) | | (2,231) | (3,666) |
| LIQUID | | | | | | | 0,001 | 0,000 | 0,001 |
| | | | | | | | (0,424) | (0,162) | (0,257) |
| (Constant) | 0,028 | 0,193*** | 0,111*** | 0,111*** | -0,025 | 0,025 | 0,024 | 0,187*** | 0,106*** |
| | (0,942) | (5,527) | (3,610) | (3,528) | (-0,827) | (0,864) | (0,766) | (5,016) | (3,113) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 |
| Number of firms | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 |
| Adjusted R2 | 0,006 | 0,015 | 0,016 | 0,013 | 0,017 | 0,006 | 0,006 | 0,033 | 0,032 |
| F-statistic (overall) | 1,872*** | 3,100*** | 3,125*** | 2,713*** | 3,369*** | 1,860*** | 1,844*** | 5,234*** | 5,082*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable asset growth and the independent variable leverage on a subsample. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 22: FE regressions for the impact of leverage on firm growth (Sales growth) on a subsample

*FE Panel Regression results hypotheses 1A and 1B based on a subsample*

| **SALES GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | 0,045*** | 0,039*** | 0,045*** | 0,030** | 0,028** | 0,045*** | 0,035** | 0,000 | 0,005 |
| | (3,373) | (2,917) | (3,386) | (2,243) | (1,963) | (3,386) | (1,974) | (0,010) | (0,275) |
| **Control variables** | | | | | | | | | |
| SIZE 2 (ln_Assets) | | -0,014*** | | | | | | -0,012*** | |
| | | (-6,280) | | | | | | (-5,245) | |
| SIZE 3 (ln_Employees) | | | -0,021*** | | | | | | -0,020*** |
| | | | (-8,340) | | | | | | (-7,444) |
| AGE | | | | -0,031*** | | | | -0,025*** | -0,022*** |
| | | | | (-7,120) | | | | (-5,819) | (-5,093) |
| PROF | | | | | -0,118*** | | | -0,115*** | -0,116*** |
| | | | | | (-3,572) | | | (-3,463) | (-3,486) |
| TANG | | | | | | 0,010 | | 0,002 | 0,031 |
| | | | | | | (0,486) | | (0,110) | (1,481) |
| LIQUID | | | | | | | -0,002 | -0,002 | -0,003 |
| | | | | | | | (-0,767) | (-0,847) | (-1,013) |
| (Constant) | 0,005 | 0,155*** | 0,110*** | 0,113*** | 0,031 | 0,004 | 0,015 | 0,259*** | 0,217*** |
| | (0,126) | (3,399) | (2,693) | (2,722) | (0,780) | (0,090) | (0,357) | (5,224) | (4,778) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 |
| Number of firms | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 |
| Adjusted R2 | 0,008 | 0,013 | 0,017 | 0,014 | 0,010 | 0,008 | 0,008 | 0,019 | 0,022 |
| F-statistic (overall) | 2,130*** | 2,752*** | 3,253*** | 2,939*** | 2,308*** | 2,099*** | 2,105*** | 3,363*** | 3,802*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable sales growth and the independent variable leverage on a subsample. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table .*

| | |
|---|---|
| * | *Statistical significance at the 10% level* |
| ** | *Statistical significance at the 5% level* |
| *** | *Statistical significance at the 1% level* |

Table 23: FE regressions for the impact of leverage on firm growth (Employee growth) on a subsample

*FE Panel Regression results hypotheses 1A and 1B based on a subsample*

| **EMPLOYEE GROWTH** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| **Independent variables** | | | | | | | | | |
| LEVE | -0,013 | -0,012 | -0,013 | -0,025*** | 0,008 | -0,012 | -0,038*** | -0,025* | -0,031** |
| | (-1,341) | (-1,283) | (-1,354) | (-2,643) | (0,764) | (-1,294) | (-2,999) | (-1,902) | (-2,290) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | -0,012*** | | | | | | -0,011*** | |
| | | (-7,355) | | | | | | (-6,339) | |
| SIZE 2 (ln_Assets) | | | -0,023*** | | | | | | -0,007*** |
| | | | (-12,740) | | | | | | (-4,417) |
| AGE | | | | -0,026*** | | | | -0,022*** | -0,024*** |
| | | | | (-8,519) | | | | (-7,134) | (-7,802) |
| PROF | | | | | 0,140*** | | | 0,168*** | 0,151*** |
| | | | | | (5,984) | | | (7,177) | (6,450) |
| TANG | | | | | | 0,023 | | 0,022 | 0,023 |
| | | | | | | (1,634) | | (1,494) | (1,583) |
| LIQUID | | | | | | | -0,006*** | -0,006*** | -0,006*** |
| | | | | | | | (-2,979) | (-3,107) | (-2,913) |
| (Constant) | 0,050* | 0,180*** | 0,162*** | 0,142*** | 0,020 | 0,047* | 0,077*** | 0,232*** | 0,201*** |
| | (1,830) | (5,540) | (5,687) | (4,825) | (0,705) | (1,706) | (2,660) | (6,659) | (5,778) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 |
| Number of firms | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 |
| Adjusted R2 | 0,004 | 0,011 | 0,024 | 0,013 | 0,009 | 0,005 | 0,005 | 0,024 | 0,022 |
| F-statistic (overall) | 1,613*** | 2,484*** | 4,279*** | 2,791*** | 2,181*** | 1,631*** | 1,734*** | 4,095*** | 3,768*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable employee growth and the independent variable leverage on a subsample. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variable is measured in time t and the independent and control variables are measured in time t-1. The T-statistics are in parentheses. Variable definitions are described in Table*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 24: FE regressions for the impact of maturity of debt on firm growth on a subsample

*FE Panel Regression results hypothesis 2 based on a subsample*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,028 | | -0,021 | 0,023 | | 0,032* | -0,017 | | -0,028 |
| | (-1,187) | | (-0,831) | (1,312) | | (1,744) | (-1,037) | | (-1,607) |
| STDR | | 0,029 | 0,022 | | 0,018 | 0,028 | | -0,025 | -0,034* |
| | | (1,234) | (0,898) | | (1,015) | (1,533) | | (-1,493) | (-1,933) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | -0,015*** | -0,015*** | -0,015*** | | | |
| | | | | (-8,186) | (-8,052) | (-8,120) | | | |
| SIZE 2 (ln_Assets) | -0,012*** | -0,012*** | -0,012*** | | | | -0,007*** | -0,007*** | -0,007*** |
| | (-5,144) | (-4,969) | (-4,946) | | | | (-4,184) | (-4,473) | (-4,431) |
| AGE | -0,026*** | -0,025*** | -0,025*** | -0,019*** | -0,019*** | -0,019*** | -0,024*** | -0,024*** | -0,024*** |
| | (-5,903) | (-5,789) | (-5,835) | (-5,816) | (-5,829) | (-5,670) | (-7,679) | (-7,684) | (-7,785) |
| PROF | -0,124*** | -0,113*** | -0,120*** | 0,265*** | 0,259*** | 0,270*** | 0,158*** | 0,162*** | 0,152*** |
| | (-3,750) | (-3,489) | (-3,585) | (10,645) | (10,665) | (10,755) | (6,817) | (7,122) | (6,479) |
| TANG | 0,004 | 0,011 | 0,010 | 0,026* | 0,033** | 0,034** | 0,031** | 0,023 | 0,022 |
| | (0,198) | (0,501) | (0,471) | (1,707) | (2,048) | (2,108) | (2,194) | (1,531) | (0,141) |
| LIQUID | -0,002 | 0,001 | 0,000 | -0,003 | -0,001 | 0,000 | -0,003* | -0,005** | -0,006*** |
| | (-1,133) | (0,163) | (-0,044) | (-1,641) | (-0,333) | (0,100) | (-1,856) | (-2,354) | (-2,674) |
| (Constant) | 0,262*** | 0,233*** | 0,241*** | 0,211*** | 0,200*** | 0,187*** | 0,173*** | 0,193*** | 0,204*** |
| | (5,713) | (4,625) | (4,699) | (6,014) | (5,308) | (4,890) | (5,354) | (5,444) | (5,653) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 |
| Number of firms | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 |
| Adjusted R2 | 0,019 | 0,019 | 0,019 | 0,032 | 0,032 | 0,033 | 0,021 | 0,021 | 0,021 |
| F-statistic (overall) | 3,385*** | 3,387*** | 3,346*** | 5,191*** | 5,180*** | 5,149*** | 3,702*** | 3,720*** | 3,704*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR) on a subsample. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variables are measured in time t and the independent and control variables are measured in time t-1.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*

Table 25: FE regressions for the impact of maturity of debt on firm growth on a subsample (Using alternative size measures)

*FE Panel Regression results hypothesis 2 based on a subsample*

| | SA_GR | | | AS_GR | | | EMP_GR | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **Independent variables** | | | | | | | | | |
| LTDR | -0,022 | | -0,013 | 0,027 | | 0,034* | -0,017 | | -0,025 |
| | (-0,924) | | (-0,535) | (1,534) | | (1,837) | (-1,004) | | (-1,448) |
| STDR | | 0,030 | 0,026 | | 0,011 | 0,022 | | -0,018 | -0,026 |
| | | (1,286) | (1,042) | | (0,626) | (1,188) | | (-1,101) | (-1,517) |
| **Control variables** | | | | | | | | | |
| SIZE 1 (ln_Sales) | | | | | | | -0,011*** | -0,011*** | -0,011*** |
| | | | | | | | (6,304) | (-6,426) | (-6,359) |
| SIZE 3 (ln_Employees) | -0,020*** | -0,020*** | -0,020*** | -0,016*** | -0,015*** | -0,015*** | | | |
| | (-7,330) | (-7,255) | (-7,211) | (-7,678) | (-7,450) | (-7,546) | | | |
| AGE | -0,023*** | -0,022*** | -0,022*** | -0,019*** | -0,020*** | -0,019*** | -0,022*** | -0,022*** | -0,022*** |
| | (-5,193) | (-5,077) | (-5,104) | (-5,906) | (-5,982) | (-5,806) | (-7,021) | (-7,029) | (-7,123) |
| PROF | -0,125*** | -0,115*** | -120*** | 0,244*** | 0,236*** | 0,248*** | 0,173*** | 0,177*** | 0,169*** |
| | (-3,778) | (-3,577) | (-3,595) | (9,831) | (9,752) | (9,901) | (7,438) | (7,809) | (7,170) |
| TANG | 0,031 | 0,038* | 0,038* | 0,050*** | 0,055*** | 0,056*** | 0,029** | 0,022 | 0,021 |
| | (1,506) | (1,775) | (1,749) | (3,251) | (3,377) | (3,457) | (2,032) | (1,490) | (1,438) |
| LIQUID | -0,003 | 0,000 | -0,001 | -0,002 | -0,001 | 0,000 | -0,004** | -0,006** | -0,006*** |
| | (-1,585) | (-0,103) | (-0,229) | (-1,336) | (-0,411) | (0,042) | (-2,451) | (-2,467) | (-2,745) |
| (Constant) | 0,225*** | 0,198*** | 0,204*** | 0,127*** | 0,122*** | 0,109*** | 0,212*** | 0,224*** | 0,233*** |
| | (5,356) | (4,338) | (4,353) | (4,027) | (3,565) | (3,098) | (6,444) | (6,351) | (6,510) |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 | 8142 |
| Number of firms | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 | 1357 |
| Adjusted R2 | 0,022 | 0,022 | 0,022 | 0,031 | 0,031 | 0,031 | 0,024 | 0,024 | 0,024 |
| F-statistic (overall) | 3,815*** | 3,827*** | 3,774*** | 5,063*** | 5,032*** | 5,008*** | 4,054*** | 4,057*** | 4,028*** |

*Notes: This table presents the fixed effects panel regression results on the relationship between the dependent variable firm growth (measured as sales growth in models 1-3, asset growth in models 4-6 and employee growth in models 7-9) and the independent variables long-term debt ratio (LTDR) and short-term debt ratio (STDR) on a subsample. The unstandardized regression coefficients including their statistical significance level are shown in the table. The dependent variables are measured in time t and the independent and control variables are measured in time t-1.The T-statistics are in parentheses. Variable definitions are described in Table 1.*

* *Statistical significance at the 10% level*

** *Statistical significance at the 5% level*

*** *Statistical significance at the 1% level*