UNIVERSITY OF GDAŃSK - FACULTY OF ECONOMICS

Milad Zargartalebi

Field of science: Social Sciences
Scientific discipline: Economics and Finance

The Interdependence of Capital Structure and Business Performance - Financing Decisions among German Listed Companies

PhD dissertation prepared under supervision of

Dr. hab. Ewelina Sokolowska Ph.D. Sc.D., Associate Professor

Sopot, 2023

STRESZCZENIE

Współzależność pomiędzy strukturą kapitału a wynikami finansowymi przedsiębiorstwa – badanie empiryczne niemieckich spółek giełdowych)

Milad Zargartalebi

Pomimo wielu badań dotyczących optymalnej struktury kapitału i jej wpływu wyniki finansowe przedsiębiorstw, istnieje luka w badaniach empirycznych dotyczących faktycznych determinantów decyzji finansowych i struktury kapitału. Jest to szczególnie istotne przy rozważaniu tego problemu w kontekście współzależności struktury kapitału i wyników osiąganych przez przedsiębiorstwa. Tematyka ta została zatem podjęta w niniejszej rozprawie doktorskiej, bazując na sprawozdania finansowych 361 niemieckich spółek giełdowych w latach 2008–2019. W rozprawie tej podjęto próbę oceny współzależności pomiędzy wskaźnikami ekonomiczno-finansowymi, obrazującymi kondycję przedsiębiorstwa a kształtowaną przez nie strukturą kapitału. Do zbadania tych współzależności zastosowano zróżnicowane metody badawcze z zakresu ekonometrii i statystyki. Wśród zastosowanych metod wyróżnić należy: metodę regresji krokowej, stałe i losowe modele regresji panelowej dla różnych kombinacji zmiennych i dla różnych podgrup zestawu danych, szczególnie w odniesieniu do różnic w rozmiarze, rozwoju a także klasyfikacji branży. Podjęto również próbę stworzenie sztucznej sieci neuronowej (ANN) z wykorzystaniem wybranych danych w celu weryfikacji wyników stałych modeli regresji. W wyniku przeprowadzonych badan stwierdzono że poszczególne grupy różnią się między sobą w zakresie statystycznej istotności zmiennych. Widoczne to było szczególnie w zakresie relacji zadłużenia dużych przedsiębiorstw, które wykazywały większą reakcję na zmienne wydajności w modelach regresji. Postawione hipotezy badawcze zostały zweryfikowane negatywnie. Nie można było potwierdzić bezpośredniego związku pomiędzy strukturą kapitału a ekonomiczno-finansową efektywnością przedsiębiorstwa. W większości przypadków brakowało wystarczających

dowodów na potwierdzenie postawionych hipotez badawczych. Istotne jest zatem dalsze prowadzenie badań w tym obszarze, które będą koncentrowały się na równiejszych próbach przedsiębiorstw.

Słowa kluczowe: struktura kapitału, efektywność ekonomiczno-finansowa, sztuczna sieć neuronowa

ABSTRACT

The Interdependence of Capital Structure and Business Performance – Financing Decisions among German Listed Companies

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There is a gap in empirical research concerning the determinants of financing decisions and capital structure despite extensive research in this field. This is particularly relevant when considering this issue in the context of the interdependence of capital structure and firm performance. The topic was evaluated in this thesis on the basis of data from German listed firms over the period from 2008 to 2019, covering data from 361 listed non-financial firms during this period. An exploratory attempt was provided in this thesis with the usage of metrics including the debt ratio and the interest coverage ratio for capital structure evaluation, while using a total of eight variables for representing and estimating performance. The methods employed include stepwise forward regression as well as fixed and random panel regression models for various combinations of variables and for different subgroups of the dataset, particularly with respect to differences in size, growth distinctions and industry classification. Also, an artificial neural network (ANN) was calculated with some of the data as well in order to verify the results from the fixed regression models. It was found that particular groups differ in terms of the statistical significance of the variables. Especially the debt ratio of large firms showed a larger responsiveness to the performance variables in the regression models. Generally, there is some selected evidence for a direct relationship between capital structure and business performance as well as a recursive relationship as well. However, in most cases, there is a lack of significant evidence to the findings. Therefore, more research on the issue is encouraged that is geared towards a higher focus on more equal samples of firms.

Keywords: capital structure, business performance, artificial neural network

ACKNOWLEDGMENTS

Many thanks to the University of Gdansk for offering this PhD Studies, especially I would like to thank my PhD supervisor, Prof. Ewelina Sokołowska.

Special thanks go to my family, in particular to my children, parents and wife for their love, support and patience during this time period.

LIST OF PUBLICATIONS

Zargartalebi M. (2021). Sustainability as a competitiveness factor: a quantitative cross-country analysis. *Economics and Environment*, *76*(1), 70-90.

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1. Introduction

The introduction provides an outline on the background of the topic on capital structure and performance that leads towards the problem statement. Also, the research design will be introduced. Finally, the expected theoretical and practical contributions of the research in this thesis will be shown as well.

1.1 Background and Topic Introduction

In general, two funding options are available for a company aiming on, for example, expanding its capacities, financing innovation or acquiring another company. These refer to the options of internal and external financing with the following key characteristics (Schulz & Wasmeier, 2012, pp. 53–55):

(1) Internal financing is using internal financial assets for financing new investments, such as cash flow, retained earnings, equity or other internally generated funds.

(2) External financing is based on the use of external sources of financial capital, such as, for example, bank loans, corporate bonds or other sources for capital funding that have to be redeemed either in the short term or long term.

Financing requirements can be triggered by events or emerge within a continuous management process:

- Funding events need to be distinguished and require an answer to the question on the selection of the most suitable financing instrument. The rational selection of financial instruments is a topic discussed in a variety of theories explaining event-driven financing as well as corporate strategic finance management. At least six event-driven financing events can be distinguished in the firm lifecycle: (1) early-stage start-up financing, (2) financing of a firm's growth and expansion, (3) financing of replacement investments, (4) mergers & acquisitions financing, (5) refinancing activities, (6) the financing of turnaround and restructuring activities (Swaay et al., 2015, p. 30).
- Form a process-oriented view, the financial management has to make a strategic finance decision beyond the financing of daily operations and the financing of lifecycle events. For both cases the capital structure theory provides models and

> theories to optimize capital structure decisions as the result of financing (Schipporeit, 2001, pp. 442–444). Such decisions refer to changes in the mix of debt and equity, debt refinancing, or changes to the term structure of a firms's debt (Sutton, 2004, p. 572).

Empirical research examining reasons for and effects of capital structure, however, provides only ambiguous results concerning the rationality of financing decisions, so that there is a "gap in our understanding of what determines heterogeneity in capital structure" (Lemmon et al., 2008, p. 1576). A large meta-analysis based on a total of 90 primary empirical studies that employ 266 models (Schneider, 2010, pp. 6–7) states that there is still a lack of assured knowledge on the effect of the main capital structure determinants (Schneider, 2010, pp. 1–4). The author also states that the research on capital structure determinants is still largely influenced by the famous irrelevance theorem, as proposed by Modigliani and Miller (1958).

Furthermore, empirical research "shows that a large amount of variation [among the capital structure among companies] remains unexplained after controlling for firm-level characteristics" (Bertrand & Schoar, 2003, p. 1170). The optimization of the capital structure of a firm is, therefore, still relevant in academic research. Hence, especially when considering unique conditions, questions on what determines the capital structure do still remain (Brusov et al., 2022). Given these results, it is tempting to evaluate the role of performance in capital structure research. This topic can be mentioned as a field with ambiguous results (Eriotis et al., 2002; Kebewar, 2013; Ramachandra & Nageswara Rao, 2008), so it is worth of further exploration.

Performance is referred to in the academic literature using various terms, of which firm performance and business performance are to be mentioned as relatively frequent. Firm performance is typically measured with traditional measures from accounting figures, such as with certain types of profit margins or revenue metrics, which are also applied to assess operational performance (Quon et al., 2012). Measures for firm performance allows analysts to evaluate how a particular firm is developing, in particular when such measures are used in combination with other firms from the same sector (Vernimmen, 2018, p. 133). However, it is not necessarily stated in academic studies how firm performance is basically defined and the understanding of firm performance has also changed historically over the last couple of decades, as shown in more detail by Taouab and Issor (2019). Nevertheless, despite the nuances of the understanding of firm performance in academic literature, the concept generally refers to the way of how organizations perform regarding their effectiveness,

efficiency and competitiveness in creating value (Ma, 2000; E. Porter, 1996), albeit the concept remains rather unspecified regarding its exact description and, therefore, very abstract in its nature as well (Miller et al., 2013).

The concept of firm performance is similar to that of business performance, which can be defined as the degree to which managerial goals are reached regarding the defined business practices and the outputs realized with respect to the stated goals after a certain time period has passed for goal evaluation (Porter, 1991). Business performance can be assessed qualitatively and quantitatively as well as with the choice depending on the particular field that needs to be assessed. Quantitative metrics are similar to the metrics used for assessing firm performance and can include profitability ratios like return on assets (ROA), return on equity (ROE) or revenue-related items for example (Bulut & Can, 2013). Consequently, it can be argued that the concept of business performance is very similar to the concept of firm performance.

1.2 Problem Statement and Research Questions

Given the relatively broad concept of performance, as was pointed out by mentioning the similarity of the concepts of firm performance and business performance, a closer consideration of the relationship between capital structure and performance is required. Regarding this relationship, it is typically assumed in financial theory that capital structure has an influence on the performance of a particular firm. This relation is typically addressed by focusing on the influence of the leverage ratio as the key ratio of the capital structure and the role of this determinant in explaining firm performance (e.g. Chen, 2004; González, 2013).

In addition to the use of the leverage ratio, there are numerous other metrics, or financial ratios, that are similarly addressed regarding their impact on a firm's financial performance as well. These can include metrics that distinguish different types of debt (or debt ratios) or equity, which are investigated as to their role as determinants for financial performance ratios (Salim & Yadav, 2012; Vătavu, 2015). Such a distinction has shown to be relevant, as for example different types of debt also show a different impact on performance as well (Abor, 2005). Empirical literature shows a body of evidence that is gained through a variety of different environments from firms in multiple countries. However, as institutional factors have been found to impact the findings of empirical studies involving the capital structure

determinants (González, 2013; Wald, 1999), it needs to be questioned whether the findings gained within a particular jurisdiction, or country, can be transferred and applied in another context.

It can be stated that the relationship between leverage and firm efficiency has been stipulated since quite some time in academic research, as evidenced for example by the classical article of Jensen and Meckling (1976) on agency costs. In addition to the role of the capital structure, such as the leverage in determining firm performance, research has also addressed whether there is a reversed causality in the sense that performance characteristics may determine the capital structure as well. The first empirical study[1] of such a reversed causality was performed by Berger and Bonaccorsi di Patti (2006) in the context of the banking sector. The authors find some evidence for the relationship and provide explanations geared towards the banking business model, which they call the efficiency–risk hypothesis, and the franchise–value hypothesis.

However, despite the promising results of Berger and Bonaccorsi di Patti (2006), there is only very little research on the reversed causality for firms in general and outside the banking sectors. Nevertheless, some authors point to evidence for an impact of business performance to the capital structure. These include, for example, a study on French manufacturing firms by Margaritis and Psillaki (2010), who found both relationships between capital structure and firm performance and reversed relationships between performance variables and leverage, which the authors use as an indicator for the capital structure. Also, a recent study by Iyoha and Umoru (2017) also found both relationships in their empirical study.

Given these results, it can be argued that, currently, there is surprisingly little empirical evidence for the relationship between performance variables and capital structure. Also, existing studies employ datasets for particular countries as well as a limited number of variables, so that potential relationships remain unknown and need to be uncovered with further research like within this thesis. In order to grasp the potential influence of performance or capital structure variables that are not sufficiently covered in the existing literature so far, it is intended to focus on a large number of potential factors in a rather exploratory approach, which will be explained in more detail in the next paragraph. This particularly addresses the potential impact of investment activities, operations activities and

[1] This was mentioned by the authors who state that prior research has not taken into account the existence of such a potential relation previously.

financing activities and is supposed to allow for a deeper understanding of the direct and the recursive relationships between capital structure and business performance. Therefore, the study uses the financial analysis research to explore secondary data (financial data from stock-listed companies) as to examine the relationship between management activities (operations activities and investment activities), management efficiency and business performance in terms of firm growth and profitability in relation to the capital structure.

Consequently, the research questions focus particularly on the relationship of the capital structure on business performance as well as on the recursive relationship that is not yet covered in greater detail in the literature. Additionally, it is intended to identify whether the relationships do apply to a selected number of firms that can be distinguished due to their criteria (e.g. sector or growth potential). The research questions derived from this research agenda can be stated as follows:

(1) Can business performance differences explain the capital structure choice of firms? (RQ1)

(2) Can capital structure explain differences in business performance? (RQ2)

Both research questions that refer to any evidence for a direct and also a recursive relationship between the capital structure and the performance of firms are particularly of relevance when group distinctions will be made. It is therefore of interest to evaluate whether a particular statistical relationship may only apply to a selected group of firms with particular characteristics, while no such evidence can be determined for other firms. In order to draw conclusions to this issue, distinctions will be made regarding differences in the growth rate of revenues and profitability as well as firm size. Also, industry or sector distinctions can be mentioned as well.

1.3 Research Design and Thesis Structure

Since the research areas have elaborated on numerous types of factor models finding a multitude of different correlations between a multitude of variables, this study follows an explorative approach as indicated in the preceding paragraph. It is therefore not intended to use a research approach that aims at confirming or rejecting an existing theoretical model with designated variables, as existing research has yet not sufficiently explored the potential relationships in the realm of variables possible for empirical application. Therefore, the use

of a research model or of potential hypotheses is not applicable. The research design is therefore using the following logical steps for addressing the research questions:

- First stage: Application of several exploratory methods of data analysis to the entire dataset, examining the cause–effect relationships between capital structure and business performance as well as the recursive relationship between both constructs. This will be performed by applying different forms of regression analysis by using applicable panel regression methods, where parameters have first been evaluated using stepwise forward regression for the panel dataset.
- Second stage: Definition of subgroups in the sample data for which the methodological approach mentioned in the first step will be applied. This serves to identify existing nuances in the data and to uncover relationships that are specific to these groups (e.g. relationships for a particular industry or size). The evaluation of differences that have been found for the subgroups in the data are expected to lead to questions regarding further research and exploration.
- Third stage: In addition, the relationship between capital structure and performance variables including its recursive relationship is further explored with an artificial neural network analysis to provide additional insight.

The research questions are answered through analyzing the financial data of the included companies provided by a financial services data provider's database. The sample includes listed German companies, which allows to collect a homogenous set of data of companies affected by comparable factors within a particular jurisdiction, including external factors, such as interest rates, corporate governance rules and other regulations as well as other factors specific to the economic structure (Havlik et al., 2012, p. 219; Schmitt, 2009, p. 123).

From the total set of variables available for the firms, a final selection of ten variables was chosen as the most useful for indicating business performance, management efficiency and management activities. These variables have been identified by reviewing the literature of both research areas (capital structure research and firm performance research). The variable selection process will be explained in more detail in chapter 2 of the thesis.

Structurally, the thesis is ordered into five parts:

- Chapter 1 provides an introduction with a short note on the literature from which the problem statement is derived. Also, the research questions are stated and an outline

of the methodological procedure is provided. In addition, the anticipated theoretical and practical contributions of the thesis are pointed out, including the potential methodological contributions.

- Chapter 2 points out an in-depth overview of the state and the fundamentals of capital structure theory as well as the empirical results in the research on capital structure and on firm performance. Also, from these literature results, the main ideas, including the relevant variables or metrics for the empirical approach in this thesis are going to be derived. These form a mayor part of the research design that is stated in chapter 3.
- Chapter 3 develops the research design based on the research questions and on the conclusions from the research framework presented in chapter 2. Moreover, the methods for data analysis are described and variables used in the sample are specified and defined in the context of data description.
- Chapter 4 then provides the results of the explorative quantitative analysis based on structured numerical data from financial statements providing standardized financial data. This chapter forms the key contribution of this thesis by applying several quantitative methods on the dataset. Also, a discussion on the limitation of the results is provided as well.
- Chapter 5 then discusses the data analysis results in referring to the reviewed literature and develops evidence-based management recommendations. This chapter finally closes the study with a reflection of the contributions of this work as well as on the limitations of the study and its implications for future research.

1.4 Theoretical and Practical Research Contribution

This thesis aims to make a general contribution to capital structure research and to the research on business performance, focusing on the interactions between both constructs. While the causal relationships of capital structure characteristics on firm performance have been extensively researched since quite some time (e.g. Abor, 2005; Jensen & Meckling, 1976; Salim & Yadav, 2012), it was mentioned in this introduction that the reverse causal relationship of performance and capital structure is generally lacking in-depth research. This is despite empirical results hinting at the existence of such a recursive relationship, which

has been found not only for the banking sector (Berger & Bonaccorsi di Patti, 2006) but also for other non-financial sectors of the economy (e.g. Iyoha & Umoru, 2017; Margaritis & Psillaki, 2010).

Given the existence of this research gap, this thesis aims to provide a theoretical contribution especially to the recursive relationship of a firm's performance on its capital structure. This will be derived from data on firms in Germany, making it obvious that the contribution is particularly suitable for shedding light on this jurisdiction as well. Here, it can be noted that Wald (1999) has found capital structure differences across different jurisdictions, making it necessary to engage into research that distinguishes country-specific factors. However, while the focus on one particular country increases the changes of useful and significant results within this setting, it needs to be carefully asked whether the results can be transferred to other country-settings as well. Therefore, it needs to be determined at a later point whether the work in this thesis can provide evidence on firms from other countries as well.

Beside the theoretical contribution for academic theory, it is expected that the thesis also provides insight into practical problems for managerial practice as well. It is particularly to be expected to provide practitioners with some guidance on the interplay of capital structure with firm performance and vice versa, so that managers can use that knowledge for optimizing the value. Due to the distinction that is intended regarding the different groups of companies, managers from a particular group can apply a more specialized knowledge to their advantage as well. That, in turn, can be regarded as a superior approach compared to an approach that is using a less distinguished set of data with broader criteria.

Beside the contributions to theory and practice that focus on issues of recognizing relationships between certain variables and within particular contexts, there are methodological contributions to be expected as well. These refer to the novel approach taken regarding the selection and application of certain quantitative methods like the artificial neural network analysis (ANN). This technique can be regarded as belonging to the realm of methodologies from the artificial analysis toolkit. In particular, there is evidence for the ANN methodology to be able to more accurately capture the modeling parameters for the capital structure in comparison to regression analysis (Pao, 2008).

These promising results in favor of this relatively novel type of quantitative method provides a convincing argument for the use of ANN or of similar methods in research on capital structure and performance. Given the rise in the use of methods like ANN in the last two

decades and the method's superior ability in improving forecasting methods (Kordanuli et al., 2017; Pao, 2008), it is claimed in the methodology-discussing literature that "there is enormous space for additional research [on artificial neural networks] in order to improve their functioning and increase our understanding of this influential area" (Tkáč & Verner, 2016, p. 788).

Consequently, the application of ANN is deemed to provide an additional benefit and a valuable contribution from a methodological standpoint and from the viewpoint of academic researchers. In addition to that, the novel set of variables that are used in this thesis to model the relationships between capital structure and performance plus their recursive relation can be regarded as a unique approach in the realm of modelling capital structure and firm performance dynamics. This provides another methodological contribution to the academic field as well.

2. Literature Review and Research Framework

In chapter 2 of the thesis, a literature review covering the main academic theories on capital structure and on firm performance is provided. Also, the relationship of capital structure and firm performance will be explored further, including its recursive relationship as well. Additionally, a focus is set on the identification of relevant metrics for the empirical part of the thesis, whereby the variables for capital structure and for firm performance are derived. The result of this work is fundamental to the research design that is shown in chapter 3.

2.1 Capital Structure Theories

In the paragraphs below, the topic of capital structure is introduced by providing a conceptual overview of the main theories on capital structure that exist so far. The goal of this part is to provide the background on this mayor theme in this thesis, which will later be discussed in its relation to firm performance. Apart from the provision of the theoretical basis, another key aim of this part is to identify the main determinants of capital structure in order to use the results for the design of the empirical part, where metrics and relevant group definitions of firms need to be defined and applied to the data.

2.1.1 Introduction to the Concept of Capital Structure and Capital Structure Theories

The term *capital structure* is referring to the task of how a firm's assets are financed by different types of capital. Capital can include various forms, such as debt, equity or hybrid securities issued by the firm (Myers, 1984). Decisions that impact the capital structure of companies are part of the research field on corporate finance. These are practically relevant for financial managers within firms (Renzetti, 2001). Empirically, choices that refer to the capital structure like the question of how much debt[2] a firm should issue is different across different firms; a finding that is still relevant and to some degree unexplained, despite years of research on this theme in financial academic theory (Brusov et al., 2022; Modigliani & Miller, 1958).

Capital structure is also referred to in the literature as a type of indicator for measuring the source, the composition and the proportion of a firm's debt and equity capital. As such, the design of the capital structure relates to numerous business and governance areas like the

[2] For the purpose of this thesis, debt financing is, in principle, understood as being similar to loan financing.

operating environment, shareholders' rights as well as obligations, decision-making bodies and governance structure changes as well as to a firm's future development (Luo & Jiang, 2022). Given these many areas to which the capital structure themes apply, it is evident that major topics in the academic literature on corporate finance address capital structure research themes, for example regarding questions on the determinants or factors that are influencing the capital structure of firms (Frank & Goyal, 2009).

The extensive research on capital structure in academic financial research has resulted in different approaches towards this topic. Consequently, distinctive schools of thought or views on the topic must be mentioned in this context. These include, for example, the notion of the relevance or irrelevance of the capital structure on performance (Ogebe et al., 2013). Generally, the variety of different approaches to capital structure theories available in the academic literature can be distinguished into a traditional approach and a modern view, which are characterized as follows:

(1) The traditional approach focuses on the operational activity of the firm. Financing is considered only as a necessary means in the process of the production of goods. It is assumed that the real economic process as well as the business process and its requirements are the main causes that determine capital needs and therefore financing procedure, hereby determining the capital structure as a result (Ogebe et al., 2013; Renzetti, 2001).

(2) The modern view, on the other hand, takes into account the specific set of conditions that arise in the context of the persons that are associated with the companies and their particular interests and incentives as well. These include, for example, the owners of the firm and the firm's management, who pursue the maximization of the company value or their own interests and consciously make the financing decisions. Here, issues of asymmetric information and the agency problems are present (e.g. Akerlof, 1970; Jensen & Meckling, 1976; Ross, 1977). In strong relation to these approaches, investment and financing decisions or capital structure decisions are related to the aim of meeting the demands of stakeholders outside of the firm as well (Simerly & Li, 2000).

Furthermore, approaches to explain the capital structure of firms can in principle be classified into two different schools of thought. These include the neoclassical theories of corporate finance as well as the neo-institutionalist financing theory. Capital structure

theories provide approaches to the extent to which and under what premises a stock market listing or the company's ownership structure can influence financing decisions. According to the assumptions of neoclassical financing theories, these two factors should not affect the capital structure. From the perspective of neo-institutionalist theories, capital structure decisions in private and listed companies as well as in family and non-family companies may differ, for example, due to information asymmetries or principal–agent conflicts between shareholders and (external) managers (Jensen & Meckling, 1976; Ross, 1977). In the following, the theories of the modern approach are explained in more detail.

Neoclassical approaches

The neoclassical theory is based on the central tenet of firm management aiming to maximize the value of the firm to its shareholders, claiming that capital markets are efficient. Within the neoclassical approach, individuals act rationally and without behavioral biases regarding their decision-making (Vasiliou & Daskalakis, 2009). This is famously embodied in the theory of efficient capital markets (efficient market hypothesis), which goes back to the work of Fama (1970).

Neoclassical theories are hereby also relevant in the context of capital structure research, albeit they also have macroeconomic applications as well. Here, it can be mentioned that especially the neoclassical theory of investment had a large impact (Gordon, 1992). The application of neoclassical thinking in capital structure research started in the 1960s with its theoretical underpinnings being based on the assumption of capital markets being complete and efficient, hereby assuming rational decision-making and behavior by the individuals, such as investors, shareholders and managers. A key example of this is the irrelevance proposition theorem of Modigliani and Miller (1958; Tirole, 2005, p. 102). Also, the trade-off theory can be mentioned as another approach in the neoclassical realm to explain capital structure. Here, the focus is on finding the best mix of debt and equity in order to reduce overall financing cost to an optimal level (Fama & French, 2002).

Neo-institutional approaches (principal-agent theory)

In contrast to neoclassical theories, neo-institutionalist financing theories do not assume information-efficient markets. The approaches of the neo-institutionalist financing theories extend the neoclassical approaches by significant assumptions. They are based on the assumptions that (1) information asymmetries exist between the individual actors and (2)

principals and agents pursue specific objectives and make decisions based on an individual utility function (Ross, 1977). Thus, the neo-institutional corporate finance theory largely refers to the principal–agent theory (Jensen & Meckling, 1976).

Beginning in the 1970s, the new institutional economics focused on issues related to corporate governance. This field of research has raised the questions on the role of information asymmetries and on the impact of transaction costs and agency costs that are connected to it. Neo-institutionalist finance theories argue that the acquisition of information is not (always) possible without costs or that information asymmetries exist and cause these costs for the actors (Akerlof, 1970; Myers & Majluf, 1984). For example, external investors cannot fully assess the value of a company or the skills of a manager. In addition, the theory strand considers the heterogeneity of interests of managers in contrast to the shareholders of the firm or with other capital providers (Jensen & Meckling, 1976; Ross, 1977).

In neo-institutionalist models, information asymmetries and potential principal–agent costs can influence corporate policy decisions, such as capital structure. Consequently, capital structure decisions must also be considered as a result of principal–agent conflicts of interest as well (Tirole, 2005, p. 1). The neo-institutional approaches can theoretically be distinguished into agency theory, which deals with the mentioned conflicts of interest, and into signal theory, which deals with communication issues in order to solve agency conflicts (Vernimmen, 2018, preface p. IX). However, for the purpose of this thesis, these distinctions shall only be mentioned but will not be given a key role further below.

Behavioral approaches

Based on the empirical finding that financial behavior and capital structure decisions have deviated from the neoclassical paradigm, behavioral approaches have been developed as well. Through the decoding of financial manager's behavior and its application to capital structure theories, behavioral finance attempts have been made to explain certain phenomena. These can generally provide better results, as is claimed in the literature (Vasiliou & Daskalakis, 2009).

Regarding the behavioral approaches, it must be mentioned that these need to be distinguished from the principal–agent theory, albeit both refer to the role of behavior. However, whereas the principal–agent theory is concerned with behavior as a result of asymmetric information and its respective results (e.g. Jensen & Meckling, 1976), behavioral

approaches have a much broader scope. This refers, for example, to studies that highlight numerous areas, where a personal interest or a personality trait of managers is deemed to have an impact on capital structure decisions (e.g. Bertrand & Schoar, 2003; Graham & Harvey, 1997).

2.1.2 Overview of Major Capital Structure Theories and Related Theories

In the preceding paragraph, the literature on capital structure was evaluated and clustered regarding its different approaches. These different strands provide some kind of order and guidance within the total realm of the academic work on this topic, whereby several distinctive elements are highlighted. While this provides an overview, it is not sufficient for understanding capital structure theory as is necessary for the purpose set out in this thesis. Therefore, the main theories that exist on capital structure research will be mentioned and discussed below.

Irrelevance theorem of Modigliani and Miller (1958)

In the traditional approach to capital structure research mentioned in paragraph 2.1.1, the capital structure matters due to differences in the cost of debt and equity. Specifically, the cost of debt is lower than the cost of equity because, in the event of bankruptcy, debt has a superior claim over equity holders on the remaining firm value, with debtholders' claims being met prior to the claims of the firm's owners. In this understanding, the weighted average costs of capital (WACC) is decreasing with increasing debt levels up to a certain level, where debt levels are no more sustainable (Brusov et al., 2022, p. 58).

The relevance of the capital structure in the traditional approach was then criticized by Modigliani and Miller (1958), who claimed that the capital structure was irrelevant in their famous irrelevance theorem. As a result of the irrelevance of the capital structure, corporate financing should have no impact on firm value and capital costs. The result is based on the following assumptions (Brusov et al., 2022, p. 58; Modigliani & Miller, 1958):

1. No tax payments;
2. Existence of a perfect market with symmetric information distribution (meaning an absence of information asymmetries);
3. no transaction costs within an atomistic market structure;

4. no bankruptcy costs;
5. equal costs of borrowing for the company and for investors.

Assuming that the capital structure has no effect on the value of the company in efficient markets, the capital structure as the result of the financial policy should be irrelevant for capital structure decisions concerning the use of the different financial instruments and the leverage level (Modigliani & Miller, 1958). Moreover, also the capital costs are independent from the debt level. Consequently, financing decisions are independent from the investment decision in an efficient and complete market. Value is created only with real activities like investments that have the ability to increase net income but not by dividend policies or by other means of financing (Tirole, 2005, p. 78). The result of the irrelevance theorem can be stated as the reason why listed companies should have no advantage over private companies, so that the ownership structure is irrelevant with respect to the financial decisions of the firm.

Modigliani and Miller (1958) also note that leverage increase leads to the decrease of capital costs required that the company dispose on sufficient profitable investment options compared to the opportunity cost in not using such profitable business opportunities due to avoiding debt financing. The optimal debt–equity ratio (leverage) is the point of the maximum corporate value. However, in the case of positive bankruptcy costs, the debt ratio increase also results in increasing bankruptcy risks, leading to a higher risk premium for debt capital providers as well and, thus, to higher capital costs for the company (Wohlenberg & Plagge, 2012, pp. 114–115).

In addition to not considering any bankruptcy costs in the original model by Modigliani and Miller, the absence of taxes can furthermore be mentioned as critical. However, in a later article, the authors have discussed the effect of taxes for their model, resulting in an extension of the original model by the incorporation of taxes as a relevant factor; or a capital–structure determinant (Modigliani & Miller, 1963). The main reason for considering the role of taxes is the existence of tax shields as a result of the leverage level. By incorporating the beneficial tax treatment of using debt to finance a company, it is not possible to derive an optimal capital structure anymore (Brusov et al., 2022, p. 59).

Further research on this issue has pointed to another problem of using leverage: Rising leverage increases the insolvency risk, so that risk costs must be included also, as these costs limits the debt ratio and, thus, affects the capital structure (Altman, 1984; Kraus & Litzenberger, 1973; Scott, 1977; Stiglitz, 1969). By extending the original Modigliani–

Miller model through considering bankruptcy risks as well as the effect of taxation, the so-called trade-off theory of capital structure was developed, which aims at explaining the optimal capital structure by determining the minimum capital costs under the assumption that taxes and bankruptcy risks are present (Brusov et al., 2022, p. 59; Vernimmen, 2018, p. 605). The fundamentals of the trade-off theory are explained below.

Trade-off theory

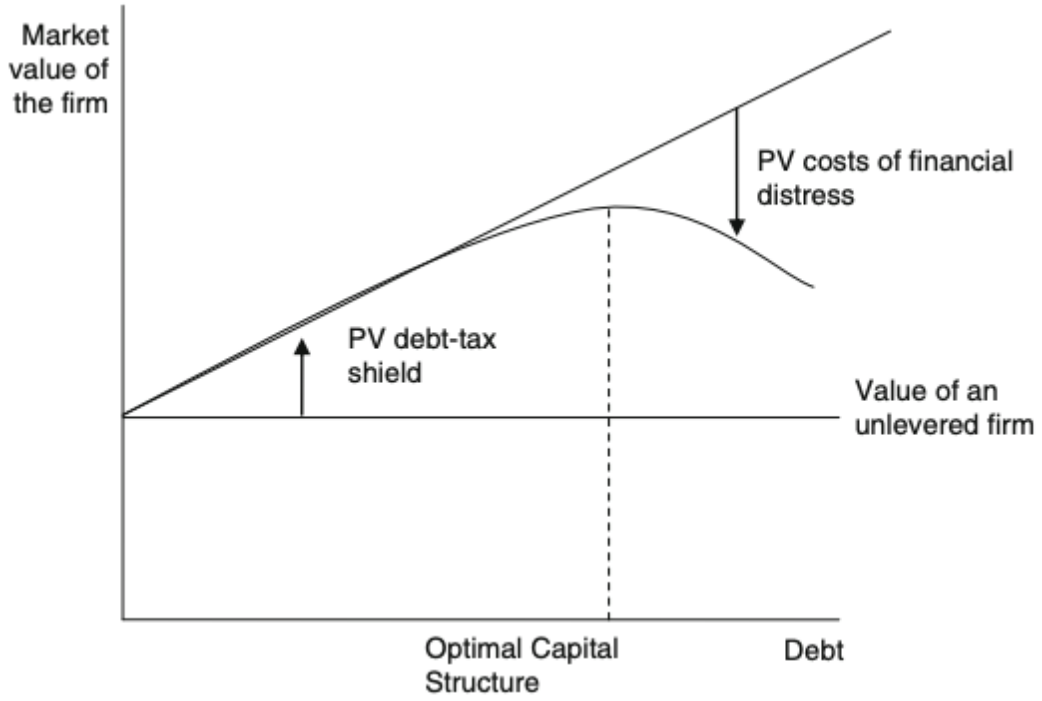
The trade-off theory assumes that companies choose the optimal capital structure (debt–equity ratio) that minimizes capital costs amid an increase in the risk of bankruptcy that is associated with higher debt levels. Furthermore, the different effects of corporate taxes on debt capital and equity capital must be included as decision-relevant in the model explaining the capital structure management. Specifically, the tax advantages of the deductibility of interest payments need to be considered in this context (Fama & French, 2002), similar in the extension of the original irrelevance theorem (Modigliani & Miller, 1963). The trade-off theory exists in two versions: the static trade-off theory and the dynamic trade-off theory (Brusov et al., 2022, p. 59). These are explained in more detail below:

1. *Static trade-off theory:* This version of the trade-off theory applies to a single-period context, were a low leverage level hints at the benefits of using the tax advantages of debt financing. This leads to a lower WAAC and a generally growing capitalization of the firm. However, with increasing bankruptcy risk, the costs of financial distress are considered with increasing intensity (Brennan & Schwartz, 1978; Brusov et al., 2022, p. 59; Leland, 1994).
2. *Dynamic trade-off theory:* Here, additional factors are taken into account that have no influence on single-period decisions but are relevant in decisions concerning multiple periods for capital structure adjustments. This includes, for example, the expectations about future investment and financing opportunities as well as the transaction costs related to it (Strebulaev, 2007). Financial decisions in the dynamic trade-off theory are therefore largely based on what a firm anticipates (Brennan & Schwartz, 1984).

While the static and the dynamic trade-off theory differ with respect to the period that they refer to, it can be stated that the optimal level of debt in the capital structure can be found when the value of the tax shield is equal to the risk of financial distress caused by potential

bankruptcy (Brusov et al., 2022, p. 59; Fama & French, 2002). Due to this trade-off of the two main factors of influence, it is convenient to depict the trade-off theory visually. This is shown below in Figure 1:

Figure 1: Trade-off theory of capital structure



Source: Mac an Bhaird (2010, p. 140)

Generally, both the irrelevance proposition theorem as well as the trade-off theory can explain parts of the capital structure puzzle based on differences regarding the tax shield benefits, insolvency risk and transaction costs. However, both theories cannot completely explain why companies are not totally debt-financed. Nevertheless, when considered for the purpose of this thesis, it can be argued that the trade-off theory shows that capital structure determinants clearly impact performance via the impact of interest and tax payments or via the insolvency risk, which, in turn, also relates to overall business performance of a firm, e.g. when a higher insolvency risk leads to higher overall cost.

Furthermore, recent research rejects the results derived from the perfect market assumptions of the trade-off model. While the basic assumptions for the trade-off theory, assuming an

optimal debt–equity ratio indicated by an equilibrium, are not considered wrong regarding the benefits of the tax deductibility of interest payments as well as regarding disadvantages of higher debt capital financing in the form of rising insolvency costs, these are particularly of less relevance. In general, other factors need to be mentioned that have more important impacts on financial decisions (Mac an Bhaird, 2010, pp. 94–95). Also, as empirical results show that profitable firms are the least likely to borrow (Fama & French, 2002; Wald, 1999), further questions on the design of the capital structure do remain, which are not answered by the trade-off theory.

Neo-institutional theories related to asymmetric information and agency problems

Principal–agent relationships also need to be mentioned within the theoretical framework on capital structure theories as well. These refer to the holders of debt and equity of a firm, where those parties that provide the capital for financing the business are considered as principals (debtholders and holders of equity), whereas the firm's management is acting as the agent involved in managing the principal's assets. This relationship leads to a cost, as both agent and principal are maximizing their utility, while the agent does not necessarily act in the best interest of the principal as well. There are three different types of implicit costs involved in the context of principal–agent relationships (Jensen & Meckling, 1976):

1. *Monitoring costs:* Costs incurred by the principal, whereby the principal undertakes monitoring in order to ensure that the agent is acting in the interest of the principal, e.g. by limiting the activities of the agent. For example, a certain level of debt in the capital structure can work as a monitoring mechanism, whereby self-interested managers contain bankruptcy risk (Harris & Raviv, 1991).
2. *Bonding costs:* Costs incurred by the agent due to the agent providing credible guarantees for making choices that are going to maximize the utility of the principal. Bonding can take the form of signaling, whereby the agent provides a costly but credible signal to the principal. An example of such a signal can be the issuance of debt. By doing so, firm managers give the signal that they are confident in the firm and in the ability to make timely repayments of the debt (Frydenberg, 2004).
3. *Residual loss:* Costs in the form of a loss that is incurred by the principal due to the fact that, despite monitoring and bonding, full alignment of the interests of agent and

principal is impossible to perform, so that the agent's activities cannot lead to full maximization of the welfare of the principal.

Generally, the equilibrium models of the neoclassical approach that integrate taxes and bankruptcy costs assume the existence of an optimal capital structure in which the marginal benefits and marginal costs are balanced out (e.g. Brennan & Schwartz, 1978; Leland, 1994). Based on this fundamental proposition of the existence of an optimal capital structure in a state of equilibrium, the principal–agent theory identifies further advantages and disadvantages of the forms of financing, which are incorporated into the model as benefits or costs (Jensen & Meckling, 1976). Regarding the use of leverage, for example, some of the effects of the principal–agent theory are shown below (Loos, 2006, pp. 19–20):

(1) In a company in which managers can maximize their own benefits and make (suboptimal) decisions for the capital providers accordingly, debt financing can restrict the manager's freedom of decision. A high level of debt reduces the free cash flows available to the management for investment due to the associated interest and repayment obligations. The reduction in free cash flows can, therefore, have a disciplining effect on the managers who maximize the benefits and prevent them from making investments that do not maximize value (Jensen & Meckling, 1976). This means that financing through borrowed capital is accompanied by a benefit for the shareholders, which is all the greater the more pronounced the principal–agent conflicts between managers and owners are.

(2) Another benefit of debt financing is when managers take on less debt than is necessary to maximize firm value. Such a situation arises when managers are also shareholders, leading to the problem that there is a strong dependence on firm success, so that they tend to be more risk averse than diversified shareholders. This risk aversion can lead to them avoiding the higher insolvency costs associated with debt financing and to refrain from value-maximizing investments (Fama, 1980), so that—to the disadvantage of the shareholders—value-maximizing investment opportunities may be missed (Finch, 2002, p. 541). In this case, additional debt capital—and the implementation of value-enhancing investment projects—can lead to an increase in the value of the company and be advantageous for the shareholders.

(3) However, high-level indebtedness can also result in higher costs and disadvantages, such as the loss of financial flexibility if a company's debt capital capacity decreases.

If the debt capital capacity is exhausted, value-increasing investments cannot be made. Thus, the higher the uncertainty about future financing requirements, the more this restriction can lead to costs for the company and its shareholders. Modigliani and Miller (1963) already assumed that, despite tax deductibility, companies do not fully utilize their borrowing capacity but retain a certain flexibility with regard to their financing. Bradley et al. (1984) combine the different views and set up a model that considers various costs associated with a high level of debt and weighs these against the tax advantage of debt. Among the costs associated with debt, they combine the factors of the neoclassical models (insolvency costs, taxes) and the principal–agent costs of the neo-institutionalist view.

Other research identifies significant differences in the capital structure, that is often dependent on the structure of ownership (Volk, 2013). Ownership structure results in differences regarding interests and, thus, in differences in financing decisions and capital structure, so that privately held high-growth firms generally avoid debt capital (Wu & Au Yeung, 2012).

Signaling theory

Signaling has already been mentioned above in the context of the neo-institutional theory of the principal–agent problem. Signaling is of key concern in the context of capital structure decisions as a mechanism for mitigating problems regarding information asymmetries between managers and the providers of capital (Ross, 1977). Managers have insider information at their disposal, whereas external capital providers do not have equal access to this valuable insider information.

Therefore, outsiders cannot distinguish between different types of companies or whether they are ‘good’ or ‘bad’, similar to the classical lemon problem described by Akerlof (1970). To avoid higher capital costs resulting from information asymmetries, managers send a signal to investors that investment projects increase the value of the company. For example, changes in capital structure or dividend payments are interpreted as a signal for a change in enterprise value (Masulis, 1983; Miller & Rock, 1985).

As a result, theories involving signaling are highly relevant in the context of capital structure research. This is also relevant in the context of using credit ratings to estimate the effect on the capital structure by applying the leverage-to-profitability ratio as a proxy indicator for

both measures. Arnold (2008) finds that if indebtedness increases with decreasing profitability, a credit rating downgrading is likely to occur. By contrast, a company that shows an increase in indebtedness parallel to a rising profitability signals that the management is continuously finding avenues for profitable investment opportunities, for which debt and equity capital can be used. This provides a powerful and valuable signal to capital providers and subsequently reduces the costs of asymmetric information and, thus, agency costs. This is likely to finally result in rating improvements of the firm. Otherwise, the finding supports the claim that financing costs grow with increasing levels of asymmetric information.

Pecking order theory

The pecking order theory goes back to Myers and Majluf (1984), whereby basic assumptions are taken from principal–agent theory. The theory assumes that company insiders have better information than external capital providers, which is a central claim of the principal–agent literature. Information asymmetries result in costs of adverse selection, which influence the financing decision. According to the pecking order theory, enterprises minimize their costs of financing by taking into account the implicit costs of asymmetrical information that accompany the respective financing sources. As a result, firms finance their investments by a particular order. First, retained profits are used for investments, followed by low-risk outside debt capital. Then, risky outside debt capital is going to finance the firm's projects, while the last option includes the fallback to equity under conditions of duress and as the last possibility (Fama & French, 2002; Myers & Majluf, 1984).

The pecking order theory, therefore, provides a clear guidance for the selection of different sources of capital. That, in turn, is also a point of criticism of the pecking order theory from the academic literature. It is mentioned by researchers that not only information asymmetries are central for capital structure decisions but that there are also other factors of relevance, which can cause a *pecking order* regarding financing instruments. For example, a pronounced control orientation or risk aversion can lead to a focus on internal financing sources. Separating the influencing factors is therefore not to be considered an easy task and is neglected in many empirical studies (Leary & Roberts, 2010; Myers, 2003).

Furthermore, empirical studies on pecking order theory provide only insufficient and sometimes contradictory results (Leary & Roberts, 2010). In addition, the pecking order theory contradicts the observation that many companies carry out share issues, even if they

have the possibility to finance themselves with additional debt capital (Fama & French, 2005). Given the existence of different durations of total leverage, the pecking order theory was confirmed by Kuč & Kaličanin (2021) for short-term debt, whereas long-term debt is better explained by referring to the trade-off theory.

Market timing theory

Given the flaws of existing theories on capital structure research, newer financing theories, such as the market timing theory, have developed. This can be exemplified regarding the trade-off theory: For listed companies, an increase in the share price changes the ratio of equity to debt capital, whereby the share of equity capital increases. According to the trade-off theory, a company should return to its target capital structure and raise additional debt capital. However, empirical studies show that companies raise equity capital depending on the market valuation and not based on capital structure optimization concepts at particular times. Specifically, companies do issue shares when they are particularly highly valued by investors, relative to book values or past market values. Also, companies repurchase their own stock in the case of low market values as well. Consequently, firms are generally following market timing logics instead of a logic based on optimizing capital structure (Baker & Wurgler, 2002).

Baker and Wurgler (2002) argued that these findings are very persistent as well. Other studies also confirm the applicability of the market timing theory in the context of issuing securities as well. Implications arise, for example, with respect to IPO pricing in different market situations (Helwege & Liang, 2004; Hoffmann-Burchardi, 2001). The question of whether markets are hot or cold is hereby not only relevant for equity pricing (Helwege & Liang, 2004) but also for debt financing as well (Doukas et al., 2011). The majority of CEOs of companies also state that current market conditions are of major concern when making decisions on the capital structure components as well (Graham & Harvey, 2001). This highlights the key role of market timing in capital structure research.

2.1.3 Other Approaches to Explain the Capital Structure of Firms

Having introduced the major theories in the context of capital structure research, it is now worth noting that, on the basis of this research, some other, more modern approaches have developed as well. It is therefore intended at this point in the thesis to emphasize some of these more recent findings on capital structure research in order to provide a conclusive

foundation for the research on the determinants of capital structure, shown in the next paragraph, below.

Behavioral approaches for explaining the capital structure

First, it is worth pointing to some selective findings from the field of behavioral finance, a concept that was introduced in paragraph 0 already. Here, the role of personality characteristics is emphasized as a key factor in managers' decision-making with respective implications to capital structure research as well. Some selected examples from that research are mentioned below:

(1) Bertrand and Schoar (2003), for example, conclude that the capital structure reflects rather the CEO's personal style than the effect of agency costs, tax shields, regulations or other determinants assumed by the mainstream theories. The authors therefore introduce a people dimension in the academic research on capital structure. Financially more aggressive CEOs tend to hold less cash but show higher levels of leverage, which is preferably used for firm growth through mergers and acquisitions (M&A). In contrast, more conservative managers typically hold more cash and prefer internal funding for capacity extension financing. However, this results in a lower return on assets compared to aggressive CEOs, except in the case of CEOs with large track records for M&A activities (Bertrand & Schoar, 2003; Graham et al., 2013; Malmendier et al., 2011).

(2) Malmendier et al. (2011) point to an impact of historical life experiences of CEOs that have an impact on financial policies as well as on the role of overconfidence. Life experiences can include the experience of times of crisis in the life of the CEO, making them more averse to risk, e.g. from debt financing. Also, military experience is mentioned by the authors, which has the impact of making CEOs more aggressive in their selection of financial policies, especially regarding the use of high levels of debt. In general, overconfidence refers to a type of bias in decision-making, where people are generally putting too much probability in their beliefs and in their actions being justified. There is massive empirical evidence for overconfidence in psychological studies on decision-making (Kahneman & Lovallo, 1993, p. 26)

(3) Overconfidence can also lead to capital providers engaging into particular actions in order to prevent negative impacts from such behavior. For example, Voon et al.

(2020) show that providers of bank loans adjust loan covenant structures accordingly and tighten access to debt financing in the case of managerial overconfidence.

(4) There have also been regional differences detected on psychological traits and attitudes of managers, based on psychometric tests. Research has shown that optimism levels and risk tolerance are different for managers for US and for non-US managers (Graham et al., 2013).

Generally, the observations from behavioral studies provide further evidence that more traditional research like regarding the neoclassical or the neo-institutional studies on capital structure provide only a partial view on the topic. It is obvious that behavioral factors also need to be considered as well in the research on capital structure.

Existence of market restrictions on the supply of capital

Furthermore, some studies point to the existence of market restrictions, especially regarding restrictions on the supply of capital to firms. Supply-side restrictions, however, are not particularly addressed so far, so that evidence for the role of supply-side factors contributes to the criticism on capital structure theories. From the overview of recent empirical studies analyzing capital structure, as it is provided by Graham and Leary (2011), it follows that most theories assume that there are no restrictions on the supply of capital and that the capital structure is determined solely by the demand for capital of the company. However, companies seeking to raise capital are clearly subject to certain market restrictions and, therefore, cannot raise equity or debt capital indefinitely:

(1) Some studies, for this reason, analyze the limiting factors on the supply side (Faulkender & Petersen, 2006; Leary, 2009; Lemmon & Roberts, 2010; Lemmon & Zender, 2010). These include, for example, information asymmetries at the company level, which lead to investors restricting the availability of capital. Although a company can take measures, such as applying for a rating, to ease the financial restrictions, this implementation requires a great deal of time and money. On the macroeconomic level, for example, the financial crisis may lead to a reduced supply of capital (Campello et al., 2010).

(2) The introduction of regulatory requirements for banks, such as in the equity capital framework of the Basel Committee on Banking Supervision (known as Basel II) of the Bank for International Settlements, may also have an effect on the debt capital

supply (Kaserer, 2013), hereby impacting the companies' possibilities for capital structure design.

(3) The capital structure theory states that the capital structure is mainly caused as a result of a firm's strategic decisions of owners and managers (Bromiley, 1991). As the lender decides about the amount of financial resources to provide to a specific company and its conditions, the size of the company or the industry may also affect the debt capital access (Börner et al., 2010). Thus, larger companies in less risky industry (e.g. the pharma industry) are rather preferred and benefit from better terms than small companies in industries considered as riskier. Smaller companies are more often exposed to the limited availability of debt capital and equity capital due to the higher likelihood of bankruptcy among SMEs (Coleman, 2000; Smolarski & Kut, 2011).

(4) Wu and Au Yeung (2012) found significant and strong negative correlations between high growth and debt issuance among non-financial firms, so that firm performance can explain capital structure heterogeneity. These findings also support the results of Lemmon et al. (2008) and Volk (2013), i.e. that the determinants of the heterogeneity in capital structure cannot be explained, at least not only, by the neoclassical capital structure theory. Consequently, evidence also points towards a role of growth in the choice of the capital structure as well.

Implications from the characteristics of the financing instruments that determine the capital structure

In addition, the analysis of the capital structure usually distinguishes only between classical debt and equity and does not address the specific characteristics of the financing instruments. Also, subcategories or mixed categories like mezzanine capital (Vernimmen, 2018, p. 842) are typically not addressed as well, at least not fully:[3]

(1) For example, a detailed analysis of the various instruments of debt financing, such as credit lines, syndicated loans or bonds, has so far received little attention in a few studies. This must be criticized, as debt heterogeneity, e.g. covenant structures and

[3] The pecking order theory provides a counterexample to this claim, as debt is at least considered in two different forms. However, the pecking order theory does not address all potential layers of capital that are theoretically available for a firm's financing opportunities.

subordination schemes, are clearly relevant in the discussion of capital structure research (Rauh & Sufi, 2010).

(2) However, scientists are devoting themselves to answering this research question. Denis and Mihov (2003), for example, show that the borrower's credit quality influences the choice of debt capital source. The authors assume that there is a ranking in the use of financing sources that is determined by creditworthiness. Companies with a high credit quality use the public capital market, while medium-quality companies resort to bank loans and companies with a low credit quality obtain capital from investors in the private debt market (Denis & Mihov, 2003).

Consequently, the discussed areas of behavioral issues, structural supply-side themes and the characteristics of the different types of financing instruments bring additional arguments to the research on capital structure. However, given these results from diverse areas or viewpoints, it is becoming increasingly difficult to get a comprehensive structural understanding on capital structure research. To provide some more guidance and for the purpose of summarizing the findings, the following Table 1 shows an overview on what has been found so far.

Table 1. Overview of the Different Theoretical Stages in Capital Structure Research in the Development of Capital Structure Theory

Stage / Theme of Research	**Core Statement**
Capital structure irrelevance theorem (Modigliani & Miller, 1958)	Capital structure is not determined by other determinants other than the costs of capital. The result is obtained under very simplistic assumptions.
Modigliani/Miller theorem with taxes (Modigliani & Miller, 1963)	With the introduction of taxes that result in beneficial tax shields for the firm, an optimal capital structure cannot be derived (Brusov et al., 2022, p. 59).
Trade-off theory (Brennan & Schwartz, 1984; Brusov et al., 2022, p. 59; Leland, 1994).	The capital structure is determined by the costs of capital under the assumption of positive tax shields (deductibility of capital costs) as well as the costs of financial distress, i.e. bankruptcy costs. There is a single-

Stage / Theme of Research	Core Statement
	period and a multi-period theory: static and dynamic trade-off theory.
Neo-institutional theories regarding the capital structure	Incorporation of agency costs, particularly in the form of costs of asymmetric information that determine the capital structure of the firm. This leads to monitoring costs, bonding costs and a residual loss (Jensen & Meckling, 1976).
Signaling theory	Can be interpreted as a part of the neo-institutional theories, as it is a problem solution mechanism to the issue of asymmetric information. There are numerous types of signals that can be derived from the capital structure (e.g. Masulis, 1983; Ross, 1977).
Pecking order theory (Myers & Majluf, 1984)	Based on different costs of asymmetric information that accompany different types of capital, managers chose the capital structure in a particular order, starting with cheap internal capital first and ending with the most expensive (new) equity capital.
Market timing theory	Based on empirical findings, the market timing theory states that managers select a particular type of capital according to current market conditions.
Behavioral approaches	Focus on the influence of personality characteristics, life experiences etc. of CEOs or managers that decide on the capital structure (Malmendier et al., 2011). Also, the theme of overconfidence is frequently mentioned (Voon et al., 2020).
Market restrictions on the supply of capital	Includes restrictions or impediments in line with current market conditions, regulatory requirements, the size of a company or some other firm characteristics that can impact the capital structure (e.g. Campello et al., 2010; Faulkender & Petersen, 2006).
Characteristics of the financing instruments	Focus on the impact of different types of financing instruments and on their influence on capital structure

Stage / Theme of Research	Core Statement
	decisions, like, for example, regarding the choice of loan covenants or debt structures (e.g. Denis & Mihov, 2003; Rauh & Sufi, 2010).

Source: Own presentation.

2.1.4 Empirical Research on Capital Structure Determinants: Selected Results with a Focus on Business Performance

According to Modigliani and Miller (1958), the capital structure of a company is irrelevant to its enterprise value. The value of a company with unleveraged financing is equal to the value of its equity capital, whereas, in the case of a leveraged company, it is made up of the value of the equity and debt capital employed. Thus, if two companies generate the same operating profit and differ only in their capital structure, so that, in well-functioning markets, two investments with identical cash flows have the same price, the value of the leveraged company must be equal to the value of the unleveraged one. On the contrary, the expected return on equity increases as the level of debt rises, however, the risk increases at the same time. Thus, optimizing the capital structure means to minimize capital costs while maximizing firm value by leveraging investments. Therefore, the optimal debt-to-equity ratio should maximize profitability (Kebewar, 2013). Hence, capital structure research should examine capital structure effects on profitability and firm growth.

However, the research on the relationship between capital structure and firm performance provides ambiguous results. Thus, several studies provide indications for a negative leverage–profitability relationship:

- Eriotis et al. (2002) analyze a sample of companies from various industries for a two-year period, finding a negative effect of the debt-to-equity ratio on firm profitability. They conclude that companies preferring internal financing for investment activities are more profitable than firms preferring debt capital for capital expenditures. However, it must be mentioned that internal financing is generally subject to competition inside the firm as well, with limited (internal) funds channeled to the different investment projects (Stein, 1997).

- Frank and Goyal (2015) point to an inverse relationship of leverage on profitability, while distinguishing firms due to their active or passive approach in adjusting their capital structure as a result of changes in the profitability.

- Goddard et al. (2005) examine a sample including manufacturing and service companies of several European countries, finding a negative relationship between leverage and profitability. Instead, they find that companies with a higher liquidity tend to be more profitable, which indicates that internal financing increases profitability.

- Yoon and Jang (2005) find that that firm size is a stronger predictor for the ROE of firms than the leverage as well as a firm size effect in the form that larger firms show higher equity returns. The authors derive their results from firms in the restaurant business.

- Rao et al. (2007) examine listed companies, finding a negative relationship between the leverage, ROA and ROE. Moreover, the authors conclude that liquidity level, firm age and capital intensity have a significant effect on the ROE and ROA.

- Zeitun and Tian (2014) examine a sample of 167 companies for the period 1989 to 2003, finding a negative effect of the leverage on the price–book ratio and revenue growth. The negative effect is also shown for Tobin's Q, a market performance measure.

- Ramachandra and Nageswara Rao (2008) find an association of higher leverage with lower income growth and revenue growth as a result of industry downturns. Moreover, smaller firms are more likely negatively affected by tightening financial conditions in downturn periods than larger ones.

- Nunes et al. (2009) examine Portuguese service industry companies, finding that firm size is a better predictor for firm growth and profitability within larger firms that show higher growth and display a lower level of leverage and higher profitability.

- Among a cross-industry sample from the Pakistan stock exchange, Muhammad et al. (2014) find negative relationships of debt-to-asset ratios and variables of firm performance like ROA and ROE. The authors conclude that capital structure

variables have a significant impact on firm efficiency and profitability, so managers should provide an optimization of the capital structure.

- Kebewar (2013) uses a sample of 2,000 unlisted service companies, finding no relationship between profitability and leverage.

- Kuehnhausen and Stieber (2014) as well as Mwambuli (2016) also find a negative relationship between leverage and profitability as well as with firms' liquidity.

Moreover, other research finds no effect on firm performance, such as in the studies from Baum et al. (2006) or Chadha and Sharma (2015). Based on these findings of negative and neutral effects, it can be concluded that capital structure decisions are an important factor for financial performance; but not in the sense suggested by the irrelevance theorem. Instead, most of the research finding negative or neutral effects conclude that managers shall not use excessive leverage but should fund their investment activities by internal sources, such as retained earnings, and should use leverage only as the last resort, which also supports the pecking order theory assuming that managers prefer internal financing over external per se.

Other research provides indications for positive effects:

- Frank and Goyal (2003) examine a broad cross-industry sample of US firms using financial data of an 18-year period. They find that the pecking order theory cannot be supported by empirical data. Instead, they found a strong positive effect of leverage on revenue growth and operating cash flow growth supporting the trade-off theory.

- Baum et al. (2006) find for a 12-year period (1988 to 2000) that short-term debt has a positive effect on firm growth.

- Nguyen and Ramachandran (2006) also find a positive effect of short-term debt on firm growth, particularly among high-growth companies having a high demand for increasing working capital, concluding that the profitability increases when short-term liabilities are preferred over long-term liabilities.

- Berger and Bonaccorsi di Patti (2006) find that higher leverage is associated with higher profitability in analyzing a sample of U.S. banks. Moreover, more efficient

companies use a higher leverage, as higher efficiency generates a higher return, which reduces financial distress and bankruptcy risks and therefore the capital costs.

- The research of Tsuruta (2017) as well as Simerly and Li (2000) supports the findings and conclusions of Fosu (2013), finding that leverage increases and drives firm performance in the short term, the increasing financial leverage also decreases the robustness towards external shocks, competition and business cycle dynamics.

- Weill (2008) finds that the relationship of performance and leverage varies across countries, concluding that context factors influence the debt-to-equity ratio, such as bank credit access and the legal system's efficiency. The inclusion of macroeconomic exogenous variables, which opens up a new dimension that has so far been neglected in capital structure mainstream research, explains, for example, the different types of financing behavior in Germany, preferring the use of internal funding in a significant manner over external capital sources (Ziebarth, 2013, p. 29).

- Fosu (2013) shows that a higher leverage allows companies more aggressive competition strategies but that, in turn, the increased competition leads to decreasing unit prices, assuming that leveraged highly competitive market strategies can prove to be disadvantageous in the longer term. He concludes that leverage allows aggressive strategies but leads to higher vulnerability.

In summary, the discussed research provides no clear evidence for the role of leverage on performance and profitability. It can be noted that, on the one hand, debt increases when the investment volume exceeds the company's internal funding capacity and vice versa. Furthermore, it can be assumed that higher profitability often leads to a capital structure with less leverage, although such companies typically show higher credit ratings and are of larger size as well.

Other studies focus on more complex relationships between capital structure and performance:

- Baum et al. (2006) find a non-linear relationship; but a significant and/or strong relationship between leverage and firm performance in terms of profitability was not found.

- Margaritis and Psillaki (2010) find a non-linear relationship between leverage and firm performance, finding an inverse U-shaped relationship implying that very low leverage as well as very high leverage can lead to the increase of firm performance.

- Kebewar (2012) provides evidence for profitability being negatively correlated with leverage up to a certain threshold, behind which the effect reverses in examining 9,100 French companies from different industries. They concluded that quantile regression methodology should be selected instead of regression models to examine the U-shaped relationship.

A word of caution is furthermore required regarding the general applicability of the empirical findings. Here, it can be argued that research on capital structure determinants has shown country-specific factors to be of relevance for influencing selected balance sheet ratios structurally within the specific context of the jurisdiction. Some selected findings from research that considers international differences regarding the capital structure shall be mentioned below:

- Al-Najjar (2013) shows, using data for emerging markets, that firms with a strong hold in jurisdiction and lower levels of shareholder protection exhibit higher levels of cash. That, in turn, may also impact financing decisions, i.e. influencing the firm's capital structure. Consequently, studies that employ data on firms from very different jurisdictions may be subject to such influences as well, which needs to be considered when interpreting the findings.

- Kuč and Kaličanin (2021) show, for data from Serbia, that country-specific determinants have a role for the capital structure of firms. The authors specifically point to the influence of inflation and to the state of the development of the banking sector.

- Wald (1999) investigates capital structure differences on a country-by-country basis, using global data on a number of firms from developed markets, including the U.S., Japan, Germany, France and the UK. The author finds evidence for a rather similar level of leverage but uncovers differences regarding the correlation between certain capital structure ratios and other variables, including profitability and firm growth. He attributes these differences to tax differences and agency problems, which change from country to country.

- The result from Wald (1999) on the relevance of legal and institutional differences, which is gained from developed country firms across the globe, is in principle confirmed by the work of Psillaki and Daskalakis (2009) for a small- and medium-sized firm sample taken within the European Union. The authors show for French, Italian, Greek, and Portuguese firms rather country-specific determinants of capital structure choice as well. However, despite the relevance of country-specific determinants, there is a clear role of firm-specific determinants to capital structure choice as well, which is even more dominating in its impact.

The findings have visible implications in terms of the empirical work in this thesis. Due to the claim in the literature of country-specific determinants on capital structure decisions or on other relevant interactions like with profitability and growth, it can be argued that a single-country focus has the potential for more accurate results on the topic. Also, when pointing out empirical results from country-specific data, the existence of differences across international data needs to acknowledge when the empirical results obtained are compared and interpreted with results gained from the literature that uses data from different countries. However, while the consideration of country-specific differences provides the advantages mentioned so far, it also risks to prevent generalized conclusions that are applicable across a broad set of firms from different jurisdictions as well. In any case, this trade-off highlights the need for a careful and balanced interpretation of the results, which is intended to be applied to the empirical data later in this thesis.

2.2 Theoretical Foundations for Business Performance and Firm Growth

Below, the theoretical foundations for the concept of business performance will be provided. It is worth mentioning that business performance in this thesis is conceptualized with a strong reliance on growth. Therefore, firm growth theories will be a major part that is covered at this point in the thesis. These will be complemented with further dimensions of business performance as well as with results from empirical studies as well.

2.2.1 Introduction to Business Performance and to the Realm of Firm Growth Theories

Performance is measured using various metrics, e.g. from accounting (Quon et al., 2012). These include metrics on profitability like with respect to the return achieved on a firm's

assets or on its equity. However, business performance can be measured either quantitatively or qualitatively as well (Bulut & Can, 2013). Given the broadness of the concept of performance in general with its qualitative and quantitative nature, it is not surprising that the definition and conceptualization of performance in academic studies on how firms perform is not necessarily stated clearly as well (Miller et al., 2013; Taouab & Issor, 2019). This problem also extends to the distinction between business performance and firm performance, as these terms are either not clearly defined and differentiated as well but referred to with notions on efficiency, competitiveness, value creation or growth (Ma, 2000; Porter, 1996; Porter, 1991). Hereby, growth is of particular interest because of its direct relation to the concept of performance, which is also shown when considering the lifecycle of firms as well that range from its foundation to expansions, and eventually to necessary restructurings (Swaay et al., 2015, p. 30).

Given this background, it is necessary to provide a meaningful treatment of business performance in this thesis. To achieve this purpose, a focus on growth as a key part of performance is considered useful to apply. This is due to the many areas in terms of which growth can be evaluated, e.g. revenue growth or profitability. Also, for a quantitative approach, a measurement of performance is required, so growth metrics can practically be applied as well. Furthermore, it should be mentioned that no distinction will be made between the concepts of firm performance and business performance, as these are generally used very similarly in the academic literature.

With respect to the research on firm growth or business growth, a larger number of concepts and models exists even on the level of the research object. Most researchers define firm growth in the context of the objective of their studies, their examination subjects and the methodology used (Schmalen et al., 2006, pp. 353–356). Consequently, the understanding of growth is typically given by different types of observed growth and how it is implemented. An indication of this large realm in which firm growth can be conceptualized is provided in Table 2 below. Here, several classification criteria and their corresponding types of growth are shown. It is worth mentioning that the growth dimensions shown below are qualitative as well as quantitative, respectively. This is a distinction that has implications with respect to the evaluation of business performance (Bulut & Can, 2013).

Table 2: Firm Growth Typology

Classification Criteria	**Types of Growth**
Character	(1) Quantitative growth; (2) qualitative growth
Intensity (Annual revenue growth rate over a defined period)	(1) Diminishing growth: < 5% (3-year average) (2) Moderate/normal growth: 5% to 20% (3-year average) (3) High growth (gazelles): > 20% (3-year average) (4) Hyper growth (unicorns): > 100% (3-year average)
Dynamics	(1) Evolutionary growth; (2) revolutionary growth
Permanence	(1) Saltatory growth; (2) continuous growth; (3) sustainable growth
Form of realization	(1) Organic growth (internal growth); (2) non-organic growth (external growth)
Nature of changes	(1) Innovative growth; (2) restructuration growth
Geography	(1) Local growth; (2) regional growth; (3) supra-regional growth; (4) domestic growth; (5) international growth
Quality	(1) Sustainable growth; (2) non-sustainable growth
Area of appearance	(1) Financial growth; (2) structural growth; (3) organizational growth; (4) strategic growth
Intensity	(1) Weak growth; (2) intensive growth, (3) high growth; (4) hyper growth
Duration	(1) Short-term growth); (2) long-term growth (longevity)

Source: Own representation based on Gruenwald, 2016, pp. 19–20; OECD, 2010, p. 16; Ross & Lemkin, 2016, p. XV; Bhide, 2003, p. 215.

Firm growth research provides a contrast to the research on turnaround and restructuring, as firm growth research examines the effect of different factors on firm growth over a comparably longer observation period than the restructuring or turnaround research (Gruenwald, 2016, pp. 46, 144). Factors explaining firm growth, which can also be interpreted as a type of success factors, can be defined, in the most thorough form, as elements (factors, resources) that consistently cause or produce firm performance (success) in any business (Lawrimore, 2011, p. 6).

Thus, the objective of success factor or firm growth research is the identification of factors explaining excessive firm performance (Herr, 2007, p. 40), as shown by the different types of growth achieved. The research focus is on identifying success factors in single functional areas within the company or on the strategic management level and the effect of exogenous factors, such as sector, industry or other group-specific determinants. In the context of this thesis, capital structure can be mentioned as one particular success factor that is responsible for the growth patterns of the firms observed.

2.2.2 Microeconomic Foundations of Firm Growth

In contrast to studies on macroeconomics, business studies focus only on the firm or companies, respectively. However, economics has established its own theory of the firm, which can be called the microeconomic theory of the firm (Negishi, 2014, p. 167). Here, the firm is conceptualized by its production function, viewing the company as an entity converting inputs into outputs (Walker, 2017, pp. 26–27, 2018, p. 82). The firm generally pursues the goal of maximizing profit. As a result in the perspective of multiple periods, the goal of maximizing the firm's value by reacting promptly and efficiently to changing price signals from the markets (Hall & Lieberman, 2013, pp. 265–278).

In contrast to macroeconomic studies that focus on larger entities, microeconomics focuses only on the firm's interaction with the markets; but with a more distinct perspective than business and management studies. According to the microeconomic theory, the firm is structured mainly from the outside by market forces, while decisions, principal–agent problems, operations and strategies remain unobserved due to the focus on the market and are, therefore, not considered relevant for firm growth, although these items have clear relevance in practice (Wiese, 2021, pp. 244–245).

In the microeconomic theory of the firm, there is a production function with only minor variations from other firms. Here, the firm exists only as long as it keeps the production costs lower than the market price (Hall & Lieberman, 2013, pp. 265–273). Thus, the firm is considered as a simple production function and adjusting production and output is performed by observing and acting on market signals (Hall & Lieberman, 2012, p. 272; Walker, 2018, p. 82).

In general, the firm adjusts its production levels and its cost structure based on demand volume as well as price signals. The approach to maximizing profits depends on the market characteristics, such as whether it is a monopolistic or a polypolistic market. These can be characterized as follows:

- In a monopolistic or quasi-monopolistic market characterized by imperfect competition, the increase of revenue and profit can be realized by the price policy. Thus, a price increase leverages the profitability but decreases market demand. And, vice versa, a price reduction results in higher sales volume but decreasing margins (Hall & Lieberman, 2013, pp. 121–125, 130).

- In contrast to the monopolistic or quasi-monopolistic market, the polypolistic market is characterized by perfect competition. Here, the individual firm cannot affect its performance besides using a strategy aimed at the given equilibrium price of supply and demand which is generated by the efficient market (Hirschey, 2008, p. 381). The firm can influence its revenue by price reductions below the equilibrium price up to the break-even point to stimulate demand. However, this reduces the firm's profitability, resulting only in quantitative growth. The only option for profitable growth (qualitative growth) is a constant cost reduction to increase operations efficiency and, thus, cost efficiency. However, constant cost reduction may result in reducing production costs significantly below the equilibrium market price of products, with the result of increasing market shares to benefit scale and scope effects, which, in turn, enhances price reduction capabilities (Hall & Lieberman, 2013, pp. 207–208).

The microeconomic theory of the firm aims at modelling the decisions of private firms. In factor markets, firms ask for the production factors labor and capital in order to use them in a certain combination in the technical production process and to offer the output quantity

produced. Under the assumption that a company wants to maximize its profit per period, it will use production factors in a way so that the minimum level of opportunity costs can be achieved (Hens & Pamini, 2008, p. 12). This implies that each reduction in the quantity of a production factor in an input bundle results in a reduction in the output quantity, so that no input is wasted. The production function (technical condition of production) describes the relationship between the minimum factor combinations and the output quantity produced with them (Eichhorn & Gleißner, 2016, pp. 341–342). Of course, this understanding is not taking into account a potential impact from capital structure considerations.

The microeconomic theory of the firm employs a three-step approach to model management decisions in allocation problems, assuming that production volumes are measured in monetary units (not quantities) and output is evaluated using market prices. The three steps are outlined below (Rubio-Misas & Gómez, 2015, pp. 56–57; Stepan & Fischer, 2008, pp. 6–9):

(1) Among the many (infinite) production possibilities, only the technically efficient production processes are to be considered for a profit-maximizing company to achieve technological efficiency.
(2) Among the (possibly infinite) technically efficient factor input combinations, the profit-maximizing firm selects only the (one) minimum-cost input bundle for each desired (given) output quantity to achieve economic efficiency.
(3) From the (possibly infinite) many cost-minimum producible outputs, the company chooses the profit-maximizing output bundle depending on the market prices to achieve the profit maximum.

The management's objective is to optimize the cost function, which includes fixed and variable costs that the firm incurs, and the revenue function to achieve maximum profit as defined in the cost-volume-profit function (Mowen et al., 2018, pp. 853–855; Walker, 2018, pp. 30, 75–76). The optimal size of a company is reached when the additional cost of an additional output unit is equal to the additional return. In terms of accounting, this refers to the breakeven point (Stepan & Fischer, 2008, pp. 62–65). Consequently, reaching the optimal size of the company would be the rational firm growth limit, beyond which additional activities initially generate risks, such as negative returns and solvency risks.

Therefore, firm growth seems to be only a rational choice up to a certain degree within the limits of profitable output possibilities.

From the theoretical point of view, it would apply that as long as a company can cover all its costs, including its capital costs, growth is not a rational option because—as the founder of the theory of the firm notes: “First, as a firm gets larger, there may be decreasing returns for the entrepreneur function, that is, the costs of organizing additional transactions within the firm will rise” (Coase, 1937, p. 394). Thus, the marginal costs define the rational limit of firm growth because, beyond this limit, the diseconomies of scale affect the profitability.

In summary, the microeconomic theory of the firm focuses on optimal asset allocation based on market forces, minimizing the impact of management activities on the results (Walker, 2017, pp. 26-27, 32-35, 46). However, in the field of managerial economics, the microeconomic theory of the firm is used as a theoretical basis for reflection and discussion of management decisions, rather than a strict guide for decision-making. This approach is a response to the lack of an explicit theory of the firm in business studies and management science (Walker, 2017, pp. 32–35). This could be considered as the reaction to the lack of a discussion of the theoretical concept of the firm, as management and business administration science has not developed an explicit theory of this concept. However, managerial economics uses a multitude of microeconomic-based and other models without referring explicitly to the microeconomic theory as its core paradigm; but as one of the several different and partially competing theories and models for rational management decision-making in the context of rational decision-making and management (Walker, 2017, pp. 117–122, 160). Therefore, microeconomic theory provides a useful theoretical background to the understanding of the nature of firms, e.g. with respect to growth mechanisms. Indeed, when neglecting uncertainty, financial economics are basically an exercise in microeconomic theory (Campbell et al., 1997, p. 3).

2.2.3 Stochastic Models, Market-Based View, Resource-Based Growth and Other Types of Growth Models

There are types of growth models that are more specific than the simple growth model of microeconomics. These models shall be introduced in this paragraph and evaluated with respect to the research aim.

Stochastic Models of Growth

First, the so-called stochastic theory needs to be mentioned. This growth model assumes that there are no identifiable success factors to achieve performance except for a multitude of factors that are generating firm growth, so that the success contribution of individual factors is only small and as a result, basically not measurable. Consequently, performance cannot be observed in principle (based on Gibrat's Law defining growth as a stochastic process; e.g. Evans, 1987; Bottazzi & Secchi, 2003; Reichstein & Dahl, 2004; Knudsen et al., 2017). With respect to the topic in this thesis, a contribution of capital structure to growth is stochastic in nature and cannot be explained by stochastic theories.

Resource-based growth and market-based growth

In contrast to the stochastic view on growth, deterministic models of corporate growth assume that there are few internal and external factors that can be observed and used to explain firm growth. In this view, corporate growth is generally understood to basically follow a management intention (Schwenker & Spremann, 2008, pp. 100–114). This paradigm forms the basis of what are probably the two most frequently cited theoretical approaches, the resource-based view and the market-based-view:

(1) Resource-based models—following the resource-based view (RBV), such as recent high-growth companies research—assume that company growth depends on the development of company-specific, competition-relevant resources that are not available on the market (company-specific resources). The property of and the access to these resources distinguishes the company from other companies, which do not have an equal position. Thus, resource access can be used for realizing a competitive advantage (e.g., Penrose, 1959; Wernerfelt, 1984; Hamel & Prahalad, 1994; Gellweiler, 2018).

(2) In contrast to the resource-based view, the market-based view (MBV) models assume that companies grow through positioning or market-product strategies, enabling them to increase the market, which, in turn, results in benefits from scale effects (e.g. Drucker, 1954; Ansoff, 1965; Porter, 1980; Buzzell et al., 1975; Buzzell & Gale, 1989; Barney, 1991; Davidsson et al., 2002; Barringer & Jones, 2004; Davidsson & Delmar, 2006; Malik, 2008). In this respect, the right choice of strategy in terms of

positioning, corporate strategy and operations management activities are at the forefront of the explanation of firm growth, as represented by the strategic management concepts of, for example, Drucker (1954); Ansoff (1965; 1988), Kotler (1999) and particularly Porter (1980; 2008). In this sense, companies can exhibit large growth and show a strong performance if they are able to achieve success in acquiring valuable core competencies (Hamel & Prahalad, 1990).

While resource-based growth models basically identify essential success factors, namely core competences (Hamel & Prahalad, 1990), company-specific resources and market positioning (close market niche and deep customer relationship; Müller, 2013, p. 143), market-based approaches and strategic management models are more strongly based on a dynamic adaptation of the firm to its corporate context (sales and procurement markets and other environmental factors), corporate structure (organization and governance) and strategy content.

An essential study from the market-based perspective is the PIMS (Profit Impact of Market Strategy) study, which, similar to Porter's approach, is rooted in industrial economics, from which Porter also derives his concept of generic strategies (Salonen, 2010, p. 114).

The aim of the PIMS project is to investigate the connection between corporate strategy and corporate performance and the generalization of this connection to controllable variables based on the evaluation of the data of numerous companies from various industries and competitive situations. The ROI is often selected as an indicator of firm performance research, as is the case in the PIMS studies. Analyzing the current PIMS database, Malik (2008, p. 152) refers to the PIMS data set, which has been further supplemented over the decades. This data lists a total of 15 independent variables that are condensed into three factor groups:

(1) competitive strength defined as an aggregated factor of absolute market share, relative market share, customer preferences, patent and segment-specific orientation;

(2) lean production measured as chapter turnover, capacity utilization, productivity and the ratio of external to internal production; and

(3) market attractiveness with the indicators market growth, market concentration, degree of innovation, bargaining power and logistics efficiency.

The factors mentioned above explain about 75% of the variance of the ROI (Malik, 2008, p. 152), with quality and market share having the highest effect, while a high investment intensity in the context of a very low market share has a strong negative effect. These results provide strong evidence for the ability of deterministic growth models to explain much of the realized business performance of firms.

Other Theories of Firm Growth

There are also other theories on growth as an indicator for business performance as well. These include theories with a learning perspective that stress the importance of knowledge acquisition and learning as a key prerequisite for growth and performance (Senge, 1990; Hamel & Prahalad, 1990; Deakings & Freel, 1998; Dalley & Hamilton, 2000; Bessant et al., 2005; Phelps et al., 2007). Another perspective is the evolutionary perspective, which states that firm growth takes place in an environment of adaption to competitive dynamics in the market environment (Alchian, 1950; Penrose, 1959; Aldrich, 1999; Vinnell & Hamilton, 1999; Kaldasch, 2012).

Also, there is a perspective with respect to a firm's lifecycle as well. Here, the growth and performance dynamics are explained through a reference to the specific stage of a firm within its lifecycle. This perspective is largely claiming that companies develop from small businesses to more mature firms, hereby exhibiting different growth dynamics throughout this development process (Churchill & Lewis, 1983; Scott & Bruce, 1987; Greiner, 1998; Dobbs & Hamilton, 2007).

It is, therefore, important to state that business performance in the sense of growth can potentially be explained by various factors. As outlined below in Table 3, there are different theoretical approaches that aim to explain growth dynamics. What is generally missing in this research is the notion of the relevance of the capital structure. This provides an open issue in the research on growth dynamics and performance.

Table 3: Theoretical Approaches to Firm Growth

Growth Theory Approach	Selected authors	Key characteristics
Stochastic perspective	Bottazzi & Secchi (2003) Reichstein & Dahl (2004) Gibrat (1931) Evans (1987)	Growth is assumed to depend on numerous factors that cannot be directly measured or observed.
Resource-based approach	Schumpeter (1934) Wernerfelt (1984) Hamel & Prahalad (1994) Gellweiler (2018)	Growth is a result of various internal and external factors. The determining factors are identifiable and provide a competitive advantage.
Market-based view	Ansoff (1965) Porter (1980) Barney (1991) Davidson et al. (2002) Hamel & Prahalad (1990)	Firm growth is mainly due to superior positioning in the market with core competencies being important.
Learning perspective	Senge (1990) Hamel and Prahalad (1990) Deakins & Freel (1998)	Acquisition of knowledge plus and a continuous learning process are mentioned as prerequisites for achieving growth.
Evolutionary perspective	Vinnell & Hamilton (1999) Kaldasch (2012) Alchian (1950) Penrose (1959) Aldrich (1999)	Companies achieve growth through adapting on the challenges imposed by competitors and the environment.
Lifecycle perspective	Dobbs & Hamilton (2007) Scott & Bruce (1987) Greiner (1973; 1998) Churchill & Lewis (1983)	Dynamics of company growth are related to a firm's current lifecycle.

Source: Own presentation.

It is worth mentioning that there is also some academic research that combines existing approaches to growth theory. For example, a special field of research can be stated as following the resource-based view that has been expanding in recent years, examining high-growth companies. The results of this research show for example: (1) Fast-growing companies often have a higher debt ratio; (2) smaller companies grow faster due to higher efficiency in more flexible, informal structures (López-Garcia & Puente, 2009); (3) fast-growing companies are not typically found in the start-up stage but rather in later stages amongst smaller to medium-sized companies; (4) higher innovation intensity explains the rapid growth of small firms, while larger firms tend to take fewer risks and, therefore, focus on incremental innovation (e.g. Acs et al., 2008; Coad & Rao, 2010).

Two other current studies have developed very similar growth predictor models that origin from the comparable samples. Both have analyzed the financial data of German, Austrian and Swiss listed companies (569 companies and 588 companies, respectively) for comparable periods. Wehrmann (2018) analyzes 569 German, Austrian and Swiss listed companies, searching for the effects of internationalization on firm growth. Gruenwald (2016) analyzes the financial data of 588 listed German companies in a ten-year period (2003 to 2013), searching for growth predictors for small-cap and mid-cap companies. He finds that leveraged investment in research & development (R&D) and in property, plant and equipment (PPE) explains net income growth as well as quantitative growth in terms of revenue growth (Gruenwald, 2016, pp. 148–151). In the case of qualitative growth, PPE investment and R&D investment show significant effects on asset turnover and on the increase of the profitability of asset use (indicated by the ROA) by intangible assets growth, while quantitative growth results from the increasing asset efficiency (asset turnover growth) only. Moreover, qualitative growth firms show a significantly higher use of debt capital and intangible asset growth (Gruenwald, 2016, p. 151). The main difference between quantitative and qualitative growth is that qualitative growth makes use of leveraging particularly for R&D and PPE investment (Gruenwald, 2016, p. 151; Wehrmann, 2018, p. 175). Other indicators like merger or acquisition activities as well as internationalization strategies are not identified as contributing to growth and, therefore, to performance (Wehrmann, 2018, p. 148).

2.2.4 Empirical Performance Research

Below, the empirical firm performance research will be evaluated. Generally, this is related to the issue of firm growth, which needs to be mentioned as a key area for research on performance in general. Also, the research on change management and corporate restructuring will be evaluated, as it is related to performance research as well. Within these paragraphs, specific characteristics of firms relevant to their performance (e.g. size etc.) are emphasized, as such characteristics will need to be considered in the empirical part of the thesis as well.

2.2.4.1 General Firm Performance Research related to Growth

A study by Henrekson and Johansson (2019) pursues a meta-analysis, where the state of high-growth companies' research focusing on employment effects is summarized. The authors reviewed 28 high-growth studies, identifying several high-growth predictors, such as innovativeness, technology intensity, higher leverage and other factors. López-Garcia and Puente (2009) found a higher long-term debt ratio among high-growth companies; and that young fast-growing companies show a significantly higher productivity. Amat and Perramon (2010) stated that quality management significantly distinguishes high-growth companies from other companies. Almus (2000) stated that high-growth companies are mainly technology-intensive. Acs et al. (2008) and Hölzl (2009) found that younger companies grow faster due to size-related efficiency advantages but that they are less productive than mature companies.

To sum up, high-growth companies show, on average, a lower firm age. However, this does not necessarily mean that such companies are start-ups: 70% of the companies with an above-20% revenue growth in a three-year period are older than four years (Acs et al., 2008). Companies that have doubled their revenue in the three-year period show an average age of 25 years and exist longer than five years (Anaydike-Danes et al., 2009). Moreover, other findings show that high-growth companies are generally not start-ups or technology companies (Almus, 2000; Acs et al., 2008; Hölzl, 2009; Coad et al., 2014). It can therefore be assumed that mature firms can also achieve a relatively large growth rate as well.

However, high-growth research does indeed have a particular focus on smaller firms because they generate the majority of innovations in contrast to larger and more mature companies, preferring less risky investments and, therefore, showing less innovativeness but more

predictable revenues (Robbins et al., 2000). Consequently, academic research searches for firm growth predictors in the field of high-growth SMEs compared to more mature firms (Siegel et al., 1993). However, such studies often use rather vaguely defined research constructs, such as growth aspiration, entrepreneur characteristics and other qualitative factors. A selected overview on predictors for high-growth and performance from the high-growth literature is depicted below in Table 4:

Table 4: Research Examples on Predictors for High Growth

Authors	**Growth / Performance predictor**
Olson & Bokor (1995)	Innovation, strategic planning
Chaganti et al. (2002)	Leadership style, strategic planning and performance controlling
Freel & Robson (2004)	Positive influence of product innovation on different growth measures, like, for example, turnover growth and profit margin growth
Wiklund & Shepherd (2003)	Growth aspiration, access to venture and debt capital as well as human capital
Barringer et al. (2005)	Clearly defined mission (commitment to growth), customer knowledge, ability of inter-organizational cooperation
Tomczyk et al. (2013)	Personal values of entrepreneurs
Vickers & Lyon (2014)	Fit between entrepreneur's capabilities to firm strategy
Milosevic & Bass (2017)	Influence of dynamic capabilities of high-growth firms (degree of installed routines and organizational knowledge develop growth)
Barringer & Jones (2004)	Addition of managerial capacity to administer growth options

Source: Own presentation.

The research examples on the performance predictors shown above hint at the existence of a large variety of potential predictors from very different fields. It is evident that some of these predictors are rather difficult to measure and to operationalize in empirical research as

well. In order to engage into quantitative research, this is mentioned as a practical problem for the researcher. Therefore, it is important to evaluate research that uses variables and data that can be gathered and operationalized with a higher degree of certainty, specifically with a focus on hard facts instead of soft data (Dobbs & Hamilton, 2007, p. 313). This is also the starting point for this study; resorting to financial data and ratios only to examine management decisions and activities using the advanced methods of the financial analysis research. However, the focus on measurement is not necessarily excluding qualitative characteristics in the search for growth predictors but aims to focus on variables that can get measured. For example, the work of Fadahunsi (2012) provides a set of 23 variables, which are qualitative in nature but can mostly be measured without much difficulty.

An overview of selected research that uses measurable factors in the prediction of firm growth is shown below in Table 5:

Table 5: Overview of Selected Studies on Firm Growth Factors

Authors	**Findings on Firm Growth Factors**	**Sample, Region, Period**
Almus (2000)	In the group of the 10% fastest growing companies, knowledge- based service providers and technology companies do not show a significantly share than 'old economy' companies.	Active and non-active companies Region: Germany (1990-1999)
Anaydike-Danes et al. (2009)	6% of the total population of all existing companies are high-growth companies (average growth of more than 20%). 70% of high-growth companies exists at least 5 years.	Existing small- and medium-sized enterprises. Region: UK (1998-2008)
López-Garcia & Puente (2009)	High-growth companies use more leverage resulting in relatively more long-term debt.	Existing small- and medium-sized enterprises. Region: Spain (1996-2003)

Authors	Findings on Firm Growth Factors	Sample, Region, Period
Amat & Perramon (2010)	Quality management, innovation focus and pro-active human resource management are key success factors, as well as conservative, long-ł term oriented financial management.	Existing SME Region: Spain (1994-2007)
Daumfeldt et al. (2010)	Young growth companies create proportionally more jobs than older ones. The group of larger growth companies generated higher percentage growth.	Meta study, including the data of 28 studies on high-growth companies Region: European countries, USA, Canada (2003-2008)
Koski & Pajarinen (2011)	Subsidies are not critical to the growth of companies in the sample but are important in the start-up phase. Therefore, the assumption is that subsidies and loans increase the probability of establishing start-ups.	The 10% of the fastest growing start- up companies from the group of all companies. Region: Finland (2003-2008)
Senderovitz et al. (2015)	Companies with a broad market strategy grow faster and more profitable than companies focusing on niche markets. Strategic orientation is the most determining factor for high growth.	Small, fast growing companies Region: Denmark. (2010-2014)
Li et al. (2019)	High growth is driven by higher leverage	Small, fast growing companies Region: 15 EU countries (2011-2012)

Source: Own presentation.

2.2.4.2 Change Management and Turnaround Research

It should be noted at the outset that business research does not make a uniform distinction between turnaround management and restructuring management; but that both terms are frequently used for the same management activities, although both terms can be considered from a process perspective in a time sequence in terms of a turnaround following from restructuring activities and marking the period of specific indicators turning positive (Eichner, 2010, pp. 49, 281).

Regarding the impact of turnaround/restructuring activities on corporate success, there was a steady increase in empirical research since the 1970s, not only in the area of distressed companies but also in the area of non-distressed corporate restructurings and reorganization (Rau, 2008, p. 213). Recent studies examining non-distressed corporate restructurings (turnaround) (e.g. Seward, 2016) as well as restructuring of distressed companies (e.g. Buschmann, 2006; Eichner, 2010; Hartmann, 2016) have been able to analyze the restructuring process much more deeply than in the past due to the increased availability of standardized and comparable data through international standardization of accounting and reporting for a growing number of companies since 2006 (Ball, 2016). The study by Hartmann (2016) as a very recent example for examining German companies has identified eight success-relevant restructuring strategies in an extensive literature analysis and empirical research on restructuring strategies of listed DACH companies: (1) increase in asset turnover, (2) divestiture, (3) CAPEX reduction, (4) working capital reduction, (5) debt reduction, (6) acquisition, (7) OPEX reduction and (8) revenue increase (Hartmann, 2016, pp. 152–153). Hartmann (2016, p. 131) as well as Eichner (2010, p. 71)—defining distressed by a negative ROIC in the starting year of the observation period—have found that an observation period of five years is required because such a period is the average period of a restructuring or reorganization process. Consequently, both the research period as well as the set of strategies mentioned above are a basis of this research.

Asset Turnover Increase (Sales Increases): It is assumed that short-term sales growth strategies (e.g. through marketing and pricing policies) are generally relevant to success. Sale increase results in an increase of capital turnover. Nothardt (2001, p. 271) states that sales growth strategies in the turnaround management lead to an increase in the return on capital employed and are indicated by an asset turnover rate increase, which also follows from the asset turnover formula. Hartmann (2016, p. 154) and Nothardt (2001, p. 271) determine a significant influence of capital turnover on restructuring success. Management

activities aiming on the increase of sales and the resulting asset turnover have a more important and significant influence on turnaround success than, for example, cost reduction (Buschmann, 2006, p. 186).

Acquisition: Acquisition is aiming at synergetic effects, resulting in higher productivity and/or efficient use of resources and/or cost efficiency. However, acquisitions are an approach that can only be applied by larger companies. Acquisitions are typically cost-intensive and require extensive financial resources. It can, therefore, be difficult for smaller companies to spend the necessary financial resources (Rocca et al., 2011, p. 111), with a general positive effect of acquisitions—particularly in a shorter period—being questionable (Castrogiovannia & Bruton, 2000, p. 25).

Divestment (Downsizing): The general objective of divestments is to generate an inflow of additional liquidity that will enable the company to reduce the financial shortage to finance restructuring activities (Sudarsanam & Lai, 2001, p. 186). However, according to Kane and Richardson (2002, p. 260), risk assessment may also be decisive for divestment. If, for example, a business unit is exposed to specific risks, a divesture can reduce the risk and reduce the volatility of operating cash flow and costs. Empirical studies show a positive correlation between divestments and turnaround success, with the exception of Sudarsanam and Lai (2001, p. 196), finding a negative, non-significant correlation between the sale of assets and the turnaround success. Eichner (2010, p. 213) as well as Naujoks (2012, p. 101) and Schmuck (2012, p. 99) find a significant positive correlation between divestments and restructuring success.

CAPEX: Eichner (2010, p. 213) finds no significant relationship between both the reduction and the increase in investments and the restructuring success. Buschmann (2006, p. 190) finds a negative but not significant relationship of CAPEX reduction and firm performance. Buschmann (2006, p. 193) argues that, although successful companies initially reduce CAPEX, they must invest significantly more in the following years to achieve long-term corporate success.

OPEX: Sudarsanam and Lai (2001, p. 185) consider a reduction in costs to be relevant to success, especially in the initial phase of the turnaround process. Overall, the relevance of cost reduction measures seems to be high, especially in the initial phase of the turnaround process (Robbins & Pearce, 1992, p. 291), since this phase is about stopping the decline in the company’s performance, stabilizing it and, thus, securing its survival by increasing the

cash flow. Buschmann (2006, p. 178) finds a positive but non-significant correlation between cost reduction and turnaround success. Castrogiovanni and Bruton (2000, p. 30) find no significant relationship. Studies that have identified a negative correlation between cost reduction and turnaround performance, such as Morrow et al. (2004, p. 201), find a negative but non-significant correlation between cost reduction and ROI in growing industries. Naujoks (2012, p. 101) finds a negative, non-significant correlation between cost reduction and turnaround success.

Working capital: Improving working capital is one way of improving the financial situation of a company in a relatively short term (Bibeault, 1999, p. 272). Inadequate control of working capital can even be a reason for a company's decline in performance (Grinyer et al., 1988, p. 32). Reducing working capital reduces the amount of capital tied up in a company. Consequently, financial resources are released (Meyer, 2007, p. 415). The funds released can then be used for the turnaround or new investments. Bergauer (2001, p. 223) points to the necessity of exploiting liquidity with the help of creditor and debtor management as the main positive effect in change management and turnarounds. However, the effect depends on the size of the company. Howorth and Westhead (2003, p. 94) point out that, for small companies, a strict, organized working capital management has a much greater effect on the turnaround performance. Small companies need to control working capital, as they generally have a comparatively higher proportion of short-term assets, lower liquidity, higher cash flow volatility and greater dependence on short-term debt than more mature and older companies (Howorth & Westhead, 2003, p. 94).

Debt reduction: A high debt–equity ratio and the associated high interest payments can influence a company's funding ability (Pant, 1991, p. 628). However, an increase in the debt ratio can enable necessary growth spurts and restructuring. Naujoks (2012, p. 101) finds a significant positive correlation between the reduction of the debt ratio and the turnaround success. Eichner (2010, p. 221) as well as Hartmann (2016, p. 201) do not find any effect. Here, it is possible to assume a threshold in terms of the ratio between free cash flow and the debt-to-capital ratio with a positive effect of a rising free cash flow on the potential to increase the debt-to-capital ratio (Damodaran, 2002, p. 361).

Company size: The company size can have an influence on the turnaround success. From a more resource-oriented perspective, Ramanujam (1984) argues that large companies are more likely to achieve a turnaround due to their larger resource base and experience. In

contrast, Smith and Graves (2005, p. 316) find a positive correlation between the size of a company and the turnaround success. Eichner (2010, p. 221), on the other hand, finds a negative but not significant correlation between company size and turnaround success. Just as in firm growth research, the restructuring/turnaround research provides the indication that firm size is a relevant control variable.

Concerning the performance indicator, Hartmann (2016, p. 87) and Eichner (2010, pp. 55-61) pointed out that the existing literature contains a multitude of different concepts for turnaround and restructuring as well as for its operationalization in research. It should also be noted that there is a common understanding of performance criteria. Hartmann (2016, pp. 88-89), for example, found at least three groups of performance criteria in 32 empirical studies, although the majority of performance indicators is accounting-related indicators, with the majority of studies in this area preferring ROI or ROIC (Eichner, 2010, pp. 280–281; Hartmann, 2016, p. 92). As a benchmark, it can be defined that restructuring is successful if the company's ROIC achieves at least 7% to 9%, which is above average risk-free interest rate of government bonds plus the risk premium of the capital market (Hartmann, 2016, pp. 94–95; Buschmann, 2006, p. 161). Otherwise, the further investment does not generate an acceptable return to justify the continuation of the company.

2.2.4.3 Firm Performance Metrics

Delmar et al. (2003) state that one third of the studies included in their literature review uses revenue growth as growth indicator. Shepherd and Wiklund (2009) even found that two thirds of firm growth studies uses revenue as growth metric. Achtenhagen et al. (2010, p. 293) find that almost 50% of the examined studies use revenue growth as growth indicator, 30% staff numbers and 20% measure the management's growth intention. 40% of the studies are only cross-sectional studies; 60% are longitudinal studies. Only 30% of the studies are based on secondary data, while 70% are based on primary data (Achtenhagen et al., 2010, p. 293), which does not allow to reproduce or to compare the results. Achtenhagen et al. (2010, p. 309) find in interviewing 2,000 Swedish CEOs a wide gap between the growth perceptions and metrics of managers and business research, concluding that growth metrics and factors in business research are mainly quantitative, whereas managers prefer to apply also a lot of qualitative indicators and qualitative factors to explain firm growth.

Quality measures are seldom in academic literature. Some studies use qualitative growth indicators, such as innovation intensity increase (e.g. Beers & Zand, 2014; Frenz & Letto-Gilles, 2009). According to Kanji et al. (2015, p. 51), traditional metrics for evaluating growth and performance are limited to isolated aspects, lacking the necessary complexity to capture the full range of factors that contribute to these outcomes. As such, there is a need for a more multifaceted approach to assessing firm growth and performance. One promising avenue is to measure performance in terms of the proportion of innovative sales to total revenue, an approach employed by recent studies such as Frenz and Letto-Gilles (2009) and Beers and Zand (2014).

However, on the one hand, there are studies that have failed to uncover any correlations between firm performance and innovation growth (e.g., Acs et al., 2008; Coad et al., 2014). On the other hand, it is suggested that these indicators are most useful for evaluating the performance of technology-driven firms and may serve as reliable predictors of revenue or income growth. It is important to note, however, that innovation growth may not be an appropriate metric for evaluating firm performance across different industries (Coad et al., 2014, p. 35).

To sum up the results so far, existing research primarily utilizes two indicators to gauge firm growth: (1) employment growth and (2) annual turnover or sales growth, with profitability ratios being less commonly used in empirical research. However, this study employs a broader range of measures to capture multiple dimensions of firm performance. Specifically, the study employs (1) revenue growth to assess quantitative growth, (2) operating income growth to evaluate qualitative growth, and (3) profitability ratios, such as ROA, ROE, or ROIC, to determine overall firm performance. By incorporating both traditional measures of growth (i.e., revenue and employment growth) and additional indicators to differentiate between qualitative and quantitative growth and to explore the relationship between investment activities and profitability, this study aims to offer a more comprehensive assessment of firm performance.

Achtenhagen et al. (2010, p. 289) note that firm growth research is relevant when theory is linked with business practice. However, academic research develops and often answers research questions that have no relevance in terms of management practice; or uses definitions, concepts, and indicators that are also not relevant in the reality of business management. Moreover, the selection of such indicators is not explained or substantiated

(Achtenhagen et al., 2010, p. 294). This becomes particularly apparent in the diversity of different growth indicators, which are stated below in Table 6. Thus, it is to be questioned, for example, why the ROE is used as a performance indicator, as it is an indicator that is rejected as being useful by the financial analysis research due to its calculatory sensitivity to moral hazards.

Table 6: Examples and Frequency of Growth Indicators in Empirical Research

Growth Indicator Variable	**Percent**
Revenue (also called sales or turnover)	41.8
Number of employees	27.3
Growth intention	18.2
Profitability	7.3
Combined measures	16.4
Growth Strategies	16.4

Source: Achtenhagen et al. (2010, p. 293).

3. Research Design

3.1 Research Philosophy and Data Model

Research design development should start with the researcher's more or less explicitly stated research philosophy (Easterby-Smith et al., 2015, p. 8), which can mainly be assigned to realism, objectivism (positivism), constructivism or pragmatism. Research philosophy is less a question of a decision but more of a priori existing values and attitudes of the researcher, resulting in a system of assumptions and beliefs about the nature of knowledge (Saunders et al., 2016, p. 124). Thus, a research philosophy is rather formed in the researcher's lifecycle and is generally not a clearly defined concept of the nature of knowledge or science or the result of a rational decision process (Saunders et al., 2016, p. 121).

Objectivism is the meta-theoretical basis of this study, assuming the existence of an observer-independent reality in the form of objective financial data. Also, such data are collected and calculated by financial accounting conventions (rules standardizing the collection and aggregation of data). This data is numerical and structured given the definitions and standardization, allowing to objectively measure management decisions, which are social constructions by nature.

In summary, this study takes a constructionist view by adopting the financial data model of the firm as a mental model (Napier, 2009, p. 43). However, the study also employs a positivist perspective by utilizing numerical data to generate robust assumptions about cause-and-effect relationships. The existing data model of the firm, as provided by reporting standards (Most, 1977, p. 38), can be considered an intersubjective model of the firm, established to inform various external stakeholders about the firm's business economics (Sunder & Yamaji, 1999, p. 27). Thus, this study draws on both constructionist and positivist perspectives to provide a comprehensive understanding of firm performance.

A model represents a system of model components and defines the relationships among them (Bryman & Bell, 2011, p. 229). However, both elements of the scientific method are rarely differentiated in business administration research. While a theory consists of a system of scientifically substantiated statements to explain certain facts or phenomena and underlying laws, a model is the abstract, simplified representation of the essential influencing factors of a process or the elements of a system (Burke, 2002, pp. 176-177).

At a fundamental level, it is possible to convert a theory into a model, but the reverse is not necessarily true (Bryman & Bell, 2011, p. 229). Like a theory, a model serves to structure relevant knowledge about a subject area into an orderly format, resulting in a conceptualization of the observed reality. Both theory and modeling achieve this by establishing a system of relationships. However, while a theory takes shape through the system of linguistic descriptions of the interaction of system elements and cause-and-effect relationships, a model represents the relationships through visualizations, usually in the form of graphic representation for heuristic, content-based models or through mathematical calculations for formal models (Zikmund, 2009, p. 701).

Consequently, a model is a simplified representation of a subject area. According to Helfrich (2016, pp. 67–71), model building requires:

(1) the reduction of the complexity of the subject area, resulting in a simplified representation of reality

(2) the definition of the relationships between the model components.

In principle, two types are distinguished: (1) heuristic models and (2) formal models:

(1) Heuristic models as well as heuristic theories are referring to a particular observed area of reality, focusing on the inherent structure of the observed segment of reality. Heuristic models are descriptive or functional models. They describe a structure of functional relationships.

(2) Formal models are quantitative models. They describe a system of components by their formal, quantitative relationships.

Formal models are expressed as an objective, mathematical function that represents the variable to be optimized in terms of specific independent variables (input variables). The primary areas of application for formal models in business research and economics are aimed at enhancing economic activities, processes, and outcomes, as well as forecasting economic trends. With the help of formal models, target indicators can be maximized or minimized.

The system of the external financial reporting consisting of the income statement, balance sheet, and cash flow statement can be interpreted as a formal financial model of the firm. This "*accounting model of the firm*" (Bruner et al., 1998, p. 165) results from requirements

of shareholders and financial regulations and legislation defining its components and the data to collect the firm-specific data for these model components (Wahlen et al., 2016, p. 94). Therefore, some researchers consider the financial reporting model of the firm as an independent model and "*a rational abstraction of the firm's economic and decisions-making processes*" (Zambon, 2013, p. XVIII).

In conclusion, regarding the research philosophy adopted in this study, it can be stated that it follows both objectivism and constructivism. The constructivist perspective on the firm is based on the accounting model of the firm, which enables the use of financial analysis as the fundamental theory that defines what is measured by financial indicators and how to interpret the evidence obtained from data analysis of individual companies or cause-and-effect models resulting from data analysis of a sample of companies.

This study is based on the fact that all business-relevant activities are visible in the changes of accounting data. All business-relevant qualitative activities lead to transactions recorded in the accounting system sooner or later; and are—in the case of limited companies and listed companies—aggregated and presented in the external financial reporting.

In addition, the ongoing process of international standardization and the use of refined definitions, as exemplified by the Generally Accepted Accounting Principles (GAAP) and International Financial Reporting Standards (IFRS), have contributed to the harmonization of accounting and valuation principles across different countries and regions (Zimmermann & Werner, 2013, pp. 15–40). This standardization has led to the creation of highly objective and comparable financial reporting data. Consequently, researchers and practitioners are able to compare financial data across different firms and industries, as well as over time, with greater accuracy and reliability.

The financial model of the firm consists of three main components, namely the income statement, the balance sheet, and the cash flow statement, as defined by reporting standards (Most, 1977, p. 38). The primary purpose of establishing this model was to provide data and information to the external stakeholders of the firm regarding its business economics, as noted by Sunder and Yamaji (1999, p. 27). It hereby ensures that there is a high level of standardization in the presentation and documentation of financial data.

Some researchers note that the financial reporting data model represents a specific model of the firm, which also implies another specific theory of the firm, as the financial model is "*a rational abstraction of the firm's economic and decision-making processes*" (Zambon, 2013,

p. XVIII). According to the new institutional economics, the firm is the result of contracts and business decisions of managers, employees, stockholders, suppliers and customers.

To observe management activities and its effect on firm performance, the collection of intentions, attitudes and other personal characteristics as preferred in qualitative research is not necessary: “Success is based on results, not motivation” (Alchian, 1950, pp. 213–214). Therefore, this study focuses primarily on measurable managerial results, as they become apparent in changes in financial data and do not examine management decisions. Only the supplementary case studies use qualitative data to triangulate the results of the statistical data analysis.

The three components of the financial model of the firm provide different classes of accounting indicators: The balance sheet provides stock variables, while the income statement and cash flow statement provide flow variables (Sunder & Yamaji, 1999, p. 28). A stock variable indicates a quantity in existence at a moment in time, whereas a flow variable measures the change of an indicator over a period of time and measures, thus, the aggregated quantity (amount) of past flows of money or goods (Dwivedi, 2010, p. 31):

- The income statement, according to Stolowy and Lebas (2013, p. 57), serves as a documentation of all transactions related to the firm's activities on the level of business operations as they impact the success of the firm, specifically those associated with serving customers within the accounting period.

- The balance sheet but also the cash flow statement provide documentation to the results of activities that are related to investing and financing (Stolowy & Lebas, 2013, pp. 491, 508). Specifically, the cash flow statement states how cash is created by the firm’s activities and how operational activities, financing activities and investing activities contribute or provide changes to the cash position (Stolowy & Lebas, 2013, p. 57).

Thus, the accounting data provides an implicit model of business activities (Stolowy & Lebas, 2013, p. 2). In the framework of this research, firm performance is seen as the result of the multitude of decisions that can be observed by accounting data. Decision making is observed by the fluctuations in the stock variables and flow variables indicated by change rates and information on resource allocation decisions indicated by ratios allowing to observe three essential area of management activities (McMenamin, 1999, pp. 29–30):

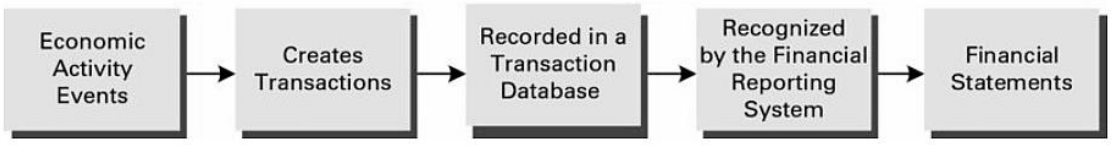
(1) Cash flows from operating activities represent the cash inflows and outflows related to the firm's core business operations, such as cash received from customers for goods and services and cash paid out to suppliers for inventory or other operating expenses.

(2) Cash flows from investing activities represent the cash outflows for purchasing or investing in tangible and intangible assets, such as property, plant and equipment, and intellectual property.

(3) Cash flows from financing activities represent the cash inflows and outflows related to the firm's financing activities, such as raising new capital through the issuance of bonds or shares resulting in cash inflows, and repayments of debt capital such as loans. This category also includes dividend payments to shareholders.

Business activities create transactions that are recorded in the accounting and transformed by a regulated procedure into financial statement data. Therefore, the financial statement data is the end result of an economic activity reporting cycle, which is grounded in economic activity events. The process can be depicted as shown below in Figure 2:

Figure 2. Economic Activity Reporting Cycle



Source: Ginter et al. (2018, p. 599).

The financial analysis research provides the instruments to interpret such kind of data. The analysis of key financial figures is a common method for the analysis of such data to assess the business performance of a company. Ratios are of particular importance for the interpretation of the raw data from the annual report (Ginter et al., 2018, p. 612), such as (1) liquidity ratios, (2) profitability ratios, (3) asset ratios and (4) capital structure.

The basis for the analysis of the most important activities in a company is formed by the data from the financial analysis (Albrecht et al., 2011, p. 216). These include activities of (1) operational management, (2) investment management and (3) financial management:

(1) Operating activities in the context of operations management are defined as all events involving buying inventory, manufacturing processes and selling products and services (Albrecht et al., 2008, p. 228), so that operating activities are equal to the concept of the input-output transformation of the firm. All these results are reflected in accounting data because all operating activities are associated with financial transactions, such as paying for necessary expenses and income from selling activities.

(2) Financing activities in the context of financial management involve raising money to finance business operations by means other than the cash flow from business operations. As such, financing activities are defined as all transactions and events, whereby resources are obtained from or repaid to creditors (debt financing) and owners (equity financing) (Albrecht et al., 2008, p. 228). Financing activities can be broken down into financing decisions in terms of managing equity and liabilities and managing the payout of dividends (dividend policy) in the framework of the management's shareholder policy.

(3) In investment management, investment activities encompass all transactions and events that involve the sale and purchase of tangible and intangible assets, including financial assets (Albrecht et al., 2008, p. 228). The investment behavior of the "average firm" typically follows market cycles, as evidenced by strong empirical evidence (e.g. Brost, 2005, p. 117–122). Therefore, growth is largely dependent on market cycles, which justifies both the stochastic and microeconomic perspectives on firm growth. The differences in growth behavior among firms can only be attributed to qualitative factors, such as better management, according to the MBV and RBV of the firm. This study does not aim to explain growth through the visible hand of management or the invisible hand of the market, but rather through the observation of corporate behavior in terms of financials, including differences in growth, investment, and financing behavior.

All three types of management activities can be subsumed under the terms business management and financial management, following the guidelines of the strategic management determining the financial market policies and the product-market strategy. Each management activity leads to costs and revenues, income and expenses, cash inflow and cash outflow, as reported in the income statement, the cash flow statement and the balance sheet and measured by asset metrics, capital structure indicators, financial strength metrics (financing ratios, respectively capital structure indicators) as well as performance and profitability indicators like shown below in Table 7:

Table 7. Management Activity Indicators and Business Performance Indictors (Examples)

Indicator Groups	**Exemplary Variables**	**Description**
Firm Growth	− Revenue Growth − Market Capitalization Growth − Net Income Growth	Such variables are indicators for the business success of the management's decisions and the output from firm-specific skills and knowledge in the areas of strategy, procurement, research and development, operations and financing. Firm growth variables represent the results of all explicit or implicit decisions and actions of the organization in interaction with market forces.
Operations Efficiency	− Asset Turnover − Operating Margin − Cash Conversion Cycle	Efficiency can be defined as the difference between input and output. Such variables describe the efficiency of operations on different levels.

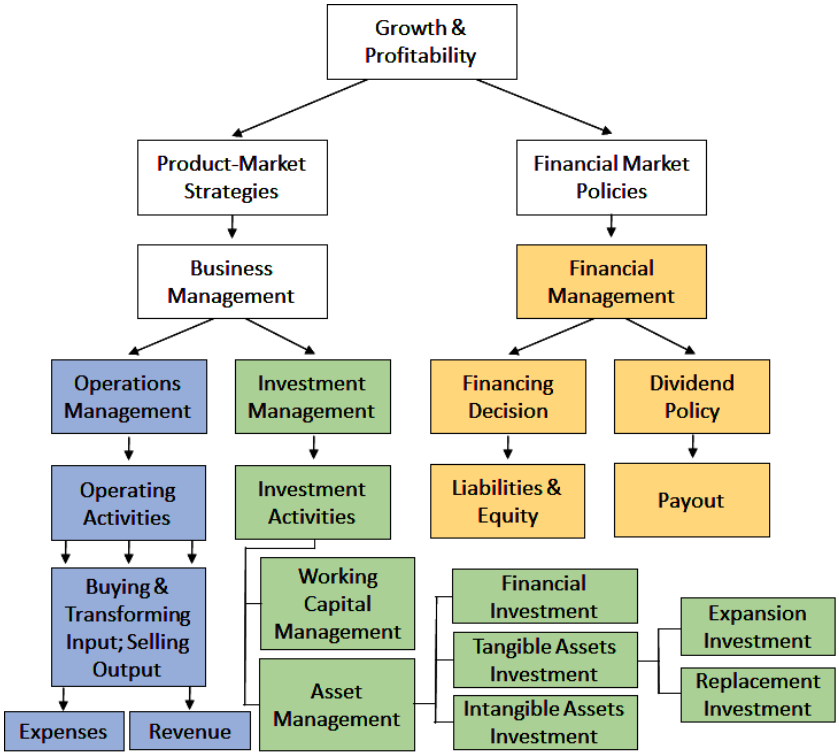
Indicator Groups	**Exemplary Variables**	**Description**
Investment Activities	− Investments in property, plants and equipment (PPE) − Acquisitions, net − R&D expenditures as % revenue − Investments in technology − Capital Expenditures as % revenue − Intangible Assets as % total assets	Such variables indicate how the firm expands and, in comparison with measures like debt issued and the debt-to-equity ratio, how the firm finances growth.
Capital Efficiency (Profitability)	− Working Capital to Total Capital − Capital Expenditures as % revenue − ROA − ROE − ROIC	Management is efficient when it uses the lowest amount of input to create the greatest amount of output. Capital efficiency ratios indicate the efficiency of using the different.
Financing Activities	− Financial Leverage − Debt/Equity − Dividend Paid − Retained Earnings	Such variables indicate capital structure decisions (financing decisions).

Source: Own presentation.

As mentioned, the analysis of indicators and ratios enables to analyze management activities for company outsiders. Thus, for example, the ratio analysis aims at evaluating the effectiveness of the management activities in each of these areas. Ratio analysis involves relating the financial data to underlying business activities and indicators (Palepu et al. 2007, p. 318). Main ratios for assessing operating management efficiency are (1) gross profit margin, and (2) administration cost in percent of revenue (Palepu et al., 2007, p. 324–340).

The gross margin is influenced by three factors: (1) the price premium that a firm's products or services generate, (2) the efficiency of the production process and the cost efficiency of operations and (3) the cost efficiency in the procurement. The price premium a firm's products or services can command is influenced by the degree of competition and the extent to which its products are unique (Palepu et al. 2007, p. 324). As a consequence, performance can be visualized in principle in relation to numerous variables that are interrelated. The principle of these relations is shown below in Figure 3:

Figure 3: Model of Management Objectives, Activities and Outcomes



Source: Own presentation referring to Palepu et al. 2007 (2007, p. 318).

3.2 Research Questions and Hypotheses

In summary, the current state of research on capital structure and business performance indicates that empirical studies investigating the reasons for selecting a particular capital structure yield inconsistent results with regard to the rationality of financing decisions. This gap in understanding the factors contributing to the heterogeneity of capital structures among companies serves as the starting point for this research. This study aims to explore the

relationship between capital structure and business performance by examining investment activities, operations activities, and financing activities. As there is relatively little research on the recursive relationship between capital structure and business performance, this approach is considered exploratory in nature. (Iyoha & Umoru, 2017; Margaritis & Psillaki, 2010).

As already mentioned in chapter 1, this study uses the financial analysis research to explore secondary data (financial data from stock-listed companies) to examine the relationship between management activities (operations activities and investment activities), management efficiency and business performance (firm growth and profitability) in relation to capital structure to answer the research questions that have been stated as:

(1) Can business performance differences explain capital structure choice of firms? (RQ1)

(2) Can capital structure explain differences in business performance? (RQ2)

Since the discussed research areas (capital structure, firm growth, firm performance) led to a multitude of factor models and found a multitude of different correlations between a multitude of variables, this study follows an explorative research approach. Therefore, this study does not confirm or reject an existing factor model or assume cause–effect relationships based on the discussed literature. Consequently, no research model and, therefore, no hypotheses are developed. Instead, both factor dimensions are examined in different steps of the research procedure.

3.3 Sampling and Data Collection

This study is based exclusively on financial data of annual financial reporting statements. The data has been gathered from GuruFocus, a financial data service provider. The research questions are answered through the explorative analysis of financial data. The sample includes listed companies headquartered in Germany. Obviously, the focus on Germany allows for the consideration of data from a leading trading economy with strong export activities and an important manufacturing sector and services sector (BMWI, 2021; Prittwitz, 2022) as well as a leading international position in knowledge-based industries, as exemplified by German companies' strongly established role in research and development (Belitz et al., 2019).

The focus on a single country is considered to be of help, as it excludes potential external intervening variables, which is often an issue in the case of cross-country studies, as was mentioned in the section on capital structure theories in the preceding chapter (Schmitt, 2009, p. 123; Havlik et al., 2012, p. 219). However, it must be mentioned that, while the data is certainly providing a rough picture of the German economy, due to the existence of a relatively large number of medium-sized firms (called Mittelstand in German) (Mueller, 2007, p. 283), there might still be a large number of economically relevant firms that are potentially not listed and therefore not included in the sample.

The selection of only companies from Germany also provides an argument for the assumption that the subjects are active within a comparable business environment regarding the tax system, they operate with the same interest rates and highly comparable regulations, such as corporate governance regulations, accounting and report regulation and others (Schmitt, 2009, p. 123; Havlik et al., 2012, p. 219). However, given the much pronounced international activity of globally oriented German firms (Belitz et al., 2019), it is fair to assume that German firms are otherwise also heavily impacted by additional regulations and market characteristics that are unique in their specific field of business as well. Nevertheless, it can be assumed that the companies included in the sample do share at least higher similarity regarding issues like tax treatment, insolvency proceedings, financial market conditions and other such factors than a truly internal set of companies headquartered in different countries. Consequently, regarding the capital structure, the irrelevance proposition theorem and the trade-off theory are the same for all included companies.

The observation period to be used as the database within this thesis spans a total of 12 years and is set to range from the year 2008 until 2019. This time period is within the general interest of academics on historical data for German stock market returns, which has, consequently, been researched more extensively as well (Stehle & Schmidt, 2015, p. 2). For this observation period, sufficiently complete time series of financial data are available. Unfortunately, when attempting to use earlier data from before the year 2008, data quality was not good enough to justify the inclusion of the data. Such data is only available in the case of some companies that have a long tradition of being listed in the German stock market. For example, the data shows that in the particular case of MAN SE, an industrial firm, the available data even goes back for a long time until the 1970s. However, this example is an exception. Consequently, data from before the observation period cannot be included due to availability issues. Also, due to some missing values for some firms in the case of the year

2020, the year has been dropped as well from the final set of data to be used in the empirical analysis.

The data that was gathered is in the form of panel data, which is also called longitudinal data. A panel data set is hereby characterized by having a cross-sectional as well as a time series component (Wooldridge, 2013, p. 448). The total panel includes financial data from 361 different listed firms[4] from Germany, for which a total of 4,229 firm years are available. However, it must be mentioned that the availability of firm year data does not necessarily imply the availability of data for the calculation of every variable for every firm during the time period, as there are still some missing data for some firms, which could not be gathered from the data as collected from the financial service provider.

Also, there is a potential survivorship bias in the data due to some stocks being delisted or included in the data. This does potentially cause a distortion of statistics drawn from such data, as studies that are referring to other indices have shown (Davis, 2015). However, the observation of the data shows rather little firms to be delisted, providing an argument for the delisting bias in the data to be rather small. What is interesting to note is that the delisting of firms has occurred within the last couple of years, as depicted in Table 8, where an overview of firm data is presented:

Table 8: Overview of firm data

Years with firm data in Sample	Included Firms per year	% of dataset
2008	360	8.5
2009	356	8.4
2010	358	8.5
2011	357	8.4
2012	355	8.4
2013	353	8.3
2014	353	8.3
2015	351	8.3
2016	353	8.3
2017	348	8.2
2018	344	8.1
2019	341	8.1

[4] A total of 44 firms from the financial sector have been excluded to ensure comparability in the sample.

Years with firm data in Sample	Included Firms per year	% of dataset
Total	**-**	**100.0**

Source: Own presentation.

The delistment effect in the sample can be seen in line with the general market trend of the number of listed companies to decrease, which has been observed not only in Germany but also in the UK and the US (Katsamitros, 2019). As such, it must not necessarily have an impact on the analysis of capital structure and its relation to business performance and vice versa, particularly because of the fact that delisting is relatively rare, as is evidenced by Table 8.

3.4 Dealing with Outliers in the Data

A challenge in the analysis of financial data is the presence of outliers in the form of extreme values in the dataset. When these outliers can be interpreted generally as noise, rather valuable information, it is recommended to eliminate this subgroup of data from the final dataset is used for the analysis of the research questions. If such data is kept and not eliminated, the results of the analysis can be subject to misinterpretation, which can lead to false conclusions. There are two main ways that are mentioned in the literature on empirical finance, which can be used to solve these problems. These are winsorization and truncation, which are described below (Ang, 2021, pp. 61–62):

- Winsorization: Replacement of the values that are present above or below a certain threshold in the form of a percentile like at the level of 0.5% with the value at this cut-off point.[5]
- Truncation: Contrary to the procedure used for winsorizing, truncation eliminates the data outside the percentiles that are defined by the researcher to be outliers.

Generally, it can be stated that there is no existing rule regarding the application of such data manipulation methods as well as choosing winsorization or truncation in a particular situation. The choice is considered to be made best in the context of demands of the analysis.

[5] That means in the context of the example that the values above 99.5 percent are replaced with the value that is measured at the 99.5% level. Similarly, values below 0.5% are replaced with the level measured at the 0.5% level.

Also, the decision for a particular approach should be considered more intensely if the results are materially changed by the selection, so that results can be impacted (Ang, 2021). Also, the level of the cut-off point for winsorization (or truncation) can be selected differently than at the 0.5% level shown above. For example, other authors perform winsorization using 1% for the percentiles and in the context of ratios that are calculated from financial statements like performance ratios (Braun et al., 2017; Habib et al., 2013). This is comparable to the method in this thesis, where winsorization was applied using a 1% percentile.

3.4 Overview of Variables

The basic financial data that has been gathered from the financial data provider GuruFocus was used to derive suitable variables from, regarding capital structure and performance. Regarding performance, operational, investment management and other indicators have been used. The final set of data includes a total of 13 variables, which are shown below in Table 9:

Table 9: Overview of Variables

Variable	**Code**	**Calculation / Definition**
Capital structure variables		
Debt Ratio	DE	Ratio of debt to total assets
Interest Coverage Ratio (EBIT / Interest Expense)	EI	EBIT divided by interest expense
Long-Term Debt / Total Debt	LTD	Long-term debt divided by total assets
Operational management indicators for performance		
Operating Margin	OM	Ratio of operating income divided by revenue (net sales)
Asset Turnover	AT	Sales divided by total assets
ROE	ROE	Return on a firm's equity (tangible equity)
YoY revenue growth	REV	Yearly growth in revenues
YoY profit growth	PRO	Yearly growth of net income

Variable	Code	Calculation / Definition
Investment management indicators for performance		
ROIC	ROIC	Return on invested capital[6]
CAPEX / Total Assets	CAP	Total capital expenditures divided by total assets
ROA	ROA	Return on total assets
Other indicators for performance		
Price-to-Book Ratio	PB	Ratio of price to book value
Price-to-Earnings Ratio	PE	Price divided by earnings

Source: Own presentation

In order to analyze different groups that exist within the dataset, relevant subsets of the total data were defined. The criteria for the definition of the subsets were based on differences in growth behavior (high growth vs. low growth), company size as well as company type (i.e. industry). Specifically, the following subsets have been constructed:

1. *Revenue growth*: Two subsets based on the median value with a group having lower and higher growth, respectively;
2. *Profitability growth*: Similar to revenue growth but both groups are distinguished using profitability growth;
3. *Size*: Two groups with the log of total assets[7] as a distinguishing factor and the median used for group definition;
4. *Company type*: Three subsets of the data have been defined, which represent the three most frequent industries in the data: industrials, technology and consumer cyclical. These can be mentioned as typical for representing the German market according to the stock market data.

[6] The definition of ROIC is: Return on Invested Capital (ROIC) = (EBIT - Adjusted Taxes) / (Book Value of Debt + Book Value of Equity - Cash), according to GuruFocus who provides the ROIC value.
[7] It should be mentioned that total assets have been winsorized similarly to other variables from the dataset by applying a 1% percentile.

3.5 Data Analysis Procedure and Methods

In this last section of this chapter, the methodological approach to the data analysis will be explained. These include bivariate analysis and regression analysis. Also, an artificial neural network was employed on the data, which will also be described. Finally, a note on group distinction will be made. An overview of the methods is provided in the first subsection below.

3.5.1 Overview of the Data Analysis Procedure

The analysis of the data is performed in several distinctive steps. Most of the methods applied can be considered independent from each other. However, the first step in the analysis, the bivariate analysis, is also used for excluding particular variables from later analysis, such as regressions. Insofar, the analytical procedure is performed in steps, as shown below in Table 10:

Table 10. Statistical Analysis Procedure

Step / Method	**Sample and Variables**	**Methods and Statistical Tests**
Step 1: Bivariate Analysis	Total sample	Calculation of bivariate correlations between variables; calculation of variance inflation factor
Step 2: Regression Analysis	Total sample Selected samples distinguished by differences in revenue growth, profit growth, size and company type	Panel regression analysis; stepwise forward regression, regression with fixed and random effects Hausman Test
Step 3: Artificial Neural Network analysis (ANN)	Same as in step 2	Determination of predictive capabilities of variables with using a linear regression model in the ANN environment
Group Comparison	Comparison of selected subgroups as defined in step 2 regarding growth	Interpretation of differences of results from preceding analysis regarding the sub datasets (groups)

Step / Method	Sample and Variables	Methods and Statistical Tests
	in revenue and in profitability as well as regarding size and industry (three top industries in Germany) Evaluation of top and bottom half of the dataset for each group	Application of t-test for mean value differences of important variables

Source: Own presentation

3.5.2 Bivariate Analysis: Correlation and VIF

Bivariate analysis is an analysis between two single variables, such as in a simple linear regression model, involving only variables x and y (Wooldridge, 2013, p. 22). Similarly, the correlation coefficient between two variables provides another type of bivariate analysis. In this thesis, the Pearson correlation coefficient was used for every possible dichotomous combination of variables, as depicted in Table 9. The Pearson correlation coefficient is not dependent on the scale of measurement and also independent from sample size. It is defined to range between +1.00 and -1.00, which indicates perfect positive or negative correlation, respectively. Values for the Pearson correlation coefficient of 0.00 point to the conclusion that no relationship between variables exists (Tabachnick & Fidell, 2013, pp. 55–56).

While bivariate correlations have their place in the analysis, they also have drawbacks. For example, bivariate correlations cannot reveal whether there potentially are factors within the data that can serve as supervariables (Tabachnick & Fidell, 2013, p. 3). Also, the analysis of the correlations between input variables can give the researcher valuable information on potentially existing problems in the calculational model. As such, the interpretation of the correlation coefficients serves as a type of data reduction method as well. Data reduction is applied in multivariate statistics as a way for summarizing information from multiple variables into a reduced form. This can be performed via different techniques, for example with factor analysis (Zikmund et al., 2009, pp. 595–596). In this thesis, factor analysis was not applied. That is because the total number of variables is considered to be relatively low,

so that bivariate correlations between variables shall be sufficient to detect considerable relations in the data. This is helpful in the case of analytical techniques, such as linear regression, whereas methods involving an artificial network do not necessarily suffer from highly correlated input variables (Pao, 2008).

In addition to the analysis of bivariate correlations between variables, the variance inflation factor (VIF) and the tolerance (TOL) were also calculated for controlling multicollinearity effects among regression predictors. Collinearity exists if there are variables that constitute nearly perfect linear combinations, while multicollinearity means that multiple variables show such behavior (Belsley et al., 1980). Both indicators, VIF and TOL, indicate that there is some level of collinearity. They can therefore be used for the evaluation of the quality of the model used such as the regression models:

- The VIF is a measure of the extent to which multicollinearity effects increase variance (Hair et al., 2014, p. 197). Generally, there is no widely accepted threshold for the VIF, with some scholars proposing that multicollinearity is not significant if the VIF is less than 10 (Mertler & Reinhart, 2017, p. 174), while others advocate for a VIF below 3 (Hair et al., 2014, p. 200). A VIF value of 1 indicates the complete absence of any collinearity effects (Hair, 2014, p. 197). Most scholars consider a variance inflation factor of less than 5 to indicate negative multicollinearity (Pedhazur, 1997, p. 298; Bonate, 2011, p. 69).

- The tolerance is the reciprocal of the VIF and indicates the proportion of a predictor's variance that is explained by other predictors included in the regression model. A tolerance of 0, which is equivalent to a VIF of 1, indicates no multicollinearity, meaning that the standard error of the regression model is not affected. A tolerance of 0.25, on the other hand, implies high multicollinearity, as 75% of the predictor's variance can be explained by another predictor in the regression model (Hair et al., 2014, p. 197). As VIF = 1/TOL, a TOL of 0.25 is equivalent to a VIF of 4 (1/0.25=4). Some researchers recommend a TOL > 0.8 to select the final model or assess the quality of a regression model (e.g. Scheld, 2013, pp. 203, 237). Following this recommendation, this research applies a very strict cut-off threshold for the assessment of a regression model or the selection of the final regression model among several models.

The measurement of VIF and TOL allows to control multicollinearity. In the case that several variables should be included or are entered in the regression model because it is necessary for theoretical reasons, the robustness of a model can be assessed by referring to these metrics (Schneider, 2010, p. 196). In the case of forward selection of the independent variables, a limit value is to be set accordingly, limited by a cut-off point to the number of possible regression models.

Moreover, the problem of outliers should be discussed. It is generally assumed that the OLS-based regression analysis using small samples is sensitive to outliers (Wooldridge, 2013, p. 302). Among a small sample, only a single outlier may produce exceptionally low or high regression coefficients. In larger samples, however, the normality assumption loses its significance, as the coefficients become increasingly independent from the distribution of the residuals according to the central limit theorem (Backhaus et al., 2018, p. 99). Then, only extreme outliers can distort the regression coefficients (Cleves et al., 2010, p. 2). According to Backhaus (2018, p. 99) and Wooldridge (2013, p. 155), reality is characterized by outliers, whereas a bell curve distribution of observed values is the exception. Consequently, the normal distribution assumption is principally violated (Baltes-Götz, 2018, p. 64). Therefore, the central limit theorem states that the observations for a variable can also be considered as normally distributed if the number of observations is sufficiently large (Wooldrigde, 2013, p. 155).

Moreover, the multiple linear regression can be considered as sufficiently robust against violations of the normal distribution assumption. According to the central limit theorem, a normal distribution can be assumed even in very small samples if the mean and median are very similar (Treyer, 2003, p. 103). Consequently, this research observes the robustness of the regression analysis, mainly by comparing the median and the mean for each variable in discussing the quality of a regression model. Also, issues regarding the impact from outliers are potentially mitigated due to the winsorization of variables as well.

3.5.3 Regression Analysis

Generally, a linear regression model describes the proposed or assumed linear relationship between a dependent and an independent variable (Wei, 2019, p. 16). In the case of a linear relationship between a single independent variable, the model can be referred to as a simple linear regression model. In linear regression, the dependent variable is also called the

explained variable, while the independent variable can be called explanatory variable, regressor, or predictor variable (Wooldridge, 2013, pp. 22–23). Regression analysis is therefore used as a technique for examining quantitative relationships between the predictor variable and the predicted variable.

In the case of multiple independent variables within a regression model, the model forms a multiple regression analysis. Here, the dependent variable is predicted with a set of independent variables. Due to its flexibility and improved ability for estimating parameters, the multiple regression methodology is a commonly used model in the empirical literature within economics or social science (Wooldridge, 2013, p. 68). Multivariate statistical methods, therefore, provide an extension to bivariate statistics, which is also mentioned as univariate statistics. Generally, relationships of bivariate nature are special cases of multivariate statistics (Tabachnick & Fidell, 2013, p. 1).

Due to the large number of variables, the stepwise forward regression method was applied first in order to obtain a relevant set of predictors, which are later used for fixed and random effects regression. The stepwise forward regression method is performed by gradually adding predictor variables in a stepwise manner to the regression equation based on their explanatory power. The explanatory power is hereby measured by the R^2 measure of the regression model. Basically, the stepwise procedure works such that not all variables are introduced simultaneously into the regression model but in a stepwise procedure (Holtmann, 2010, p. 88).

In the stepwise forward regression model, the first independent variable x needs to be mentioned as the most important variable, as this variable is able to best explain[8] the variance of the dependent variable y. The independent variable x therefore shows the highest correlation. Subsequently, other variables are added to the original regression model. These are able to explain another part of the variance. Specifically, given that variable x_1 is the best variable for explaining the variance of y, then the second independent variable x_2 is a variable that is useful for explaining most of the remaining variance in the model. Therefore, with the addition of independent variables to the stepwise forward regression model, the regression equation is changing accordingly (Holtmann, 2010, p. 88). Generally, stepwise

[8] It can be mentioned that the best explanation is always considered within the context of the model itself. That means that the best variable for explaining the variance is considered the best option available within the modeling context. It can therefore not be stated that variables outside the model may be able to provide more of the variance.

regression can also be regarded as a type of data mining as well, as it automates the careful selection of variables for the inclusion in a model through its algorithm (Wooldridge, 2013, p. 686).

In the context of evaluating the capital structure variables DE and EI on the basis of the performance variables, y is either DE or EI, while the predictor variables $x = 1, \dots, n$ are either OM, AT, ROE, REV, PRO, CAP, PB or PE. Similarly, the analysis of the recursive relationship necessitates a change of independent and dependent variables. Given the results of the stepwise regression models, some of the models may occasionally be skipped from the final regression model. As such, the results shown in section 4.3.1 provide a preceding analysis or a decision criterion for the selection of the final model used in section 4.3.2.

The regression approach can nevertheless be stated as a panel regression, using a cross-sectional dimension with the time dimension t measured in years, and the respective firms stated as i. The time period conforms to the reporting periods of the firms in the dataset. Mathematically, the regression equation can be described as follows:

$$y_{i,t} = \alpha + \beta X_{i,t} + u_{i,t}$$

with

$i = 1, \dots, 361$

and $t = 1, \dots, 12$

In the regression equation, α is the constant, while $X_{i,t}$ refers to the vector of performance or capital structure variables, depending on whether the direct or the recursive relationship is being assessed. The symbol β depicts the vector of parameters for the independent variable vector. The error term $u_{i,t}$ can be depicted as the sum of the time μ_t and firm-specific μ_i effects plus an error term $\varepsilon_{i,t}$:

$$u_{i,t} = \mu_i + \mu_t + \varepsilon_{i,t}$$

Examples of unobserved firm-specific effects in the regression can include issues like managerial motivation or risk appetite, whereas unobserved time-specific effects can refer to differences in macroeconomic variables, for example, in relation to the term structure of interest rates or inflation (Chen, 2004; Hackbarth, 2008). As a result, firm-specific effects can imply the existence of agency issues, which can potentially lead to incentives that are detrimental to the interests of shareholders of the firm (Jensen & Meckling, 1976). An example of this is the issue of underinvestment, which is based on conflicts between holders of equity and debt (Myers, 1977). However, unobservable firm-specific effects do not show the sheer existence of such problems but point to the existence of differences between firms.

In order to determine whether the fixed effects or the random effects regression model is more useful, the Hausman test is used. This test is based on the null hypothesis of repressors being uncorrelated and fixed effects being unobservable. A significance of the Hausman test will lead to a rejection of the null hypothesis, making the fixed effects model more suitable for interpretation. Otherwise, if the null hypothesis cannot be rejected, the random effects should be used (Chen, 2004). However, in practice, the failure to reject the null hypothesis in the Hausman test can simply imply that there is not much difference between both fixed and random effects regression (Wooldridge, 2013, p. 498).

3.5.4 Group Comparison Analysis

The computations methodologically described so far will be applied to the entire dataset of listed firms in Germany. However, they will also be applied to selected subsets of the data with the aim to find group differences based on certain criteria. Given the results from the literature review, it is obvious that particular groups of firms potentially exhibit different characteristics, making it worthwhile to investigate the relationship between performance and capital structure based on group distinctions. The same can be stated for the recursive relationship as well. For the purpose of the analysis, group distinctions referring to company types (or industries), growth characteristics and size have been defined. These will be explained in more detail in the following. Also, the issue of ownership structure as a criterion for group distinction is discussed as well.

Sectors / industry

A central element in the analysis is the distinction between different groups that have rather homogenous attributes; or for which such attributes can be assumed. As for example performance issues are typically benchmarked and evaluated by financial analyst in comparison to firms in the same sector (Vernimmen, 2018, p. 133), a group selection based on sectors appears to be worthwhile. Sector distinctions for the purpose of group definitions are used in academic studies on capital structure and performance as well, like, for example, for data on listed firms (Margaritis & Psillaki, 2010; Salim & Yadav, 2012). However, in order to derive meaningful results for a sector-based group analysis, a sufficient number of firms from each sector needs to be included in the analysis.

Consequently, a suitable set of homogenous firms needs to be selected based on the firm data for the listed firms in Germany. This was performed based on the most frequent industry classification found in the data. Also, in order to have enough firm data for each group, a suitable selection of these clusters is required as well. Finally, this led to the use of data from three subsets: industrials, technology and consumer cyclical. These can be considered as highly relevant in the characterization of the German market.

Revenue and profitability growth

The issue of growth was intensively discussed already in the second chapter of the thesis, where it was shown that growth can be measured or evaluated very differently, depending on the classification criteria applied to the types of growth.[9] It is hereby particularly worthy to note that some growth types are rather qualitative in nature and therefore not deemed as very suitable to address with a quantitative method. Some growth types are also related to structural characteristics or addressed empirically with regard to the experienced intensity in the growth of a particular metric (e.g. revenue) in a given time span.

Given the challenge to adequately address the growth issues with a quantitative approach, a literature review by Gruenwald (2015) shows that a high proportion of studies use revenue growth as a proxy for firm growth. Similarly, growth in metrics related to earnings like net income, operating income or the like are also prevalent. Additionally, ratios have been employed as well. These can include return ratios such as return on equity, return on assets or measures related to stock price.

[9] A reference can be made to Table 2, where a total of eleven criteria have been used to distinguish growth types.

Given the prevalence of growth measures based on revenue and profitability, a group depicting revenue growth and profitability growth, respectively, was defined. Both group classes are distinguished into a high-growth and a low-growth group. The median was used as a cut-off point for both groups. This helps to have equally sized groups with different characteristics. However, the use of the median does not allow for the analysis of small samples of firms with either very high or very low growth momentum.

Size

Size is used as another criterion to distinguish different subgroups as well. This indicator is discussed in the literature too. While some authors do not state that there is a relevance of size in determining the capital structure, others point out differences. For example, Strebulaev (2007) states that large firms are simply a scaled version of smaller firms. Therefore, size does not have an impact on target leverage ratios. However, other authors assert such a relationship, claiming that differences exist between smaller firms and larger firms, i.e. because of their unique financing options as a result of size differences (Frank & Goyal, 2015).

Whether there are differences in financing option among listed firms of different size may be subject to discussion. However, it was decided that size will be used as another criterion for group distinction as well. Therefore, two groups were defined, separating firms into low and high size. This is based on the log of total assets as derived from the financial statements. Similarly to revenue and profitability growth, the median was used as the cut-off point for group distinction.

Ownership characteristics

In addition to the sectors that can be used to distinguish between different groups of firms in the data, there are other factors available for a useful distinction. For example, in the study of Margaritis and Psillaki (2010), firms are distinguished in terms of growth opportunities as well as ownership structure as well. Whereas growth is regarded as useful to the analysis in this thesis, ownership is of potentially less relevance.

Albeit ownership, especially regarding the role of family firms, has been found as being of relevance to explain distinctions in structural considerations of balance-sheet ratios (Lozano & Durán, 2017; Maury, 2006), it can be argued that this criterion is less relevant for a sample

because it is a sample that consists entirely of publicly traded firms. It should therefore not be considered further for the empirical analysis.

The analysis of group differences is approached by using either of two different ways. First, an analysis like regression analysis is conducted with respect to subsets of the total data, employing the same methodology as described in the preceding paragraph. Second, group differences for selected variables are evaluated as well in order to identify distinctions. To examine such group differences, the t-test is applied. The t-test is a statistical method that can be used to compare the means of different groups within a sample or between a sample and a larger population. There are two types of t-tests: (1) the one-sample t-test and (2) the two-sample t-test. The one-sample t-test is used to determine whether a sample is representative of a population by comparing the mean of the sample to a known population mean. The two-sample t-test, on the other hand, compares the means of two different samples or groups from the same population or sample (Sirkin, 2006, p. 272).

The t-test assumes that samples from the same total population or groups from the same sample are characterized by the same standard deviation. Consequently, the t-test results indicate the level of difference between the mean values of different groups or between a sample and the total population (Sirkin, 2006, pp. 201, 272) by measuring the statistical significance of the differences indicated by the p-value (Sirkin, 2006, p. 201). This research considers a difference at the usual level of $p < 0.05$ as significant.

The reliability of the t-test does not depend solely on the normal distribution assumption of the variable. When the group sizes are approximately equal, the t-test remains reliable, even in the case of extreme unequal distribution (Wenzelburger et al., 2014, p. 58; Bortz & Schuster, 2010, p. 122). Therefore, testing for normal distribution of the data is not necessary.

3.5.5 Artificial Neural Network Analysis

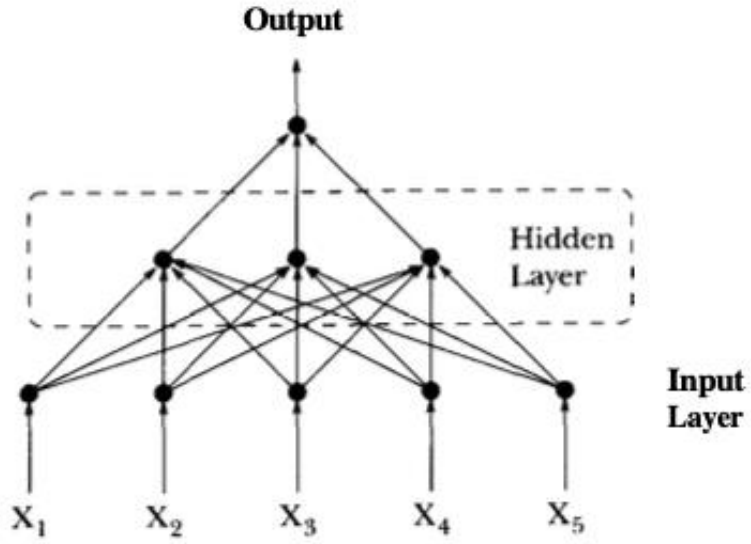
Another methodology that was applied for analysis is the artificial neural network analysis. This type of analysis is, in principle, a type of a nonparametric analysis technique, which has become prominent in the last couple of years. Originating from biological phenomena, artificial neural networks are, in principle, similar to nerve cells. Within physiology, this analysis techniques has been employed through engineering and for answering questions in business and finance (Campbell et al., 1997, p. 512). Generally, neural networks belong to

the realm of artificial intelligence, where computer algorithms are used for processing information, similar to the way humans are processing and learning (Zikmund et al., 2009, p. 169).

Through employing an artificial neural network model (ANN), it becomes theoretically possible to increase the accuracy of predictions significantly, for example, when applied to the prediction of capital structure on the basis of its respective determinants (Pao, 2008). As such, the modelling of capital structure themes is expected to improve in terms of accuracy and quality of prediction when compared with more traditional forms of quantitative methods like regression analysis. The improvement in the ability to predict capital structure parameters by employing ANNs can be mentioned as similar to results from other fields in economics and business research. Here, the application of artificial neural network analysis has shown to be able to produce more accurate results in forecasting parameters as well, including economic parameters (Kordanuli et al., 2017).

Technically, an ANN model consists of an input layer and an output layer. In between these two layers, there is at least one or even more hidden layers. The task of these hidden layers is to capture non-linear relationships that exist between the variables from the model. This is performed with the help of multiple neurons that are part of a layer. These neurons are connected with other neurons in adjacent layers. It is precisely through these non-linear interactions between the neurons that complex phenomena can be explained in a satisfactory manner (Pao, 2008). The basic design of an ANN is depicted in Figure 4 with the depiction of a single hidden layer and with five different inputs, described through the vector $X_j = X_{1,} X_2, \dots, X_5$ (Campbell et al., 1997, pp. 513–514).

Figure 4: Depiction of an ANN with a single hidden layer



Source: Campbell et al. (1997, p. 514).

The ANN is a model that is generally mimicking the structure as well as the function of the human brain. As such, it is part of what is described as deep learning, which is part of the family of machine learning methods. There are several types of artificial neural networks in existence, such as the multilayer perceptron, the convolutional neural network or deep belief networks (Wei, 2019, p. 21)

ANN models have been researched for many decades with the aim of achieving a performance compared to human-like performance, for example in image or speech recognition. Methodologies for ANN can hereby differ in terms of their number of layers or other computational elements (Lippmann, 1987). Also, in accounting or financial market research, ANN models can be fruitfully applied, for example due to the fact that these models are less prone for being distorted because of the existence of outliers in the data. Generally, different types of ANN are available for use in such research (Abdou et al., 2012).

For the purpose of this thesis, the neuralnet package in the R programming language was used for computational procedures. The following procedure was applied to the data in order to compute the ANN:

1. Normalize (also called: scaling or standardizing) the dataset, which consists of the capital structure and the performance variables[10] in order to provide for stability and performance of the algorithm. This is performed via the min-max method in the interval [0,1].
2. Split the normalized data into a training and a testing set, where the training set is set to 75% of the data and the testing set to 25% of the data.
3. Apply the neural network algorithm, using the neuralnet library in R. The function in the ANN algorithm applies the regression equation for the proposed relationships of the capital structure and the performance variables as dependent and independent variables, including the recursive relationships. The algorithm is set to a total of two hidden layers with five and three neurons, respectively.
4. Predict the model based on the functional specification using the test data.
5. Compute of the mean squared error.
6. Plot and graphically depict the results from the ANN.

The ANN model aims to provide another type of analysis to the proposed relationships in the data. As such, similar to the empirical work of Pao (2008), the ANN approach is used for comparison to the results of the regression models in order to judge if ANN models may provide a better fit and forecasting ability.

[10] Technically, NA values need to be dropped from the data in order for the algorithm to be able to perform the calculations. Therefore, NA values have been dropped accordingly.

4. Empirical Analysis

4.1 Descriptive Statistics

In this section, a descriptive evaluation of the data will be provided. This includes selected aspects of the raw data but mainly relevant statistics on the variables that were calculated to serve as inputs to the empirical analysis. As already stated in the last chapter in the context of sampling and data gathering, a total of 361 different firms that are listed and headquartered in Germany have initially been gathered. For these firms, a total of 4,229 firm years are included in the dataset. The time period of the data ranges over a 12-year period, starting from the year 2008 until 2019. It must be noted that there are some data missing for particular firm years, a topic that will be addressed further below.

Similar to other studies (e.g. Frank & Goyal, 2009; Gropp & Heider, 2008), financial services firms are excluded from the analysis. This was performed in order to ensure a sufficient level of comparability across the typical ratios used in the analysis. However, this does not mean that financial services firms like banks are not relevant for the topic but simply that these firms belong to a particular type of industry that requires a narrower industry perspective directed solely to financial sector firms. There is academic research available that covers this topic, which is directly geared towards an analysis of such firms (e.g. Berger, 1995; Berger & Bonaccorsi di Patti, 2006; Tarek Al-Kayed et al., 2014). Due to the exclusion of firms from the financial sector, a total of 43 firms were excluded from the original data.

A first descriptive step in the analysis was the analysis of the industries. Here, an overview of the industry classification was performed, based on the number of firm years in sample. The results are shown below in Table 11. The distinction of the industry is hereby to be mentioned as potentially relevant in the context of the thesis because managerial ability to design capital structure is found in empirical studies to be dependent on the industry type, especially regarding debt financing, which, again, largely depends on asset structure and profitability of firms (Börner et al., 2010; Hall et al., 2000). Studies even use industry-adjusted levels for metrics like performance or cash flow (Lamont, 1997).

Regarding the industry classification, the data in Table 11 provides a mirror on the structure of the German economy, with its main focus being set on the service sectors but also with a relatively high percentage of industrial firms in existence that contribute to economic activity as well (BMWI, 2021).

Table 11: Overview of the industry classification of the firms in the sample (by firm years)

Industry	**N**	**%**
Industrials	958	22.7
Technology	823	19.5
Consumer Cyclical	546	12.9
Healthcare	462	10.9
Communication Services	391	9.2
Real Estate	362	8.6
Basic Materials	283	6.7
Consumer Defensive	192	4.5
Utilities	154	3.6
Energy	58	1.4
Total	4,229	100.0

Source: Own presentation.

Summary statistics for the variables, as defined in the preceding chapter, were also calculated. The results are shown below in Table 12:

Table 12: Descriptive statistics for variables

Variable	Label	n	mean	sd	median	min	max
Debt Ratio	DE	4138	0.16	0.18	0.10	0.00	0.73
EBIT / Interest Expense	EI	3738	20.42	106.87	3.68	-245.70	826.27
Long-Term Debt / Total Debt	LTD	3789	0.19	0.32	0.01	0.00	1.00
Operating Margin	OM	4122	0.02	0.38	0.05	-2.30	1.00
Asset Turnover	AT	4141	0.62	0.63	0.43	0.00	3.17
ROE	ROE	4090	0.08	0.49	0.08	-2.36	2.29
YoY revenue growth	REV	3322	12.80	63.50	0.03	-1.00	455.08
YoY profit growth	PRO	3652	3.57	25.83	-0.14	-23.42	224.96
ROIC	ROIC	4140	0.02	0.26	0.04	-1.56	0.72
CAPEX / Total Assets	CAP	3790	4.41	17.45	0.02	0.00	116.79
ROA	ROA	4141	0.74	14.78	2.88	-74.31	38.18
Price-to-Book Ratio	PB	4136	2.21	2.45	1.51	0.00	14.67
Price-to-Earnings Ratio	PE	4132	17.55	31.04	10.34	0.00	211.19

Source: Own presentation.

4.2 Bivariate Analysis

For the bivariate analysis, correlation analysis as well as the calculation of the variance inflation factor were performed. The results are shown in the paragraphs below.

4.2.1 Correlation Analysis

For the variables as shown in Table 12, a correlation matrix was calculated as well. Due to the large number of variables considered, there are numerous combinations of a bivariate nature possible. The correlations are depicted in Table 13.

The correlation analysis shows that, for the majority of the variables, there is little evidence for a linear bivariate relationship, as most correlation coefficients circle around zero. This is particularly evident for the capital structure variables in comparison to the performance variables. However, LTD shows a high correlation with DE, which is plausible, as an increased use of debt may be aligned with a higher share of long-term debt use as well. In addition, there are cases where comparable variables of performance show a relatively strong positive relationship, like for example between ROE and ROA; but also ROIC as well. Return ratios also show a high correlation with OM.

In alignment with the suggestion by Abdou et al. (2012), variables with a high correlation have to be skipped when performing regression model calculations. The author proposes such an elimination of highly correlated variables if the correlation coefficient is higher than 0.30. As a result, the variables LTD, ROIC and ROA were dropped from further calculations because of the likelihood of the multicollinearity that these variables may cause.

Table 13: Correlation matrix for variables

	DE	EI	LTD	OM	AT	ROE	REV	PRO	ROIC	CAP	ROA	PB	PE
DE	1.00	-0.13	0.44	0.07	-0.03	-0.01	-0.04	0.03	-0.04	0.04	-0.05	-0.02	-0.01
EI	-0.13	1.00	-0.08	0.15	0.08	0.16	0.01	0.00	0.32	-0.01	0.32	0.12	0.06
LTD	0.44	-0.08	1.00	0.11	-0.05	0.06	0.10	0.08	0.03	0.32	0.05	-0.04	0.00
OM	0.07	0.15	0.11	1.00	0.04	0.27	0.03	0.02	0.44	0.06	0.45	-0.03	0.07
AT	-0.03	0.08	-0.05	0.04	1.00	0.09	0.03	0.00	0.13	0.06	0.11	0.15	0.06
ROE	-0.01	0.16	0.06	0.27	0.09	1.00	0.02	0.04	0.38	0.05	0.49	0.02	0.06
REV	-0.04	0.01	0.10	0.03	0.03	0.02	1.00	0.00	0.03	0.11	0.03	0.01	0.00
PRO	0.03	0.00	0.08	0.02	0.00	0.04	0.00	1.00	0.01	0.00	0.02	-0.01	0.01
ROIC	-0.04	0.32	0.03	0.44	0.13	0.38	0.03	0.01	1.00	0.06	0.73	0.06	0.09
CAP	0.04	-0.01	0.32	0.06	0.06	0.05	0.11	0.00	0.06	1.00	0.07	0.02	0.04
ROA	-0.05	0.32	0.05	0.45	0.11	0.49	0.03	0.02	0.73	0.07	1.00	0.04	0.12
PB	-0.02	0.12	-0.04	-0.03	0.15	0.02	0.01	-0.01	0.06	0.02	0.04	1.00	0.15
PE	-0.01	0.06	0.00	0.07	0.06	0.06	0.00	0.01	0.09	0.04	0.12	0.15	1.00

Source: Own presentation.

4.2.2 Variance Inflation Factor and Tolerance

To further evaluate the issue of multicollinearity of the variables, the variance inflation factor (VIF) was also calculated. The results of the VIF calculation can hereby provide valuable insights concerning the task to identify variables that better need to be excluded from the analysis.

In order to calculate the VIF, the specification of a regression model is first required. For the purpose of this thesis, that implies the specification of several multiple regression models. First, the there are two models for the specification of the performance variables as independent variables for the capital structure variables DE and EI. Second, the regression models use each of the performance variables as dependent variable and with the capital structure variables serving as the independent variables, respectively.

The model VIF values were calculated, and the results are shown below in Table 14 and Table 15, respectively:

Table 14: VIF values (regression with performance variables as independent variables)

	OM	**AT**	**ROE**	**REV**	**PRO**	**CAP**	**PB**	**PE**
DE	1.093	1.032	1.092	1.013	1.002	1.018	1.040	1.028
EI	1.101	1.031	1.102	1.013	1.003	1.018	1.042	1.027

Source: Own presentation

Table 15: VIF values (regression with capital structure variables as independent variables)

	DE	**EI**
OM	1.018	1.018
AT	1.018	1.018
ROE	1.019	1.019
REV	1.025	1.025
PRO	1.021	1.021
CAP	1.021	1.021

	DE	EI
PB	1.018	1.018
PE	1.019	1.019

Source: Own presentation.

The VIF results show relatively small values of close to 1. That implies that multicollinearity is not deemed to be an issue in the analysis, as this result implies nearly an absence of collinearity effects between predictors. Consequently, no further elimination of variables was performed on the basis of the VIF values as indicated in the literature, given high VIF values for the data (Abdou et al., 2012; Pao, 2008).

Despite the useful results from the calculation of the VIF, which imply that multicollinearity is not an issue, the values for tolerance (TOL) were calculated as well. These are shown below in Table 16 and Table 17, respectively.

Table 16: TOL values (regression with performance variables as independent variables)

	OM	AT	ROE	REV	PRO	CAP	PB	PE
DE	0.914	0.968	0.915	0.987	0.997	0.982	0.961	0.972
EI	0.908	0.970	0.907	0.987	0.997	0.982	0.959	0.974

Source: Own presentation

Table 17: TOL values (regression with capital structure variables as independent variables)

	DE	EI
OM	0.981	0.981
AT	0.982	0.982
ROE	0.981	0.981
REV	0.975	0.975
PRO	0.979	0.979
CAP	0.979	0.979

	DE	EI
PB	0.982	0.982
PE	0.982	0.981

Source: Own presentation.

As expected, the results for TOL imply, like the values of the VIFs, that multicollinearity is not an issue in the data. It is therefore useful to potentially apply the variables in further analysis.

4.3 Regression Analysis

Below, the results of the regression analysis are presented. First, the stepwise forward regression results are shown, followed by the panel regression analysis results.

4.3.1 Stepwise Forward Regression

The results of the stepwise forward regression are shown below, first for the capital structure variables as dependent variables. The criterion for the inclusion of a variable in the regression table output is a p-value of at least 0.05. The regression statistics are depicted in Table 18 below for the debt ratio (variable: DE):

Table 18: Results for stepwise forward regression (Debt Ratio: DE)

Step	Var	R^2	Adj. R^2	C(p)	AIC	RMSE
1	OM	0.0051	0.0049	50.6742	-2424.3158	0.1802
2	REV	0.0085	0.0079	72.3311	-1915.2855	0.1810
3	AT	0.0145	0.0136	53.7566	-1933.5173	0.1805
4	PB	0.0177	0.0166	44.9624	-1940.9785	0.1802
5	ROE	0.0201	0.0187	35.6045	-1940.0126	0.1799
6	CAP	0.0210	0.0192	10.9908	-1915.8268	0.1792
7	PE	0.0226	0.0204	7.9310	-1918.8954	0.1791

Source: Own presentation.

The results show a total of seven variables as significant to be included in the model, with OM being the most important predictor. Generally, the ranking of the variables as indicated by the number of steps provided the information on the importance of the variables (Kutner et al., 2005, pp. 364–365). That means that PE is the least important variable in the stepwise forward regression model for the debt ratio. With the exception of profitability growth (variable: PRO), all predicting performance variables were included. Similarly, Table 19 shows the results from stepwise forward regression for the interest coverage ratio (variable: EI).

Table 19: Results for stepwise forward regression (Interest Coverage Ratio: EI)

Step	Var	R^2	Adj. R^2	C(p)	AIC	RMSE
1	ROE	0.0264	0.0262	104.1712	44911.6552	106.1084
2	PB	0.0385	0.0379	59.3361	44867.7736	105.4652
3	OM	0.0502	0.0494	11.8852	44772.1444	104.7808
4	AT	0.0529	0.0519	3.2587	44763.5138	104.6441

Source: Own presentation.

Regarding the interest coverage ratio, only four variables showed sufficient significance for model inclusion: ROE, RB, OM, and AT. That means that four other variables (REV, PRO, CAP, and PE) are not able to significantly predict the interest coverage ratio.

Similarly, stepwise forward regression was also performed by using each of the performance variables as dependent variables, while the capital structure variables DE and EI were used for prediction. The results for all variables are depicted below in Table 20:

Table 20: Results for stepwise forward regression on the performance variables

Step	Var	R^2	Adj. R^2	C(p)	AIC	RMSE
OM						
1	EI	0.0217	0.0214	25.6386	2815.1869	0.3526

Step	Var	R^2	Adj. R^2	C(p)	AIC	RMSE
2	DE	0.0281	0.0276	3.0000	2792.6096	0.3515
AT						
1	EI	0.0068	0.0065	16.5705	7150.7712	0.6296
2	DE	0.0109	0.0103	3.0000	7135.3121	0.6283
ROE						
1	EI	0.0264	0.0262	0.2947	5276.3691	0.4942
REV						
1	DE	0.0014	0.0011	-33.2877	36927.9075	63.0272
PRO						
1	DE	0.0008	0.0005	-145.0854	34089.1797	25.8302
CAP						
1	DE	0.0013	0.0010	-270.0920	32405.7752	17.4456
PB						
1	EI	0.0134	0.0131	0.9335	17230.8668	2.4253
PE						
1	EI	0.0040	0.0037	1.4499	36409.6612	31.6470

Source: Own presentation.

The results for the stepwise forward regression are mixed. For OM and AT, both capital structure variables show a significant relation at the $p = 0.05$ level. In contrast, the remaining six variables only show a predictive relationship with either one of the capital structure variables, respectively.

4.3.2 Panel Regression Models

The regression analysis was performed with several types of panel regression models, specifically with fixed as well as with random effects regression. Other available regression models like regression with pooled cross-sectional data were not used, as pooled regression is deemed as less useful and more applicable for the evaluation of particular events (Wooldridge, 2013, p. 454). The results for the fixed and the random regression are shown

below in Table 21 for DE as dependent variable. Given the results from the stepwise regression model, variable PRO was not used, as it was found as not significant.[11]

Table 21: Fixed and Random Effects Regression results for DE

Fixed effects Regression		**Random effects Regression**	
Dependent variable: DE			
OM	-0.012	OM	-0.005
	(0.008)		(0.008)
AT	0.014***	AT	0.003
	(0.005)		(0.005)
ROE	-0.006	ROE	-0.006
	(0.005)		(0.005)
REV	-0.00003	REV	-0.00005
	(0.00004)		(0.00004)
CAP	0.0001	CAP	0.0001
	(0.0002)		(0.0002)
PB	-0.0004	PB	0.0003
	(0.001)		(0.001)
PE	-0.00002	PE	-0.00002
	(0.0001)		(0.0001)
		Constant	0.175***
			(0.008)
Observations	3,207	Observations	3,207
R^2	0.004	R^2	0.004
Adjusted R^2	-0.127	Adjusted R^2	0.002
F Statistic	1.636 (df = 7; 2834)	F Statistic	4.334
Note: *p<0.1; **p<0.05; ***p<0.01			

Source: Own presentation.

[11] Nevertheless, a calculation with the inclusion of this variable was also performed, providing similar results. This is potentially the result of very low collinearity between the predictors, as was also shown by the low VIF and TOL values for the predictors as well.

Similarly, a fixed and random regression was performed for EI as dependent variable as well. In this case, even more variables were excluded from the panel regression model, based on the results of the stepwise regression. Specifically, only variables ROE, PB, OM and AT were used as independent variables. The results are depicted below in Table 22:

Table 22: Fixed and Random Effects Regression results for EI

Fixed effects Regression		**Random effects Regression**	
Dependent variable: EI			
OM	37.167***	OM	36.331***
	(5.834)		(5.361)
AT	12.194***	AT	11.415***
	(3.570)		(3.191)
ROE	14.666***	ROE	18.226***
	(3.509)		(3.423)
PB	3.134***	PB	3.366***
	(0.862)		(0.769)
		Constant	5.459
			(4.286)
Observations	3,687	Observations	3,687
R^2	0.029	R^2	0.036
Adjusted R^2	-0.08	Adjusted R^2	0.034
F Statistic	24.841*** (df = 4; 3315)	F Statistic	131.828***
Note: *p<0.1; **p<0.05; ***p<0.01			

Source: Own presentation.

Based on the results, the Hausman test was then applied on the random and the fixed effects model. This provided evidence for the alternative hypothesis of one of the models being inconsistent. The Hausman test was calculated for both models, using DE and EI as

dependent variable, respectively. The Chi-squared using DE was 64.507, while the Chi-squared value for the model that used EI was 22.752. Consequently, due to the test results, the fixed effects model needs to be selected for analysis.

Evaluating the results from fixed effects regression, it is evident that the majority of the is are not significant to predict the debt ratio (variable: DE). Only AT was found to have significant predictability for the debt ratio. That result provides a contrast to the result from the stepwise forward regression model, as this analysis has indicated the inclusion of all but one variable (variable PRO was excluded). In the case of EI, there is a total of four variables that show a significant relationship: OM, AT, ROE and PB. Consequently, the evidence is more pronounced for EI instead of DE.

In addition to the investigation of the role of performance variables to capital structure variables, the recursive relationship was also evaluated. For this purpose, and similarly like with the method for the stepwise regression, the capital structure variables DE and EI were regressed on each of the performance variables. Due to the low number of independent variables that are applicable for regression the performance variables, no exclusion was performed based on the results of the stepwise regression. However, the results of the stepwise regression models will be discussed and compared with the panel regression model values.

The results for fixed effects regression are shown below in Table 23. Similarly,

Table 24 depicts the random effects regression results:

Table 23: Fixed-effects regression of capital structure variables on performance variables

	OM	AT	ROE	REV	PRO	CAP	PB	PE
DE	-0.062*	0.220***	-0.019	-8.005	2.143	1.323	0.453*	1.919
	(0.036)	(0.059)	(0.061)	(9.282)	(3.799)	(2.216)	(0.245)	(4.131)
EI	0.0004***	0.0004***	0.0005***	0.010	0.006	0.001	0.001***	-0.0003
	(0.0001)	(0.0001)	(0.0001)	(0.012)	(0.005)	(0.003)	(0.0003)	(0.006)
Observations	3,732	3,736	3,690	3,101	3,380	3,464	3,736	3,734
R^2	0.017	0.009	0.009	0.001	0.001	0.0001	0.006	0.0001
Adjusted R^2	-0.091	-0.099	-0.101	-0.133	-0.121	-0.119	-0.103	-0.109
F Statistic	28.676*** (df = 2; 3362)	16.071*** (df = 2; 3366)	14.602*** (df = 2; 3320)	0.741 (df = 2; 2735)	0.864 (df = 2; 3012)	0.230 (df = 2; 3094)	9.499*** (df = 2; 3366)	0.110 (df = 2; 3365)
Note: *p<0.1; **p<0.05; ***p<0.01								

Source: Own presentation.

Table 24: Random-effects regression of capital structure variables on performance variables

	OM	AT	ROE	REV	PRO	CAP	PB	PE
DE	-0.013	0.103*	0.011	-13.500*	2.651	0.798	0.960***	-0.529
	(0.033)	(0.055)	(0.052)	(7.420)	(2.902)	(1.938)	(0.232)	(3.186)
EI	0.0004***	0.0004***	0.001***	0.005	0.003	0.0002	0.002***	0.012**
	(0.00005)	(0.0001)	(0.0001)	(0.011)	(0.005)	(0.003)	(0.0003)	(0.005)
Constant	0.005	0.625***	0.059***	16.656***	3.372***	4.781***	2.006***	17.898***
	(0.014)	(0.027)	(0.017)	(2.293)	(0.842)	(0.698)	(0.096)	(0.898)
Observations	3,732	3,736	3,690	3,101	3,380	3,464	3,736	3,734
R^2	0.017	0.007	0.014	0.004	0.001	0.001	0.010	0.0004
Adjusted R^2	0.016	0.006	0.013	0.003	0.0003	0.001	0.009	-0.0001
F Statistic	64.316***	23.685***	54.584***	3.713	1.081	0.170	37.009***	5.777*
Note: *p<0.1; **p<0.05; ***p<0.01								

Source: Own presentation.

Similar to the regression models that are employed to evaluate the impact of performance variables on capital structure variables, the Hausman test was applied on the random and the fixed effects regression model as well. The results of this test provide evidence for the alternative hypothesis of one of the models being inconsistent. The Hausman test was applied for the fixed and for the random regression models for each of the eight performance variables (test statistics for Chi-squared are as follows: OM = 18.13, AT = 31.976, ROE = 14.671, REV = 2.0583, PRO = 2.0613, CAP = 1.0277, PB = 511.31, and PE = 18.823). Therefore, the test results imply that the fixed effects model is more useful for the analysis.

The results provide a mixed picture. For the performance variables REV, PRO, CAP and PE, no relationship to either of the two capital structure variables has been found. Therefore, the model implies that there is no impact of these variables at all. In contrast to that, OM, AT and PB show a relationship with both capital structure variables. However, except for AT, the significance of the results is much stronger in the case of EI than for DE. Given the results of the stepwise regression models, the panel regression models give plausible results.

Generally, it can be stated that the predictive capability of performance variables is more pronounced for EI. In the case of ROE, a significant relationship was only found for EI but not for DE. This again confirms the strength of the results for EI.

4.4 Group Comparison Analysis

The results shown above for the total dataset of listed firms from Germany have also been calculated for the subgroups that were defined with respect to differences in growth and profitability rates, industry differences and size. This refers to the analysis of the capital structure on performance variables as well as the recursive relationship as well. In addition to the regressions on the particular subgroups, t-tests for mean differences across the subgroups are performed.

4.4.1 Regressing Firm Performance Variables on Capital Structure Variables

The results for the fixed effects regression are shown below in Table 25 and Table 26, respectively, for the debt ratio (DE). Random effects regression was also performed but results presentation was skipped because the Hausman test for both types of models indicated that fixed effects regression provides a superior way for the estimation. This is similar to the results for the entire dataset, where the Hausman test provided evidence in favor of the

alternative hypothesis of one of the models being inconsistent. It is, therefore, not necessarily relevant to report the random regression results.

Table 25: Fixed-effects regression of capital structure variable DE on performance variables (subsets for differences in revenue growth, profitability growth and size differences)

	All firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)
OM	-0.012	0.046***	0.041***	0.029**	0.037***	0.051***	0.019
	(0.008)	(0.013)	(0.012)	(0.012)	(0.013)	(0.015)	(0.012)
AT	0.014***	-0.027***	-0.010	-0.042***	0.008	-0.014*	-0.003
	(0.005)	(0.007)	(0.009)	(0.007)	(0.009)	(0.008)	(0.008)
ROE	-0.006	0.002	-0.016*	-0.024***	0.002	-0.043***	-0.0004
	(0.005)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.008)
REV	-0.00003	-0.0001	0.044***	0.0001	-0.0001**	-0.0002**	-0.00005
	(0.00004)	(0.0001)	(0.013)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
CAP	0.0001	0.001*	0.001*	0.0002	0.0002	0.011	0.0003
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.011)	(0.0002)
PB	-0.0004	-0.003*	-0.002	0.0004	-0.004**	-0.002	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
PE	-0.00002	0.0001	-0.0001	-0.0003**	-0.0001	-0.0002*	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Observations	3,207	1,626	1,581	1,614	1,591	1,744	1,463
R^2	0.004	0.026	0.019	0.036	0.014	0.028	0.005

	All firms	**High revenue growth**	**Low revenue growth**	**High profitability growth**	**Low profitability growth**	**Large (Size)**	**Small (Size)**
Adjusted R^2	-0.127	-0.081	-0.092	-0.080	-0.108	-0.087	-0.139
F Statistic	1.636 (df = 7; 2834)	5.661^{***} (df = 7; 1464)	3.954^{***} (df = 7; 1419)	7.721^{***} (df = 7; 1440)	2.770^{***} (df = 7; 1416)	6.444^{***} (df = 7; 1558)	1.006 (df = 7; 1277)
Note: *p<0.1; **p<0.05; ***p<0.01							

Source: Own presentation.

Table 26: Fixed-effects regression of capital structure variable DE on performance variables (subsets for sector differences: industrials, technology and consumer cyclical)

	All firms	Industrials	Technology	Consumer Cyclical
OM	-0.012	0.049**	-0.022	0.037
	(0.008)	(0.020)	(0.027)	(0.036)
AT	0.014***	-0.008	0.015	-0.012
	(0.005)	(0.008)	(0.010)	(0.014)
ROE	-0.006	-0.00001	-0.016	-0.033
	(0.005)	(0.011)	(0.010)	(0.021)
REV	-0.00003	-0.00003	-0.0002	-0.0003
	(0.00004)	(0.00005)	(0.0001)	(0.0002)
CAP	0.0001	0.0002	0.0001	0.0002
	(0.0002)	(0.0002)	(0.001)	(0.001)
PB	-0.0004	-0.003	0.002	0.005
	(0.001)	(0.002)	(0.002)	(0.004)
PE	-0.00002	0.0001	0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Observations	3,207	706	698	423
R^2	0.004	0.018	0.014	0.020
Adjusted R^2	-0.127	-0.144	-0.131	-0.155
F Statistic	1.636 (df = 7; 2834)	1.621 (df = 7; 605)	1.194 (df = 7; 608)	1.069 (df = 7; 358)

	All firms	Industrials	Technology	Consumer Cyclical
Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$				

Source: Own presentation.

The results of the fixed effects regression analysis clearly show a number of differences in the ability of some performance variables in predicting the debt ratio; depending on the subgroup. Whereas the dataset containing all groups only showed AT to be a significant predictor variable, selected datasets show a much larger set of significant predictor variables. Additionally, some relationships of predictor variables show different signs, depending on which subgroup is used. The results, which will be discussed later in this chapter, clearly imply that functional relationships of the variables in the model need to be distinguished with respect to subgroups in order to provide more depth to the analysis of the relationship between capital structure and firm performance.

Similar to the debt level (variable DE), the fixed effects regression was also performed with respect to EI as dependent variable for all subsets. The results of these calculations are shown below in Table 27 and Table 28:

Table 27: Fixed-effects regression of capital structure variable EI on performance variables (subsets for differences in revenue growth, profitability growth and size differences)

	All firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)
OM	37.167***	19.862**	31.678***	35.791***	30.459***	34.902***	28.045***
	-5.834	-9.917	-6.482	-9.054	-6.871	-8.640	-7.575
AT	12.194***	6.398	7.612*	16.017***	0.116	14.750***	6.695
	-3.570	-5.148	-4.284	-4.913	-4.150	-4.360	-4.792
ROE	14.666***	18.707***	17.955***	27.879***	14.938***	2.943	22.390***
	-3.509	-6.553	-4.659	-6.100	-4.596	-5.610	-5.117
PB	3.134***	5.367***	2.742***	5.137***	2.737***	3.465***	2.736***
	(0.862)	-1.326	(0.910)	-1.204	(0.937)	-1.218	-1.026
Observations	3,687	1,578	1,51	1,712	1,644	1,868	1,69
R^2	0.029	0.027	0.045	0.058	0.029	0.023	0.033
Adjusted R^2	-0.080	-0.082	-0.066	-0.046	-0.084	-0.083	-0.084
F Statistic	24.841*** (df = 4; 3315)	9.759*** (df = 4; 1419)	15.989*** (df = 4; 1351)	23.775*** (df = 4; 1540)	11.013*** (df = 4; 1472)	9.834*** (df = 4; 1684)	12.947*** (df = 4; 1507)
Note: *p<0.1; **p<0.05; ***p<0.01							

Source: Own presentation.

Table 28: Fixed-effects regression of capital structure variable EI on performance variables (subsets for sector differences: industrials, technology and consumer cyclical)

	All firms	Industrials	Technology	Consumer Cyclical
OM	37.167***	62.464***	91.134***	33.141
	-5.834	-10.317	-22.083	-28.813
AT	12.194***	6.875*	6.494	41.800***
	-3.570	-4.050	-8.295	-11.288
ROE	14.666***	10.485**	19.612**	12.819
	-3.509	-5.287	-8.748	-14.800
PB	3.134***	6.524***	4.614**	10.212***
	(0.862)	-1.253	-1.890	-3.104
Observations	3,687	869	720	485
R^2	0.029	0.096	0.066	0.062
Adjusted R^2	-0.080	-0.018	-0.061	-0.075
F Statistic	24.841*** (df = 4; 3315)	20.469*** (df = 4; 771)	11.154*** (df = 4; 633)	7.014*** (df = 4; 422)
Note: *p<0.1; **p<0.05; ***p<0.01				

Source: Own presentation.

The results of the fixed-effects regression using EI as a dependent variable are generally more homogenous across subgroups. However, differences exist as well, which will be discussed later in paragraph 4.6.

4.4.2 Regressing Capital Structure Variables on Firm Performance Variables

In addition to the relationship of performance variables on a particular capital structure variable as independent variable, the recursive relationship was assessed as well. This was performed for all groups that were distinguished on the basis of differences in revenue and profitability growth, size differences. Also, the calculations were performed for all three main industries: industrials, technology and consumer cyclical.

The results of these calculations are shown in the tables below. It must be noted that the calculations were performed equally for all subsets been defined so far regarding the differences in revenue and profit growth, size as well as industry classification.

Table 29: Fixed-effects regression of capital structure variables on OM for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	-0.062*	0.184***	0.128**	0.104**	0.113**	0.103**	-0.026	0.172***	-0.105	-0.021
	(0.036)	(0.054)	(0.054)	(0.053)	(0.048)	(0.042)	(0.058)	(0.065)	(0.068)	(0.066)
EI	0.0004***	0.0002***	0.001***	0.0004***	0.001***	0.0003***	0.0004***	0.001***	0.0004***	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	3,732	1,581	1,519	1,720	1,658	1,874	1,711	883	733	488
R^2	0.017	0.014	0.029	0.024	0.021	0.014	0.015	0.065	0.047	0.004
Adjusted R^2	-0.091	-0.094	-0.082	-0.083	-0.091	-0.092	-0.101	-0.048	-0.076	-0.136
F Statistic	28.676*** (df = 2; 3362)	10.094*** (df = 2; 1424)	20.227*** (df = 2; 1362)	18.829*** (df = 2; 1550)	15.586*** (df = 2; 1488)	11.913*** (df = 2; 1692)	11.610*** (df = 2; 1530)	27.142*** (df = 2; 787)	16.116*** (df = 2; 648)	0.918 (df = 2; 427)

Source: Own presentation.

Table 30: Fixed-effects regression of capital structure variables on AT for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	0.220***	-0.418***	-0.096	-0.470***	-0.020	-0.236***	-0.007	0.143	0.370**	0.134
	(0.059)	(0.101)	(0.079)	(0.093)	(0.078)	(0.082)	(0.091)	(0.163)	(0.163)	(0.165)
EI	0.0004***	0.0002	0.0004**	0.0005***	0.00002	0.0004***	0.0003**	0.001**	0.0004*	0.001***
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0002)
Observations	3,736	1,581	1,520	1,721	1,659	1,874	1,715	883	734	488
R^2	0.009	0.015	0.005	0.028	0.0001	0.012	0.003	0.008	0.012	0.034
Adjusted R^2	-0.099	-0.093	-0.109	-0.078	-0.113	-0.093	-0.114	-0.112	-0.115	-0.101
F Statistic	16.071*** (df = 2; 3366)	10.581*** (df = 2; 1424)	3.533** (df = 2; 1363)	22.611*** (df = 2; 1551)	0.039 (df = 2; 1489)	10.567*** (df = 2; 1692)	2.347* (df = 2; 1534)	3.237** (df = 2; 787)	4.079** (df = 2; 649)	7.611*** (df = 2; 427)

Source: Own presentation.

Table 31: Fixed-effects regression of capital structure variables on ROE for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	-0.019	0.094	-0.055	-0.035	0.106	-0.226***	0.054	0.207	-0.137	-0.271**
	(0.061)	(0.082)	(0.075)	(0.079)	(0.072)	(0.066)	(0.087)	(0.135)	(0.170)	(0.130)
EI	0.0005***	0.0004***	0.001***	0.001***	0.001***	0.0001	0.001***	0.001***	0.001***	0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Observations	3,690	1,578	1,511	1,713	1,645	1,868	1,693	869	720	485
R^2	0.009	0.012	0.020	0.028	0.012	0.009	0.019	0.021	0.027	0.015
Adjusted R^2	-0.101	-0.097	-0.093	-0.078	-0.101	-0.097	-0.098	-0.099	-0.101	-0.125
F Statistic	14.602*** (df = 2; 3320)	8.331*** (df = 2; 1421)	13.842*** (df = 2; 1354)	22.473*** (df = 2; 1543)	9.229*** (df = 2; 1475)	7.791*** (df = 2; 1686)	14.387*** (df = 2; 1512)	8.314*** (df = 2; 773)	8.896*** (df = 2; 635)	3.174** (df = 2; 424)

Source: Own presentation.

Table 32: Fixed-effects regression of capital structure variables on REV for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	-8.005	-22.677	0.109*	3.119	-21.502**	-26.325**	-6.384	-22.243	-17.191	-18.876
	-9.282	-14.094	(0.056)	-9.220	-10.759	-10.720	-11.200	-35.074	-14.850	-15.734
EI	0.010	-0.012	-0.00002	-0.007	0.044*	0.006	0.011	-0.013	0.005	0.002
	(0.012)	(0.019)	(0.0001)	(0.013)	(0.022)	(0.018)	(0.017)	(0.063)	(0.016)	(0.019)
Observations	3,101	1,581	1,520	1,558	1,540	1,684	1,393	704	653	408
R^2	0.001	0.002	0.003	0.0003	0.006	0.004	0.001	0.001	0.003	0.004
Adjusted R^2	-0.133	-0.107	-0.111	-0.121	-0.117	-0.115	-0.146	-0.155	-0.145	-0.164
F Statistic	0.741 (df = 2; 2735)	1.382 (df = 2; 1424)	1.949 (df = 2; 1363)	0.242 (df = 2; 1389)	4.184** (df = 2; 1370)	3.292** (df = 2; 1503)	0.437 (df = 2; 1214)	0.213 (df = 2; 608)	0.751 (df = 2; 568)	0.777 (df = 2; 348)

Source: Own presentation.

Table 33: Fixed-effects regression of capital structure variables on PRO for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	2.143	0.583	0.061	0.289	-0.095	-8.401*	5.959	-3.039	7.914*	1.258
	-3.799	-4.671	-3.605	-5.444	(0.620)	-4.855	-4.051	-8.042	-4.394	-12.548
EI	0.006	-0.002	0.015**	-0.0002	0.002	0.002	0.009	0.006	0.003	-0.009
	(0.005)	(0.006)	(0.008)	(0.008)	(0.001)	(0.008)	(0.006)	(0.016)	(0.005)	(0.015)
Observations	3,38	1,580	1,518	1,721	1,659	1,761	1,509	804	668	436
R^2	0.001	0.0001	0.003	0.00000	0.001	0.002	0.003	0.0005	0.006	0.001
Adjusted R^2	-0.121	-0.110	-0.111	-0.109	-0.112	-0.112	-0.131	-0.134	-0.137	-0.156
F Statistic	0.864 (df = 2; 3012)	0.065 (df = 2; 1423)	1.931 (df = 2; 1361)	0.002 (df = 2; 1551)	0.859 (df = 2; 1489)	1.623 (df = 2; 1579)	2.024 (df = 2; 1329)	0.160 (df = 2; 708)	1.770 (df = 2; 583)	0.217 (df = 2; 376)

Source: Own presentation.

Table 34: Fixed-effects regression of capital structure variables on CAP for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	1.323	3.510	2.445	0.122	0.626	-0.004	4.790	8.562	0.131	2.962
	-2.216	-2.406	-2.925	-3.164	-2.269	(0.059)	-3.874	-7.303	-3.269	-4.380
EI	0.001	-0.003	0.012**	-0.001	-0.0001	-0.00003	0.002	-0.002	0.004	0.002
	(0.003)	(0.003)	(0.006)	(0.004)	(0.005)	(0.0001)	(0.006)	(0.012)	(0.004)	(0.005)
Observations	3,464	1,557	1,468	1,653	1,556	1,874	1,590	798	704	461
R^2	0.0001	0.002	0.003	0.0001	0.0001	0.00004	0.001	0.002	0.002	0.001
Adjusted R^2	-0.119	-0.109	-0.115	-0.114	-0.122	-0.107	-0.126	-0.133	-0.133	-0.149
F Statistic	0.230 (df = 2; 3094)	1.733 (df = 2; 1400)	2.195 (df = 2; 1311)	0.037 (df = 2; 1483)	0.039 (df = 2; 1386)	0.034 (df = 2; 1692)	0.783 (df = 2; 1410)	0.714 (df = 2; 702)	0.711 (df = 2; 619)	0.242 (df = 2; 400)

Source: Own presentation.

Table 35: Fixed-effects regression of capital structure variables on PB for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	0.453*	-0.272	-0.054	0.302	-0.453	-0.185	0.710*	-0.502	1.828**	1.613***
	(0.245)	(0.392)	(0.374)	(0.383)	(0.348)	(0.296)	(0.425)	(0.519)	(0.723)	(0.593)
EI	0.001***	0.002***	0.002***	0.003***	0.002**	0.001***	0.002***	0.004***	0.003***	0.003***
	(0.0003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0005)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	3,736	1,581	1,520	1,721	1,659	1,874	1,715	883	734	488
R^2	0.006	0.015	0.006	0.018	0.006	0.006	0.006	0.028	0.026	0.041
Adjusted R^2	-0.103	-0.093	-0.108	-0.089	-0.107	-0.100	-0.111	-0.089	-0.100	-0.094
F Statistic	9.499*** (df = 2; 3366)	10.521*** (df = 2; 1424)	3.931** (df = 2; 1363)	13.937*** (df = 2; 1551)	4.258** (df = 2; 1489)	5.274*** (df = 2; 1692)	4.504** (df = 2; 1534)	11.438*** (df = 2; 787)	8.564*** (df = 2; 649)	9.119*** (df = 2; 427)

Source: Own presentation.

Table 36: Fixed-effects regression of capital structure variables on PE for all subsets

	All Firms	High revenue growth	Low revenue growth	High profitability growth	Low profitability growth	Large (Size)	Small (Size)	Industrials	Technology	Consumer Cyclical
DE	1.919	1.558	-5.674	-3.761	-4.029	-7.553	-1.329	8.964	4.652	-5.935
	-4.131	-5.437	-5.223	-4.257	-5.768	-4.959	-5.067	-9.894	-9.748	-9.782
EI	-0.0003	0.007	0.015	0.024***	-0.002	0.010	0.012	-0.006	0.006	-0.007
	(0.006)	(0.007)	(0.011)	(0.006)	(0.012)	(0.008)	(0.008)	(0.019)	(0.011)	(0.012)
Observations	3,734	1,581	1,520	1,720	1,659	1,874	1,713	883	734	488
R^2	0.0001	0.001	0.002	0.012	0.0003	0.003	0.002	0.001	0.001	0.001
Adjusted R^2	-0.109	-0.109	-0.112	-0.096	-0.113	-0.104	-0.116	-0.119	-0.129	-0.139
F Statistic	0.110 (df = 2; 3365)	0.480 (df = 2; 1424)	1.589 (df = 2; 1363)	9.479*** (df = 2; 1550)	0.248 (df = 2; 1489)	2.222 (df = 2; 1692)	1.312 (df = 2; 1532)	0.489 (df = 2; 787)	0.232 (df = 2; 649)	0.301 (df = 2; 427)

Source: Own presentation.

The results are, in principle, comparable to the results for the subsets calculations for the capital structure variables, as it was found that some subsets show very different results when compared to the results for the entire data of listed German firms. However, some of the subsets show comparable relationships like the total firm data on the relevance of DE and EI for the particular performance variable.

The main finding from the calculation is that there is indeed in some cases a recursive relationship of firm performance to capital structure. Nevertheless, this relationship is not equally strong across all possible cases involving the defined variables, or even existing, as it depends on the way how performance is being measured. For example, there is virtually no evidence for PE or CAP[12] and little evidence with respect to REV or ROE, especially regarding any predictability for DE.

However, there is a comparatively strong impact of capital structure variables on OM and AT. Interestingly, the sign of statistically significant relationships that were found is not equal across the subsets, with some showing a positive and some a negative relationship. This result is particularly interesting because it shows that, statistically, a higher leverage level can either reduce or increase the operating margin or asset turnover. This may imply managerial implications, as leverage may need to be applied differently depending on the subgroup.

4.4.3 Evaluating Mean Differences of Subsets

As it was found in the preceding paragraph that firms may exhibit different characteristics regarding the statistical relationships of capital structure and performance variables, it may be interesting to further investigate if these firms show significant mean differences regarding these variables. It may be argued that existing differences, for example in the leverage of firms, may contribute to the findings. This would imply the existence of non-linear relationships, which are further investigated with the artificial neural network analysis in the next section of this thesis.

Given the large number of potential combinations for a t-test involving all capital structure and performance variables in combination with all the subgroups, some of the combinations

[12] Some evidence was found for the panel with high-profitability firms regarding the relationship of EI to PE or within the low-revenue group regarding the relationship of EI to CAP.

were excluded from the analysis and only the most relevant combinations for the analysis in this thesis were included in the t-test calculations. Specifically, only the variable DE was tested, as it is deemed as the most central variable for capital structure research. Also, only OM and AT were selected as examples for performance variables to be used for the t-test. This was performed because of the results of the preceding section 4.4.2, where it was found that OM and AT showed comparatively good ability for predicting capital structure variables across the subgroups.

The results for the t-tests of the subgroups were calculated based on the assumption of having an equal mean with the total sample, whereas unequal variances were assumed. That means that the null hypothesis assumes equal means, whereas the alternative hypothesis assumes that a difference in mean values exists. The confidence level for the t-test was set to 0.95. As such, the t-test procedure can be mentioned as a classical example of determining significant mean group differences (Tabachnick & Fidell, 2013, p. 29). The results are shown below in Table 37:

Table 37: Results for Mean Group Differences (t-test) for variables DE, OM and AT across all Subgroups (subsets for differences in revenue growth, profitability growth, size differences and top three German industries)

Group	t-value	df	p-value	Mean Total Sample	Mean Subgroup
Variable: DE					
High revenue growth	3.8857	1658	0.000106	0.1596665	0.1766743
Low revenue Growth	3.1234	1659	0.001819	0.1596665	0.1738379
High profitability growth	2.9233	1822	0.003506	0.1596665	0.1719661
Low profitability growth	1.0702	1825	0.2847	0.1596665	0.1641897
Large (Size)	3.8936	1966	0.0001021	0.1596665	0.1752533
Small (Size)	-2.1386	1962	0.03259	0.1596665	0.1508708
Industrials	-4.9123	935	0.000001062	0.1596665	0.1371974
Technology	-6.4148	809	0.00000000002	0.1596665	0.1242523
Consumer Cyclical	3.066	534	0.002279	0.1596665	0.186595
Variable: OM					
High revenue growth	2.0168	1654	0.04387	0.01861414	0.03655303
Low revenue Growth	-2.5119	1651	0.0121	0.01861414	-0.006577318
High profitability growth	1.1874	1818	0.2352	0.01861414	0.02940831
Low profitability growth	-1.7027	1815	0.08879	0.01861414	0.003712149
Large (Size)	4.683	1965	0.000003021	0.01861414	0.05203684
Small (Size)	-4.3919	1952	0.00001184	0.01861414	-0.02487079
Industrials	0.90548	936	0.3654	0.01861414	0.02645799

Group	t-value	df	p-value	Mean Total Sample	Mean Subgroup
Technology	0.40033	808	0.689	0.01861414	0.02192758
Consumer Cyclical	1.9235	534	0.05494	0.01861414	0.03557684
Variable: AT					
High revenue growth	8.6504	1658	0,000000000000002	0.6243914	0.7669468
Low revenue Growth	-7.2616	1659	0.0000000000005	0.6243914	0.5253395
High profitability growth	7.8	1824	0.00000000000001	0.6243914	0.7440569
Low profitability growth	-8.3603	1825	0.0000000000000002	0.6243914	0.5152706
Large (Size)	2.4014	1966	0.01642	0.6243914	0.6571371
Small (Size)	0.39145	1964	0.6955	0.6243914	0.6302529
Industrials	5.4084	935	0.00000008079	0.6243914	0.7297754
Technology	3.8987	809	0.0001047	0.6243914	0.7077388
Consumer Cyclical	5.6627	535	0.00000002435	0.6243914	0.8013302

Source: Own presentation.

The t-test values depicted in Table 37 provided the conclusion that, for all subgroups and for all variables, a statistically significant difference in the mean level exists. The differences are existent in comparison of each sample to the whole population; i.e. the total firm sample. This implies that differences in the average level of the variables exist across the subgroups. However, it needs to be mentioned that there is some deviation in the level by which the magnitude of the difference in the samples mean level differs from the statistical level of the 95 percent confidence intervals. For example, the small firm sample's mean leverage level (DE) is close to the level of the entire population.

Given the results, it is possible that non-linearities in the relationships between the variables exist, so that a linear regression methodology may not provide the best approach to the analysis of the data. The artificial neural network analysis is deemed as being better able to capture potentially existing non-linearities in the analysis of the data (Pao, 2008), which is investigated in the next section.

4.5 Artificial Neural Network Analysis

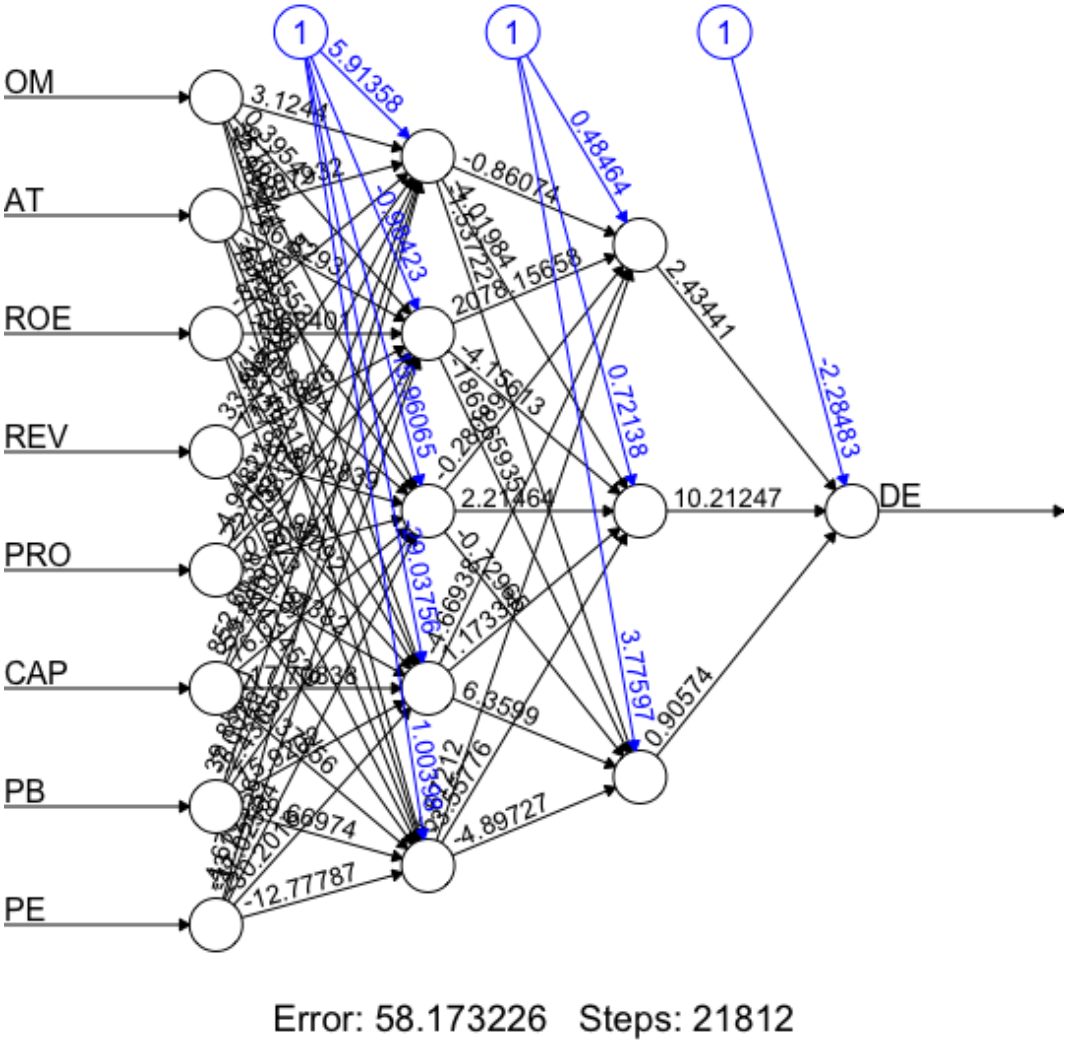
An artificial neural network analysis (ANN) was calculated as an additional tool for assessing the relationship between capital structure and firm performance as well as a potential recursive relationship as well. Given the results achieved so far, the ANN is considered as particularly useful in the investigation of non-linear relationships in the data.

Due to the complexity of employing sophisticated models like the ANN and the number of potential parameter combinations in the dataset, a selection was made regarding the capital structure variable by limiting the analysis towards the investigation of the determinants to leverage (DE) on the basis of the performance variables. Similarly, the recursive relationship was only investigated for the operating margin (OM). This decision was made on the basis of the results of the panel regression, where the group distinction showed OM to be a relatively important variable across the subsets.

Based on the use of two hidden layers with five and three neurons, respectively, the ANN model was calculated by using the performance variables as input variables and the debt ratio as output. This model is shown below in Figure 5 with the lines in black depicting the

connection of the layers with its weights, while the blue lines provide information on the bias that is added to each of the steps:

Figure 5: ANN model using performance variables as regression parameters for the debt ratio (DE)

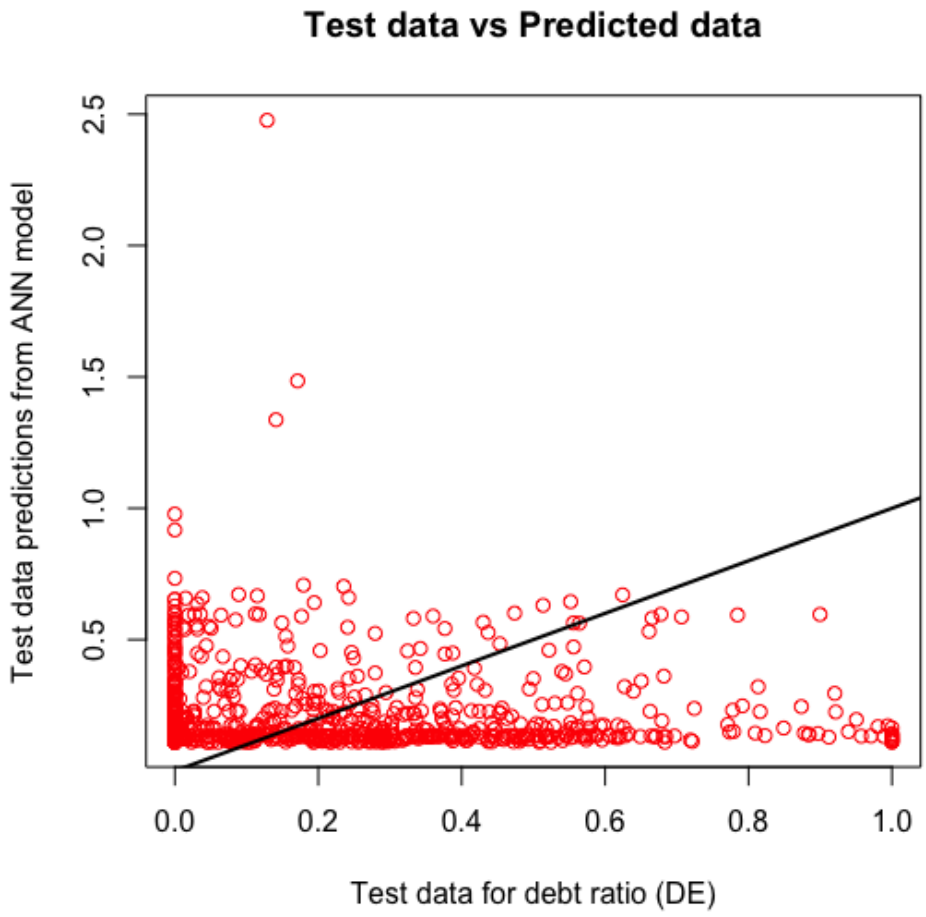


Source: Own presentation.

While Figure 5 cannot be interpreted in detail with respect to the weights or regarding the relationship between the variables and their ability for predictability, it is useful to demonstrate the logic of the analysis of the ANN approach. As the model is based on using

test data as a share of the total data in order to perform predictions, it is relevant to investigate how the ANN model is able to make predictions. The accuracy of the predictions was assessed as well. This was performed by comparing real values with predicted values, as stated below in in Figure 6, where the circles in the graphic show the model predictions. The line in the graph can be used to assess the quality of the predictions with the model. As can be seen, there is a relatively low level of alignment or a relatively small fit of the predicted data to the regression line.[13]

Figure 6: ANN model predictions vs. test data for the debt ratio (DE)



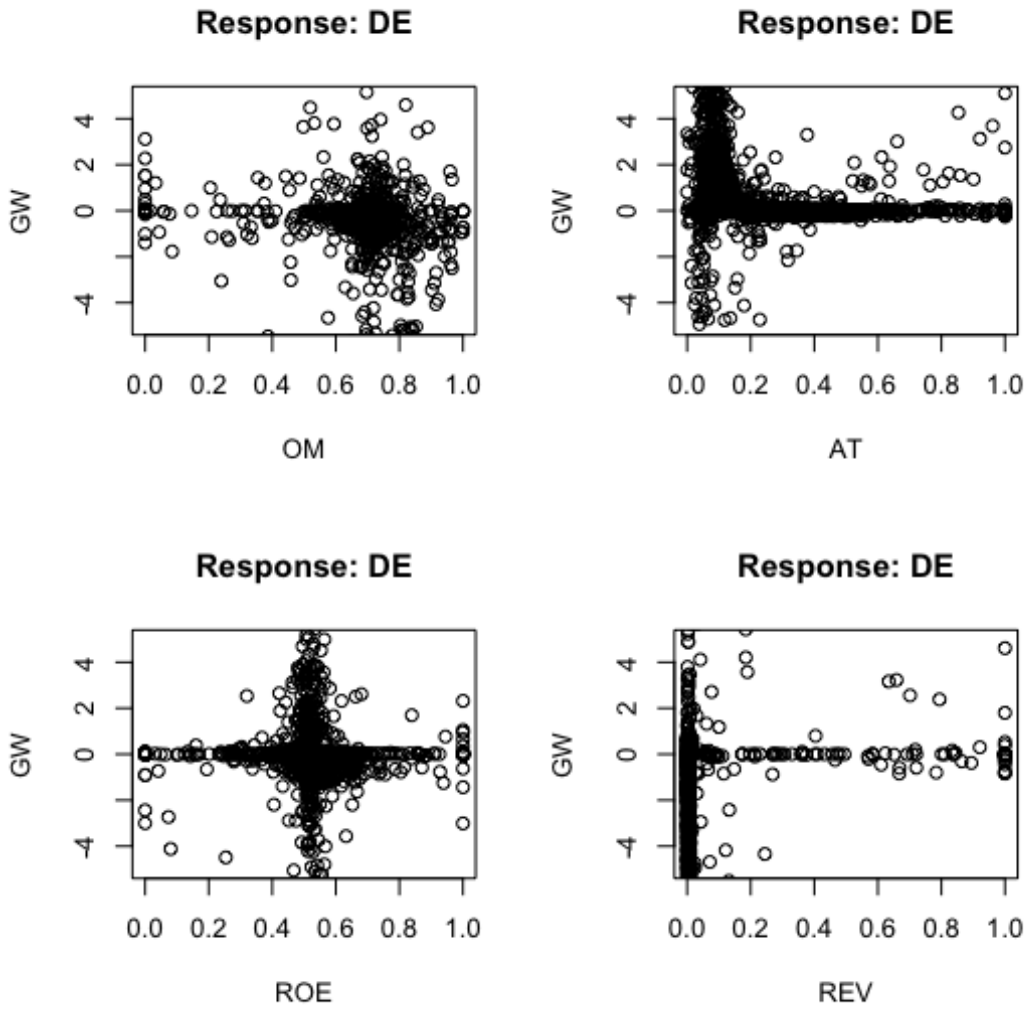
Source: Own presentation.

[13] It can be mentioned that a full alignment is equal to a mean-squared error value of zero.

The result gives evidence to the argument that the model's performance variables are lacking in their ability for explaining the debt ratio. This may not imply the irrelevance of particular variables for explaining the debt ratio but it shows that the model itself does not account for other influences adequately. In this sense, it must also be mentioned that the results for the R^2 in the regression equations also showed very small values. That equally implies that much of the variance of the dependent variable (DE) is not explained by the independent (performance) variables.

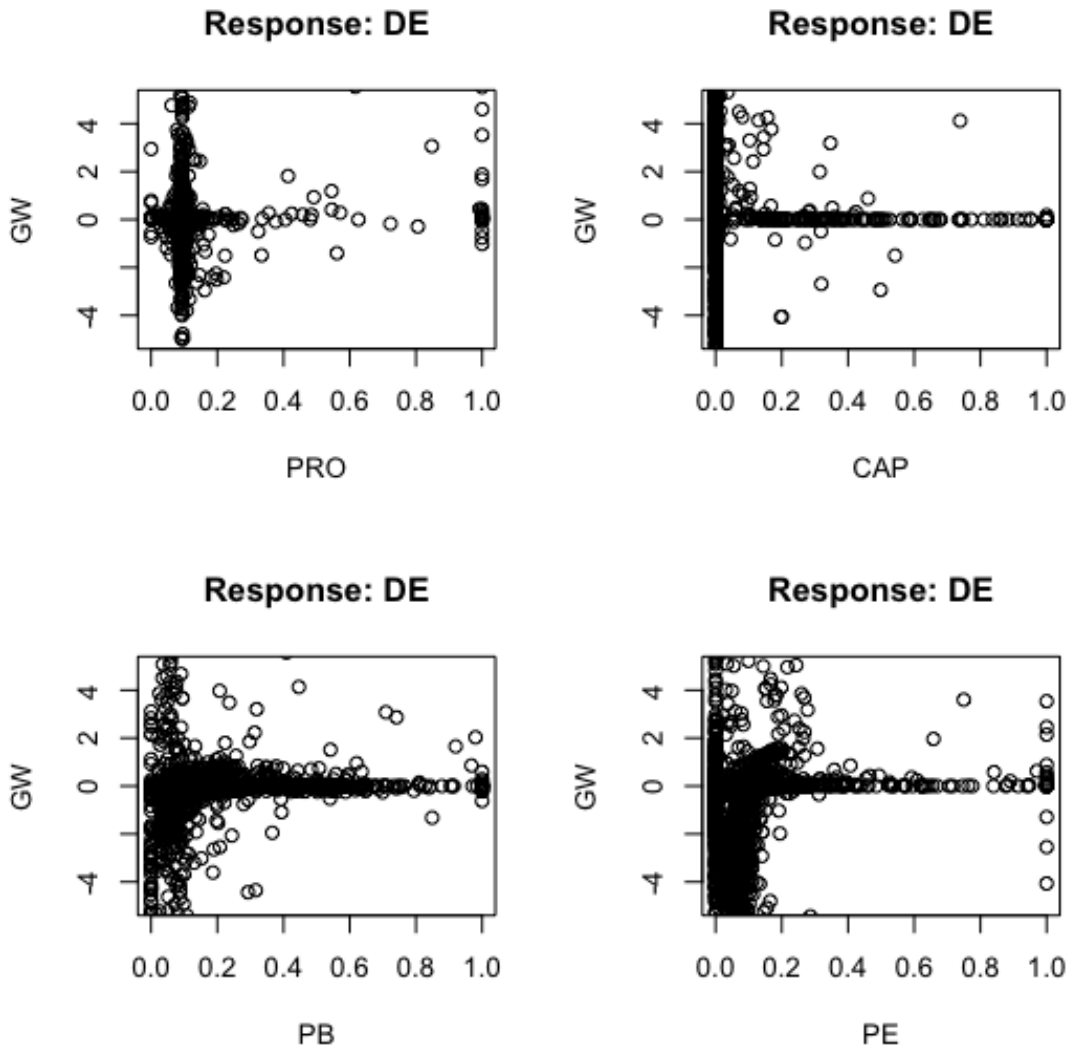
A fundamental concern in the quantitative analysis performed so far in this thesis was the issue of nonlinear relationships in the data. Therefore, the ANN model was evaluated with respect to the generalized weights (GW) of the performance variables. These are shown below in Figure 7 and Figure 8 regarding their responsiveness towards DE.

Figure 7: Generalized weights response of OM, AT, ROE and REV on DE in the ANN model framework



Source: Own presentation.

Figure 8: Generalized weights response of PRO, CAP, PB and PE on DE in the ANN model framework

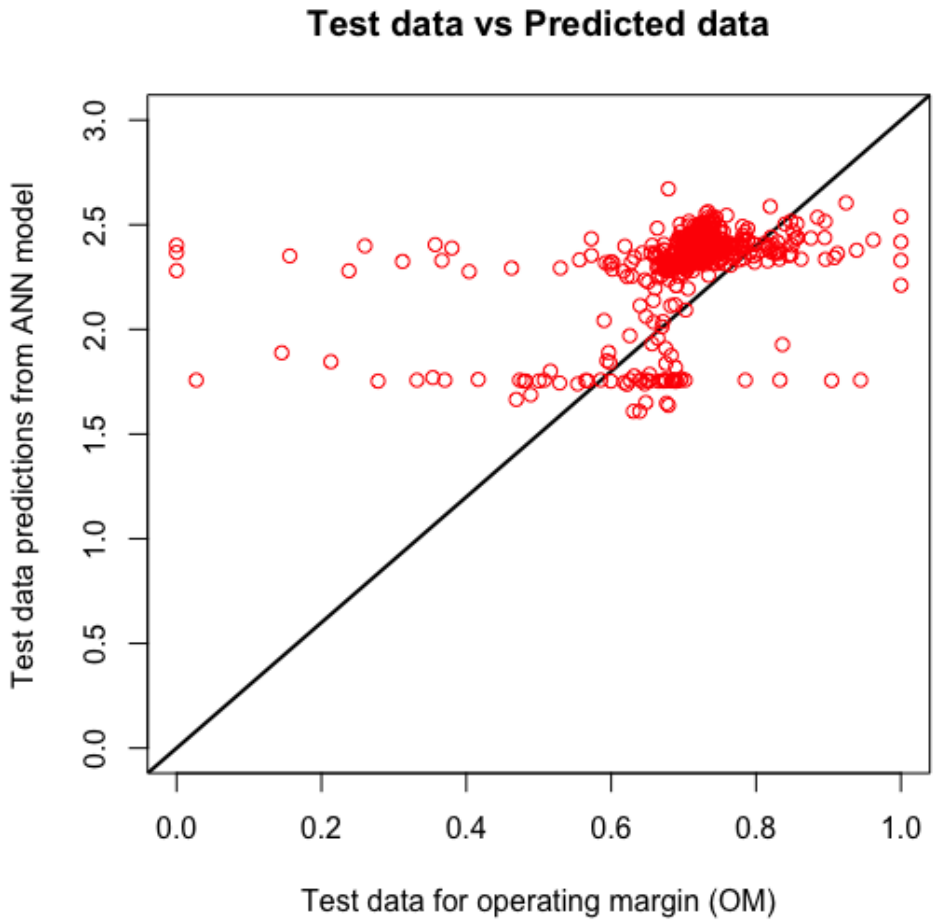


Source: Own presentation.

The results for the responsiveness imply that particular ranges for the values of variables can lead to relatively large deviations in the dependent variable. Given that there are significant mean differences in the mean of the variables across different subgroups (see section 4.4.3 for the results of the t-tests on the subgroups), it can be argued that different levels in performance, typical for some groups of firms in the data in combination with nonlinearities in the data relationships, are making it difficult to adequately predict results.

Similar to the results for DE, the ANN model was also calculated by using the operating margin OM as dependent variable in the regression equation. The results, depicted below in Figure 9, show equally that the model predictions are rather lacking in ability to adequately predict the dependent variable. Therefore, much of the variability of OM remains unexplained when only DE and EI are used as explanatory values.

Figure 9: ANN model predictions vs. test data for the operating margin (OM)

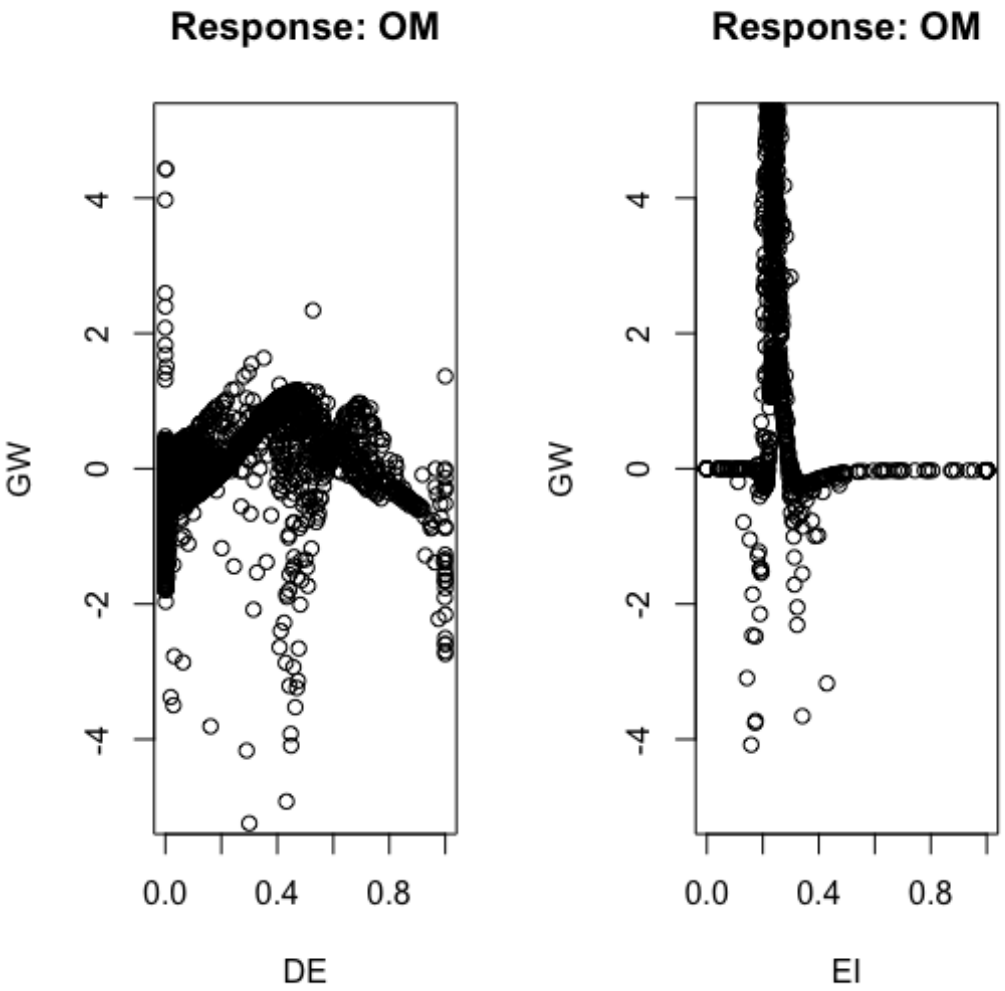


Source: Own presentation.

Additionally, the issue of nonlinearities in the data was also used on the basis of the responsiveness of the generalized weights in the ANN model regarding the independent

variables DE and EI. This is shown below in Figure 10. Compared to the variability of the performance variables, as already shown above, there is also a visible level of responsiveness in the data. Therefore, the current level of the independent variables DE and EI is not irrelevant to the response of OM in the model. However, it is interesting to point out that the response of DE on OM is smaller in comparison.

Figure 10: Generalized weights response of DE and EI on OM in the ANN model framework



Source: Own presentation.

4.6 Results evaluation and discussion

Based on the results shown so far in this chapter, an evaluation and discussion will be provided in order to align the findings with the state of the literature. Also, answers to the central research questions will be provided. This will be performed by discussing, firstly, the impact of firm performance on capital structure. Secondly, the recursive relationship will be addressed. A particular emphasis is provided in terms of the results of the group comparison because of the ability of this distinction for showing how relevant a distinguished analysis to the topic is required.

4.6.1 The impact of business performance on capital structure choice

The first research question refers to the investigation of a potential impact of business performance on capital structure choice of firms. Such research is conducted by a variety of authors (e.g. Frank & Goyal, 2003; Goddard et al., 2005; Zeitun & Tian, 2014). Methodically, it must be mentioned here that existing research is using various ways of measuring performance. Therefore, predictions regarding the influence of business performance on capital structure choice are performed quite differently. For the purpose of this thesis, a set of variables for measuring performance was defined and tested regarding its predictive ability. Hereby, selected performance variables that may show too much correlation were excluded from calculations to enhance predictive capabilities.

The results of the entire set of data from German listed firms in the period from 2008 to 2019 showed little indication for the predictive capabilities of selected performance variables for the debt ratio but also for the interest coverage ratio. Only asset turnover was found to have a statistically significant positive relationship with the debt ratio. The result implies that, for the total firm data, the evidence for an influence of performance to capital structure choice is rather poor. It is, therefore, not possible to draw meaningful conclusions on the validity of mayor capital structure theories, as these could neither be rejected nor directly confirmed by the results.

In contrast to the results of the entire set of firms, group analysis provided more insight into the relationship of business performance on capital structure choice. For example, the debt

ratio of large firms was found as more responsive to performance variables. Interestingly, large firms' performance variables show both, positive and negative relationships. For example, the operating margin is positively related to the debt ratio, whereas ROE, PE and revenue growth show a negative relationship. This may imply that large firms use debt to further grow profitable business opportunities, exemplified by an increasing operating margin. On the other hand, debt may also be helpful and therefore used by large firms in order to finance further investments that are necessary when the firm faces problems growing its revenue of in the case of lower equity returns. The results confirm the notion of Frank and Goyal (2003) that large firms have more reputation in the debt markets and are, therefore, better equipped to use debt in the capital structure. This higher use of debt in the capital structure of large firms was found empirically as well with the t-test, by which mean differences have been evaluated. The results, therefore, provide evidence for the applicability of the existence of market restrictions on the supply of capital, as pointed out for example by Campello et al. (2010). It can also be argued that asymmetric costs may be of relevance as well, particularly as it was found that there is no impact of performance of small firms to their debt ratio. It is possible that superior performance cannot be used effectively to signal the quality of the firm and to obtain more debt capital for smaller firms (Ross, 1977).

Grouping companies based on their revenue or profit growth reveals a certain level of correlation between performance indicators and capital structure decisions. Although this connection is not observed in the majority of cases, there are some exceptions, especially among firms with exceptionally high profitability growth. These firms demonstrate that performance may not necessarily be positively associated with leverage. In fact, for companies in this group, a decrease in return on equity (ROE) and asset turnover led to a significant increase in their debt ratio.

Interestingly, high-growth and highly profitable firms are in a superior position, which allows them to utilize additional debt to fund their activities. This approach can help sustain their high profitability levels, indicating that their capital structure decision is influenced by their growth potential and the potential benefits of additional debt financing. These findings are consistent with those of Eriotis et al. (2002), who also observed a negative correlation between profitability and debt ratio. While the relationship between performance and capital

structure is complex, as evidenced by the empirical results shown so far, this research highlights the importance of considering a company's unique position (including sector and size issues) and potential when making capital structure decisions. While a high level of leverage may not always be beneficial, firms with strong growth potential may benefit from taking on additional debt to fund activities that will help them maintain their position in the market.

With respect to industry distinctions, the results are similar to the results of the total dataset in the sense that view performance variable show an impact on capital structure choice. An observable impact was found for industrial and technology firms regarding a positive relationship of the operating margin and the ROE with the interest coverage ratio. This may show the existence of some firms from these groups with a comparatively good profitability and cash flow situation and a relatively low need to raise additional debt. Indeed, industrial and technology firms show a rather low debt level compared to consumer cyclical firms that potentially require more debt to finance their business activities.

4.6.2 The impact of capital structure on business performance

The impact of capital structure business performance was also assessed. This was performed by using each of the performance variables as dependent variable, while the capital structure variables were used as independent variable. Here, the impact of leverage on the operating margin is very pronounced in the dataset for all firms. This is similarly found for asset turnover as dependent variable as well, albeit with a positive direction. However, with the exception of PB, no significant impact of leverage on other performance variables was detected.

The results are, therefore, rather mixed with respect to the entire dataset. It can be stated that the direction of the functional relationship depends on the type of metric that is used for assessing performance. Interestingly, for particular groups of firms with a higher level of debt in the capital structure, such as large firms or firms in the consumer cyclical segment, performance is reduced with higher leverage. This can be observed regarding the performance measured with metrics including return on equity (ROE), revenue growth (REV), albeit the results are not all statistically significant. Also, regarding AT as dependent

variable, some groups show a negative, while others show a positive impact of a change in leverage. This again shows that firms' performance reacts differently. It is therefore not possible to draw general conclusions from the results.

There are also other groups in addition to large firms and firms in the consumer cyclical sector, where particular performance variables are negatively impacted by a higher level of leverage. Nevertheless, in general, most results do not show a significant relation in fixed-effects regression equation results. The most convincing argument can be made with respect to large firms, as for most performance variables, a negative relationship was found in the case of a change in leverage. It is argued that these firms are best positioned to use leverage, as stated by Frank and Goyal (2003), which is confirmed with the t-tests for the sample. However, the data implies that the increase in leverage may lower overall performance.

In essence, there are cases in the data in which a relationship between capital structure and performance variables including a recursive relationship was found. However, there are no convincing findings that point towards a broad existence of such relationships. With the exception of firms that are distinguished by size, the findings call for further research to be carried out. In this regard, it must be mentioned that the ANN model has implied the existence of nonlinear relationships of variables within the data. Therefore, the methodology applied must be refined in further investigations.

4.7 Discussion of Limitations of the Analysis

There are a number of limitations to the analysis, which will be pointed out in this final section of chapter 4. These include issues concerning timing and adjustments, data issues and model concerns.

Timing and Adjustments

The analysis presented in this thesis may be limited due to the time required for firms to adjust their capital structure. Strebulaev (2007) notes that infrequent large adjustments in the capital structure towards the target level are common, particularly for publicly traded big firms. This may be due to frictions that make firms hesitant to adjust their target leverage

ratios. The slow adjustment of a particular structure in the balance sheet, like in the case of the capital structure, is more common for larger firms and is also found regarding other balance sheet positions, such as the level of cash that firms hold (Gao et al., 2013; Jiang & Lie, 2016).

It is important to note that the presence of these frictions may lead to a slower adjustment of the capital structure towards the target level, which in turn may affect the results of the analysis. Therefore, the results obtained from this study should be interpreted with caution, given these limitations. One possible way to address this limitation is by taking a deeper view over time, such as by using forward lags in the quantitative analysis like in the regressions. Future work on the topic may benefit from focusing particularly on these issues to provide a more comprehensive understanding of the relationship between the capital structure and firm performance.

Data Issues and Missing Data

The issue of missing data is a significant concern in this thesis, and it has been established that incomplete metrics in the panel dataset can lead to a decrease in the results' ability to explain real-world phenomena, ultimately reducing their reliability. The presence of missing data in empirical research that utilizes financial metrics or balance sheet data is not uncommon, and it poses significant challenges in data analysis. The potential impact of missing data can be severe, as the data that is missing may be systematically related to the outcome variable, creating bias in the analysis. Moreover, missing data can result in a decrease in the sample size, which reduces the statistical power of the analysis and the ability to detect meaningful relationships between variables.

Therefore, dealing with missing data in research is crucial, including the issue of dealing with extreme data points, which have been winsorized for practical purposes, as suggested in the empirical literature within other studies (Braun et al., 2017; Habib et al., 2013). Nevertheless, the availability of other methods must be mentioned (Ang, 2021, pp. 61–62) including different assumptions for the cutoff point used in the winsorization of the data as well. It is possible that different methods may lead to different outcomes as well, however it can be assumed that this risk is rather low. Nevertheless, higher quality data is encouraged for future research on the topic.

For instance, the study of Vătavu (2015) is an example of this problem, where missing data resulted in issues regarding the statistical significance of the regression equations. Furthermore, the use of the winsorization approach to address outliers in the data introduces a subjective element to the computational approach. It is worth mentioning that truncation is another method for addressing outliers in the data. However, it also suffers from being a subjective method. The approach to dealing with outliers in the data may impact the results of the analysis, and this should be taken into account when interpreting the results.

To address the issue of missing data, various imputation techniques can be used. One common approach is to use mean imputation, where the missing values are replaced with the mean value of the variable. However, this method can lead to biased estimates, especially if the data are not missing at random. Other approaches such as multiple imputations or regression imputations can provide better results. Future research may also focus on developing new techniques to address the issue of missing data to enhance the reliability of empirical studies.

Model Concerns

As mentioned by Pao (2008), research on capital structure may be impacted by the presence of nonlinear relationships in the data. This critique is confirmed by the results of the ANN modeling approach in this thesis as well. It was shown that the response of the variable that is used as dependent variable in the regression equation can be different in magnitude, depending on the range of the dependent variables used in the calculation. Also, the overall ability of the model to explain relationships is rather low. Further research is encouraged to shed more light on these issues, especially regarding the relationship, where capital structure variables are used to predict firm performance.

Other technical problems to the analysis can also be pointed out. For example, a common problem in capital structure research is the incorporation of non-financial liabilities as a type of debt (Welch, 2011). Whereas values from the financial statements are used for the construction and operationalization of variables, the existence of non-financial debt may, in some cases, lead to lower values for the leverage of the firm. That, in turn, may lead to

problems in the analysis of the relationship between firm performance and capital structure as well.

5. Conclusions

Finally, the conclusion will be shown. Here, a summary of the main findings is presented. Also, contributions to theory and practice are pointed out.

5.1 Summary of Main Findings

In this thesis, the interdependence of capital structure and business (or firm) performance was evaluated. The investigation was performed on the basis of data from German listed firms over the period from 2008 to 2019. A total of 361 listed firms was hereby used, with firms in the financial services sector having been excluded in order to not distort results due to the special characteristics of the financial services sector capital structure. Generally, the sample included firms of different sizes, albeit all firms are companies listed on a German stock exchange.

Given the variety in research, for example regarding the metrics that can potentially be used for such research (Salim & Yadav, 2012; Vătavu, 2015), an exploratory attempt was made by focusing on the debt ratio and the interest coverage ratios as metrics for capital structure, while using a total of eight variables for representing or measuring performance. The methods employed include stepwise forward regression or fixed and random panel regression models for various combinations of variables and for different subgroups (panels) of the dataset. Also, an artificial neural network (ANN) was calculated with some of the data as well in order to verify the results from the fixed regression models.

Regarding the entire dataset, it can be shown that, for the majority of the variables, no significant relationships could be found in predicting the debt ratio, except for asset turnover, which showed a strong and significant relationship. The results for the interest coverage ratio have shown that a total of four variables are able to significantly predict this ratio. These include the operating margin, the asset turnover, return on equity and the price-to-book ratio.

Given that the calculations were performed not only for the total dataset but also for subgroups, differentiated by differences in revenue and profit growth as well as size and industry, it was found that particular groups differ in terms of the statistical significance of the variables. Especially the debt ratio of large firms showed a larger responsiveness to the

performance variables in the regression models. This can be used as an argument in favor of the results of Frank and Goyal (2003) in terms of the financing options of larger firms being superior compared to smaller firms. Indeed, the debt ratio of particular groups of firms, such as large firms, was found to be higher than for other groups of firms in the data.

The results imply that, for particular firms, a relationship between capital structure and performance exists, whereas the recursive relationship can also be found. For these firms, a relationship between leverage and efficiency or performance exists, as found by various researchers (e.g. Jensen & Meckling, 1976; Frank & Goyal, 2003; Goddard et al., 2005; Zeitun & Tian, 2014). However, the reverse relationship stated by others (e.g. Berger & Bonaccorsi di Patti, 2006; Margaritis & Psillaki, 2010) was also found in some particular cases. However, generally, for many combinations of variables and subgroups, the evidence is rather low.

It must also be mentioned that differences in the level of the metrics used to measure capital structure and performance differs across groups. Moreover, the ANN approach showed indications for the existence of nonlinear relationships to be relevant. Therefore, it must be stated that research on the interrelations of capital structure and business performance should be clearly performed with data of comparable firms, whereas a merged sample of firms with different characteristics regarding growth, size or industry assignment is not necessarily the best choice to draw meaningful conclusions.

5.2 Contributions to Theory

The thesis has provided another empirical research attempt in the realm of capital structure research. In contrast to most of the existing research, the interrelation or recursive relationship of capital structure and business performance was evaluated, contributing to empirical studies like for example the ones by Iyoha and Umoru (2017) or Margaritis and Psillaki (2010).

The main contribution can be stated as having shown the need for more differentiation in the sample selection to the topic. It is evident that the interrelation between capital structure and performance is different across different types of firms. Future research is encouraged to

provide more nuanced research by focusing on more equal samples of firms. This might also include research in the existence of nonlinear relationships within the interrelation of variables for capital structure and performance.

Academic research into the factors affecting firm growth has highlighted varying relationships between firm performance and capital structure determinants such as leverage ratio (e.g.. López- Garcia & Puente, 2009; Senderovitz et al., 2015; Li et al., 2019). However, this research tends to be focused on small firms that are not publicly listed. While these findings are valuable for understanding the growth dynamics of small firms, caution is advised when extrapolating them to larger or publicly traded companies, as the factors influencing growth and performance can be quite different. The results from this thesis contribute to this type of research by showing that the dynamics between capital structure and performance also need to be addressed in the context of distinguishing different types of firms as well. Nevertheless, further research is needed to understand the complex interplay between capital structure and firm performance across a broader range of firms, including larger listed firms.

It is indeed possible that there are additional differences in the dynamics of capital, structure, and growth across countries from various institutional backgrounds as well. The dynamics of firms can be affected by factors such as economic, legal, and cultural differences. Therefore, it is likely that firms in different countries would have varying dynamics as well. This is mostly an issue in the context of pursuing studies with data from various countries simuoultanously (Schmitt, 2009, p. 123; Havlik et al., 2012, p. 219). For instance, in countries with less developed financial markets, firms may have limited access to capital and rely more on internal financing sources. In contrast, firms in countries with well-developed financial markets may have easier access to external capital sources. This difference in capital dynamics could impact the way firms in these countries approach growth and structure. Moreover, the legal and regulatory frameworks in different countries could impact the way firms structure themselves. For example, in countries where there are more stringent regulations on corporate governance, firms may have a more centralized structure. In contrast, in countries where regulations are less strict, firms may have a more decentralized structure. Cultural differences can also impact the way firms approach growth and structure. In some cultures, there may be a preference for hierarchical structures, while

in others, there may be a preference for flat structures. These cultural differences could also impact the way firms approach growth and investment. Therefore, it is important to recognize that the dynamics of firms are not universal and can vary across countries. While the sample in this thesis has only covered German firms, it is essential to consider how the dynamics of firms in other countries may differ to the German firm sample. Overall, these issues mentioned at this point are known in the literature as institutional factors. These are highly relevant for the academic research as they impact empirical studies on capital structure themes (González, 2013; Wald, 1999).

It would therefore be of interest from a theoretical point of view if the obtained results are similar with data from other countries, including countries with a similar industrial structure like Germany but also in comparison to countries with other characteristics. The dynamics of firms can also vary significantly across different sectors. The factors that influence the relationship between capital structure and performance including the recursive relationship of firms in one sector may not be the same for another sector. Therefore, it is important to understand how the dynamics of firms vary across different sectors. The thesis has highlighted differences in the dynamics of firms in the industrials, technology, and consumer cyclical sector. However, it is possible that other sectors may have unique dynamics as well, which have not been investigated. Also, same sector research from different countries is encouraged as well, as the same sectors typically exhibit comparable characteristics of financial metrics and such relationships (Vernimmen, 2018, p. 133). Future research should explore the dynamics of firms across a broader range of sectors. By doing so, researchers can gain a more comprehensive understanding of how the dynamics of firms vary across different sectors. This can help firms and academic researchers better understand the factors that influence the success of firms in different industries.

In conclusion, while the thesis has provided valuable insights into the dynamics of firms in the specific sectors of industrials, technology, and consumer cyclical sector for a set of German firm data, it is important to continue exploring the dynamics of firms across a broader range of sectors. Understanding the unique dynamics of different sectors can help firms and policymakers make informed decisions and improve the overall health of the economy. This is particularly relevant given the findings from the research on the relationship between capital structure and growth and their recursive relationship across

different sectors (Berger & Bonaccorsi di Patti, 2006; Iyoha & Umoru, 2017; Margaritis & Psillaki, 2010).

5.3 Contributions to Practice and Managerial Recommendations from the Study

The empirical study on the relationship between capital structure and growth has several managerial implications for firms across industries. The study provides insights into the factors or determinants that influence a firm's capital structure and the relationship between capital structure and business performance. The thesis also highlights differences in these dynamics of firms across several industries or sectors and shows additional relevance for existence of non-linearity in the data. As such it contributes to existing studies such as from Margaritis and Psillaki (2010) or from Baum et al. (2006).

Practitioners can use the findings to optimize the capital structure of firms in order to enhance performance. However, it must be cautioned that the results are of a rather theoretical nature and practical applicability is limited. Nevertheless, a useful practical suggestion is that firms with characteristics react differently with respect to the interrelation of capital structure and performance. Managers are encouraged to use the findings from their particular subgroup of firm to their advantage for further optimization.

One of the key managerial implications of the study is the importance of understanding the factors that influence a firm's capital structure. The study found that firms in different industries have different dynamics in the interplay between capital structure and performance. For instance, firms in the consumer cyclical sector tend to rely more on debt financing than firms in the industrial or technology sectors, where equity financing has a stronger role.[14] Managers should, therefore, consider the unique factors that influence their industry when making capital structure decisions. By doing so, firms can optimize their capital structure and maximize their growth potential.

However, the study also found some relationships not showing a significant relationship in the regressions. This suggests that there may be other factors beyond those examined in the

[14] The t-test for mean differences has shown evidence for this relationship.

study that influence the relationship between capital structure and growth. Managers should, therefore, consider other factors such as industry-specific regulations, market conditions, and the firm's competitive environment when making capital structure decisions.

Moreover, the thesis has employed ANN models to investigate relationships in the data. These imply the existence of potential non-linearity in the data. This further complicates the topic and requires additional theoretical research and practical experience of real firms. Managers should, therefore, be cautious when interpreting the study's results and consider the potential non-linearity in the data when interpreting the results and apply it to their specific environments as well.

In conclusion, the empirical study on the relationship between capital structure and growth has several managerial implications for firms across industries. Managers should consider the unique factors that influence their industry when making decision on capital structure in the context of their firms' performance characteristics. In order to better understand the relationship between capital structure and business performance, it is best to consider other factors beyond those examined in the study. By doing so, managers can contribute to the optimization of the capital structure of their firms so as to enhance business performance. This might also include various issues in the realm of behavioral decision-making such as overconfidence, which is a prevent phenomenon with managers (Kahneman & Lovallo, 1993, p. 26; Malmendier et al., 2011) and which has shown to be of influence to capital structure and financing decision in practice as well (Voon et al., 2020). However, within the present thesis these influences are out of the scope of evaluation.

References

Abdou, H. A., Kuzmic, A., Pointon, J., & Lister, R. J. (2012). Determinants of Capital Structure in the Uk Retail Industry: A Comparison of Multiple Regression and Generalized Regression Neural Network. *Intelligent Systems in Accounting, Finance and Management*, *19*(3), 151–169. https://doi.org/10.1002/isaf.1330

Abor, J. (2005). The effect of capital structure on profitability: An empirical analysis of listed firms in Ghana. *The Journal of Risk Finance*, *6*(5).

Achtenhagen, L., Naldi, L. & Melin, L. (2010). Business Growth: Do Practitioners and Scholars Really Talk About the Same Thing? *Entrepreneurship Theory and Practice*, 34(2), 289–316.

Acs, Z., Parsons, W. & Tracy, S. (2008). *High-Impact Firms: Gazelles revisited*. Washington: Corporate Research Board.

Akerlof, G. A. (1970). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics*, *84*(3), 488–500. https://doi.org/10.2307/1879431

Al-Najjar, B. (2013). The financial determinants of corporate cash holdings: Evidence from some emerging markets. *International Business Review*, *22*(1), 77–88. https://doi.org/10.1016/j.ibusrev.2012.02.004

Albrecht, W. S., Albrecht, C., & Albrecht, C. C. (2008). Current Trends in Fraud and its Detection. *Information Security Journal: A Global Perspective*, 17(1), 2–12. https://doi.org/10.1080/19393550801934331

Alchian, A. (1950). Uncertainty, Evolution and Economic Theory. *Journal of Political Economy, 58*, 211–221.

Aldrich, H. (1999). *Evolving Organisations*. London: Sage Publications.

Altman, E. I. (1984). A Further Empirical Investigation of the Bankruptcy Cost Question. *The Journal of Finance*, *39*(4), 1067–1089. https://doi.org/10.2307/2327613

Almus, M. (2000). What characterizes a Fast-Growing Firm? Discussion Paper 01- 40. *Mannheim: Zentrum für Europäische Wirtschaftsforschung*.

Amat, O., & Perramon, J. (2010). Gazelle companies: Growth drivers and an evolution analysis. *Economics Working Papers*, Article 1244. https://ideas.repec.org//p/upf/upfgen/1244.html

Ang, C. S. (2021). *Analyzing Financial Data and Implementing Financial Models Using R*. Springer International Publishing. https://doi.org/10.1007/978-3-030-64155-9

Ansoff, H. I. (1988). *The New Corporate Strategy*. New York: Wiley.

Ansoff, H. I. (1965). *Checklist for Competitive and Competence Profiles; Corporate Strategy*. New York: McGraw-Hill.

Anyadike-Danes, M., Bonner, K., Hart, M., & Mason, C. (2009). *Measuring business growth: High-growth firms and their contribution to employment in the UK*. National Endowment for Science, Technology and the Arts (NESTA).

Arnold, G. (2008). *Corporate Financial Management* (4th ed.). Prentice-Hall.

Backhaus, K., Erichson, B., Plinke, W., & Weiber, R. (2018). *Multivariate Analysemethoden: Eine anwendungsorientierte Einführung.* Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-56655-8

Baker, M., & Wurgler, J. (2002). Market Timing and Capital Structure. *The Journal of Finance*, *57*(1), 1–32. https://doi.org/10.1111/1540-6261.00414

Ball, R. (2016). IFRS – 10 years later. *Accounting and Business Research*, 46(5), 545–571.

Baltes-Götz, B. (2018). *Lineare Regressionsanalyse mit SPSS*. Trier: University of Trier.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.

Barringer, B. R., & Jones, F. F. (2004). Achieving rapid growth - revisiting the managerial capacity problem. *Journal of Developmental Entrepreneurship*, *9*(1), 73–87.

Barringer, B. R., Jones, F. F. & Neubaum, D. O. (2005). A quantitative content analysis of the characteristics of rapid-growth firms and their founders. *Journal of Business Venturing*, *20*(5), 663–664.

Baum, C. F., Schafer, D., & Talavera, O. (2006). The Effects of Short-Term Liabilities on Profitability: The Case of Germany. *DIW Discussion Paper, 635*, 1–23.

Beers, C., & Zand, F. (2014). R&D Cooperation, Partner Diversity, and Innovation Performance: An Empirical Analysis. *Journal of Product Innovation Management*, 31, 292-312.

Belitz, H., Lejpras, A., & Priem, M. (2019). Research and development abroad: German companies focus on strengths similar to those at home. *DIW Weekly Report*, *9*(35/36), 313–321. https://doi.org/10.18723/diw_dwr:2019-35-2

Belsley, D. A., Kuh, E., and Welsch, R. E. (1980). *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*. New York: John Wiley & Sons.

Bergauer, A. (2001). *Erfolgreiches Krisenmanagement in der Unternehmung. Eine empirische Analyse*. Berlin: ESV.

Berger, A. N. (1995). The Relationship between Capital and Earnings in Banking. *Journal of Money, Credit and Banking*, *27*(2), 432–456. https://doi.org/10.2307/2077877

Berger, A. N., & Bonaccorsi di Patti, E. (2006). Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry. *Journal of Banking & Finance*, *30*(4), 1065–1102. https://doi.org/10.1016/j.jbankfin.2005.05.015

Bertrand, M., & Schoar, A. (2003). Managing With Style: The Effect of Managers on Corporate Policy. *Quarterly Journal of Economics*, *118*(4), 1169–1208.

Bessant, J., Phelps, B., & Adams, R. (2005). *External Knowledge: a Review of the Literature Addressing the Role of External Knowledge and Expertise at Key Stages of Business Growth and Development*. London: Advanced Institute of Management.

Bhide, A. V. (2003). The Origin and Evolution of New Businesses. New York: Oxford University Press.

Bibeault, D. B. (1999). *Corporate Turnaround. How Managers Turn Losers into Winners*. Washington: Beard.

BMWI. (2021). *Gross value added by sector in Germany, 2017*. https://www.bmwi.de/Redaktion/EN/Infografiken/gross-value-addes-by-sector.html

Bonate, P. L. (2011). *Pharmacokinetic-Pharmacodynamic Modeling and Simulation* (2nd ed.). New York: Springer.

Börner, C., Grichnik, D., & Reize, F. (2010). Finanzierungsentscheidungen mittelständischer Unternehmer—Einflussfaktoren der Fremdfinanzierung deutscher KMU. *Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung*, *62*(2), 227–275. https://doi.org/10.1007/BF03377359

Bortz, J., & Schuster, C. (2010). *Statistik für Human- und Sozialwissenschaftler* (7th ed.). Berlin: Springer.

Botazzi, G., & Secchi, A. (2003). A Stochastic Model of Firm Growth. *Physica A, 324*, 213–219.

Bottazzi, G., & A. Secchi. (2003). A Stochastic Model of Firm Growth. *Physica A: Statistical Mechanics and its Applications*, 324(1), 213-219.

Bradley, M., Jarrell, G. A., & Kim, E. H. (1984). On the Existence of an Optimal Capital Structure: Theory and Evidence. *The Journal of Finance*, *39*(3), 857–878. https://doi.org/10.2307/2327950

Braun, R., Jenkinson, T., & Stoff, I. (2017). How persistent is private equity performance? Evidence from deal-level data. *Journal of Financial Economics*, 273–291.

Braunecker, C. (2016). *How to do Empirie, how to do SPSS: Eine Gebrauchsanleitung*. Vienna: UTB Falcutas.

Brennan, M. J., & Schwartz, E. S. (1978). Corporate Income Taxes, Valuation, and the Problem of Optimal Capital Structure. *The Journal of Business*, *51*(1), 103–114.

Brennan, M. J., & Schwartz, E. S. (1984). Optimal Financial Policy and Firm Valuation. *The Journal of Finance*, *39*(3), 593–607. https://doi.org/10.2307/2327917

Bromiley, P. (1991). Testing a Causal Model of Corporate Risk Taking and Performance. *Academy of Management Journal*, *34*(1), 37–59. https://doi.org/10.5465/256301

Brost, H. (Ed.). (2005). *Unternehmensnachfolge im Mittelstand.* 2nd Edition. Bankakademie-Verlag.

Bruner, R., Eades, K., Harris, R., & Higgins, R. (1998). Best Practices in Estimating the Cost of Capital: Survey and Synthesis. *Financial Practice and Education*, 8, 13–28.

Brusov, P., Filatova, T., & Orekhova, N. (2022). Optimal Capital Structure of the Company: Its Absence in Modigliani–Miller Theory with Risky Debt Capital. In P. Brusov, T. Filatova, & N. Orekhova (Eds.), *Generalized Modigliani–Miller Theory: Applications in Corporate Finance, Investments, Taxation and Ratings* (pp. 57–63). Springer International Publishing. https://doi.org/10.1007/978-3-030-93893-2_4

Bryman, A. and Bell, E. (2011) *Business Research Methods*. 3rd Edition, Oxford University Press, Oxford.

Bulut, C., & Can, O. (2013). Business Performance. *Encyclopedia of Corporate Social Responsibility*, 273–279. https://doi.org/10.1007/978-3-642-28036-8_665

Buschmann, H. (2006). *Erfolgreiches Turnaround-Management. Empirische Untersuchung mit Schwerpunkt auf den Einfluss der Stakeholder*. Wiesbaden: Gabler Springer.

Buzzell, R. D., & Gale, B. T. (1989). *Das PIMS-Programm: Strategien und Unternehmenserfolg.* Wiesbaden: Gabler Springer.

Buzzell, R. D., Gale, B. T., & Sultan, R. G. (1975). *Market share: a key to profitability. Harvard Business Review*, 53(1), 97–106.

Campbell, J. Y., Lo, A. W., & MacKinlay, A. C. (1997). *The Econometrics of Financial Markets*. Princeton University Press. https://doi.org/10.2307/j.ctt7skm5

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics*, *97*(3), 470–487. https://doi.org/10.1016/j.jfineco.2010.02.009

Castrogiovannia, G. J., & Bruton, G. D. (2000). Business Turnaround Processes Following Acquisitions: Reconsidering the Role of Retrenchment, Journal of Business Research, 48(1), 25–34.

Chadha, S., & Sharma, A. K. (2015). Capital Structure and Firm Performance: Empirical Evidence from India. *Vision*, *19*(4), 295–302. https://doi.org/10.1177/0972262915610852

Chaganti, R., Cook, R. G., & Smeltz, W. J. (2002). Effects of styles, strategies, and systems on the growth of small businesses. *Journal of Developmental Entrepreneurship, 7*(2), 175.

Chen, J. J. (2004). Determinants of capital structure of Chinese-listed companies. *Journal of Business Research*, *57*(12), 1341–1351. https://doi.org/10.1016/S0148-2963(03)00070-5

Churchill, N. C., & Lewis, V. L. (1983). The five stages of small business growth. *Harvard Business Review, 61*(3), 30–50.

Cleves, M. A., Gould, W. W., Gutierrez, R. G. and Marchenko, Y. V. (2010). *An Introduction to Survival Analysis Using Stata, Stata Press*, College Station, TX.

Coad, A., & Rao, R. (2010). Firm growth and R&D expenditure'. *Economics of Innovation and New Technology*, 19(2), 127–145.

Coad, A., Cowling, M., Nightingale, P., Pellegrino, G., Savona, M., & Siepel, J. (2014). *Innovative Firms and Growth*. London: Macmillan.

Coase, R. H. (1937). The Nature of the Firm. *Economica*, *4*(16), 386–405. https://doi.org/10.2307/2626876

Coleman, S. (2000). Access to capital and terms of credit: A comparison of men- and women-owned small businesses. *Journal of Small Business Management, 38*, 37–52.

Dalley, J., & Hamilton, R. T. (2000). Knowledge, context and learning in the small business. *International Small Business Journal*, *18*(3), 51–59.

Damodaran, A. (2002). *Investment Valuation: Tools and Techniques*. New York: Wiley.

Davidsson, P., & Delmar (2006). High-Growth Firms and Their Contribution To Employment: The Case Of Sweden 1987-96. In P. Davidsson, F. Delmar, J. Wiklund & P. Davidsson (eds.), *Entrepreneurship and the Growth of Firms* (pp. 156-178). Cheltenham: Edward Elgar.

Davidsson, P., Kirchhoff, B., Hatemi, A., & Gustavsson, H. (2002). Empirical analysis of business growth factors using Swedish data. *Journal of Small Business Management, 40*(4), 332–349.

Davis, P. J. (2015). Implementing an employee career-development strategy: How to build commitment and retain employees. *Human Resource Management International Digest, 23*(4), 28–32. https://doi.org/10.1108/HRMID-05-2015-0066

Deakins, D., & Freel, M. (1998). Entrepreneurial learning and the growth process in SMEs. *The Learning Organization, 5*(3), 144–156.

Delmar, F., Davidsson, P., & Gartner, W. B. (2003). Arriving at the High-Growth Firm. *Journal of Business Venturing, 18*(2), 189–216.

Denis, D. J., & Mihov, V. T. (2003). The choice among bank debt, non-bank private debt, and public debt: Evidence from new corporate borrowings. *Journal of Financial Economics, 70*(1), 3–28. https://doi.org/10.1016/S0304-405X(03)00140-5

Dobbs, M., & Hamilton, R. (2007). Small business growth: recent evidence and new directions. *International Journal of Entrepreneurial Behavior & Research, 13*(5), 296–322.

Doukas, J. A., Guo, J., & Zhou, B. (2011). 'Hot'debt markets and capital structure. *European Financial Management, 17*(1), 46–99.

Drucker, P. (1954). *The Practice of Management*. New York: Harper Business.

Dwivedi, D. N. (2010). *Macroeconomics*. New Delhi: McGraw-Hill.

Easterby-Smith, M., Thorpe, R., & Jackson, P. R. (2015). *Management and Business Research* (5th ed.). SAGE Publications.

Eichhorn, W., & Gleißner, W. (2016). *Mathematics and Methodology for Economics*. Springer International Publishing. https://doi.org/10.1007/978-3-319-23353-6

Eichner, T. (2010). *Restructuring and Turnaround of Distressed Manufacturing Firms*. An International Empirical Study. Frankfurt: Lang.

Eriotis, N. P., Frangouli, Z., & Ventoura-Neokosmides, Z. (2002). Profit Margin And Capital Structure: An Empirical Relationship. *Journal of Applied Business Research (JABR)*, *18*(2), Article 2. https://doi.org/10.19030/jabr.v18i2.2118

Evans, D. S. (1987). Tests of alternative theories of firm growth. *The Journal of Political Economy*, *95*(4), 657–674.

Fadahunsi, A. (2012). The Growth of Small Businesses: Towards A Research Agenda. *American Journal of Economics and Business Administration*, *4*(1), 105–115. https://doi.org/10.3844/ajebasp.2012.105.115

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, *25*(2), 383–417. JSTOR. https://doi.org/10.2307/2325486

Fama, E. F. (1980). Agency Problems and the Theory of the Firm. *Journal of Political Economy*, *88*(2), 288–307.

Fama, E. F., & French, K. R. (2002). Testing Trade-Off and Pecking Order Predictions about Dividends and Debt. *The Review of Financial Studies*, *15*(1), 1–33. JSTOR.

Fama, E. F., & French, K. R. (2005). Financing decisions: Who issues stock? *Journal of Financial Economics*, *76*(3), 549–582. https://doi.org/10.1016/j.jfineco.2004.10.003

Faulkender, M., & Petersen, M. A. (2006). Does the Source of Capital Affect Capital Structure? *The Review of Financial Studies*, *19*(1), 45–79. https://doi.org/10.1093/rfs/hhj003

Finch, V. (2002). *Corporate Insolvency Law: Perspectives and Principles*. Cambridge University Press.

Fosu, S. (2013). Capital structure, product market competition and firm performance: Evidence from South Africa. *The Quarterly Review of Economics and Finance*, *53*(2), 140–151. https://doi.org/10.1016/j.qref.2013.02.004

Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of Financial Economics*, *67*(2), 217–248. https://doi.org/10.1016/S0304-405X(02)00252-0

Frank, M. Z., & Goyal, V. K. (2009). Capital Structure Decisions: Which Factors Are Reliably Important? *Financial Management*, *38*(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

Frank, M. Z., & Goyal, V. K. (2015). The Profits–Leverage Puzzle Revisited*. *Review of Finance*, *19*(4), 1415–1453. https://doi.org/10.1093/rof/rfu032

Freel, M. S., & Robson, P. J. A. (2004). Small Firm Innovation, Growth and Performance: Evidence from Scotland and Northern England. *International Small Business Journal*, *22*(6), 561–575. https://doi.org/10.1177/0266242604047410

Frenz, M., & Letto-Gillies, G. (2009). The Impact on Innovation Performance: Evidence from the UK Community Innovation Survey. *Research Policy*, 38, 1125-1135.

Frydenberg, S. (2004). *Determinants of Corporate Capital Structure of Norwegian Manufacturing Firms* (SSRN Scholarly Paper No. 556634). https://doi.org/10.2139/ssrn.556634

Gao, H., Harford, J., & Li, K. (2013). Determinants of corporate cash policy: Insights from private firms. *Journal of Financial Economics*, *109*(3), 623–639. https://doi.org/10.1016/j.jfineco.2013.04.008

Gellweiler, C. (2018). Cohesion of RBV and industry view for competitive positioning. *Strategic Management*, 23(2), 3–12.

Gibrat, R. (1931). *Les Inégalités Économiques*. Paris: Librairie du Recueil Sirey.

Ginter, P. M., Duncan, W. J., & Swayne, L. E. (2018). *Strategic Management*. Hoboken: Wiley.

Goddard, J., Tavakoli, M., & Wilson, J. O. S. (2005). Determinants of profitability in European manufacturing and services: Evidence from a dynamic panel model. *Applied Financial Economics*, *15*(18), 1269–1282. https://doi.org/10.1080/09603100500387139

González, V. M. (2013). Leverage and corporate performance: International evidence. *International Review of Economics & Finance*, *25*, 169–184. https://doi.org/10.1016/j.iref.2012.07.005

Gordon, M. J. (1992). The neoclassical and a post Keynesian theory of investment. *Journal of Post Keynesian Economics*, *14*(4), 425–443.

Graham, J. R., & Harvey, C. R. (1997). Grading the Performance of Market-Timing Newsletters. *Financial Analysts Journal*, *53*(6), 54–66. https://doi.org/10.2469/faj.v53.n6.2130

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, *60*(2), 187–243. https://doi.org/10.1016/S0304-405X(01)00044-7

Graham, J. R., Harvey, C. R., & Puri, M. (2013). Managerial attitudes and corporate actions. *Journal of Financial Economics*, *109*(1), 103–121. https://doi.org/10.1016/j.jfineco.2013.01.010

Graham, J. R., & Leary, M. T. (2011). A Review of Empirical Capital Structure Research and Directions for the Future. *Annual Review of Financial Economics*, *3*(1), 309–345. https://doi.org/10.1146/annurev-financial-102710-144821

Greiner, L. E. (1998). Evolution and revolution as organizations grow. *Harvard Business Review*, *76*(3), 55–68.

Grinyer, P. H., & Mayes, D. G., & McKiernan, P. (1988). *Sharpbenders. The Secrets of Unleashing Corporate Potential*. Oxford: Oxford University Press

Gropp, R., & Heider, F. (2008, May 7). *The determinants of capital structure: Some evidence from banks* [Working Paper]. None. http://ub-madoc.bib.uni-mannheim.de/1918

Gruenwald, R. K. (2016). *Causes of High-Growth of Small- and Mid-Cap Companies in the DACH Countries* (PhD Dissertation). Krakow: University of Economics.

Gruenwald, R. K. (2015). Measuring growth of the firm: Theoretical considerations - ProQuest. *International Entrepreneurship Review*, *1*(2), 121–131.

Habib, A., Uddin Bhuiyan, B., & Islam, A. (2013). Financial distress, earnings management and market pricing of accruals during the global financial crisis. *Managerial Finance*, *39*(2), 155–180. https://doi.org/10.1108/03074351311294007

Hackbarth, D. (2008). Managerial Traits and Capital Structure Decisions. *The Journal of Financial and Quantitative Analysis*, *43*(4), 843–881.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.). Harlow: Pearson.

Hall, G., Hutchinson, P., & Michaelas, N. (2000). Industry Effects on the Determinants of Unquoted SMEs' Capital Structure. *International Journal of the Economics of Business*, *7*(3), 297–312. https://doi.org/10.1080/13571510050197203

Hall, R. E., & Lieberman, M. (2012). *Microeconomics: Principles and Applications*. Cengage Learning.

Hamel, G., & Prahalad, C. K. (1990). The Core Competence of the Corporation. *Harvard Business Review*, *68*(3), 79–90.

Hamel, G., & Prahalad, C. K. (1994). *Competing for the future*. Boston: Harvard Business School Press.

Harris, M., & Raviv, A. (1991). The Theory of Capital Structure. *The Journal of Finance*, *46*(1), 297–355. https://doi.org/10.1111/j.1540-6261.1991.tb03753.x

Hartmann, S. (2016). *Turnaround-Management im deutschsprachigen Raum: Empirische Studie zum Turnaround und Lebenszyklus in Deutschland, der Schweiz und Österreich*. Göttingen: Cuvillier.

Havlik, P., Leitner, S., & Stehrer, R. (2012). Growth Resurgence, Productivity Catching-up and Labour Demand in Central and Eastern European Countries. In *Industrial*

Productivity in Europe. Edward Elgar Publishing. https://www.elgaronline.com/view/9780857932099.00016.xml

Helfrich, H. (2016). *Wissenschaftstheorie für Betriebswirtschaftler*. Springer Fachmedien. https://doi.org/10.1007/978-3-658-07036-6

Helwege, J., & Liang, N. (2004). Initial Public Offerings in Hot and Cold Markets. *Journal of Financial and Quantitative Analysis*, *39*(3), 541–569. https://doi.org/10.1017/S0022109000004026

Henrekson, M., & Johansson, D. (2010). Gazelles as Job Creators. *Small Business Economics*, 35, 227–244.

Hens, T., & Pamini, P. (2008). *Grundzüge der analytischen Mikroökonomie*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-28158-0

Herr, C. (2007). *Nicht-lineare Wirkungsbeziehungen von Erfolgsfaktoren der Unternehmensgründung*. Wiesbaden: DVU/GWV.

Hirschey, M. (2008). *Fundamentals of Managerial Economics* (9th ed.). Cengage Learning.

Hoffmann-Burchardi, U. (2001). Clustering of initial public offerings, information revelation and underpricing. *European Economic Review*, *45*(2), 353–383.

Holtmann, D. (2010). *Grundlegende multivariate Modelle der sozialwissenschaftlichen Datenanalyse* (3rd ed.). Universitätsverlag Potsdam. https://publishup.uni-potsdam.de/opus4-ubp/frontdoor/deliver/index/docId/4412/file/holtmann_multivar_a3.pdf

Hölzl, W. (2009). Is the R&D Behaviour of Fast-Growing SMEs different? *Small Business Economics*, 1, 59–75.

Howorth, C., & Westhead, P. (2003). The focus of working capital management in UK small firms. *Management Accounting Research*, 14, 94–111.

Iyoha, A.-O. I., & Umoru, D. (2017). Capital Structure And Firm Financial Performance In Nigeria: Empirical Evidence Of The Causal Link. *Contemporary Economy Journal*, *2*(4), 69–83.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Jiang, Z., & Lie, E. (2016). Cash holding adjustments and managerial entrenchment. *Journal of Corporate Finance*, *36*, 190–205. https://doi.org/10.1016/j.jcorpfin.2015.12.008

Kahneman, D., & Lovallo, D. (1993). Timid Choices and Bold Forecasts: A Cognitive Perspective on Risk Taking. *Management Science*, *39*(1), 17–31.

Kaldasch, J. (2012). Evolutionary model of the growth and size of firms. *Physica A: Statistical Mechanics and its Applications*, *391*(14), 3751–3769.

Kane, G. D., & Richardson, F. M. (2002). The Relationship between Changes in Fixed Plant Investment and the Likelihood of Emergence from Corporate Financial Distress. *Review of Quantitative Finance and Accounting*, 18(3), 259–272.

Kanji, G., Moura e Sá, P. (2007). Performance Measurement and Business Excellence: The Reinforcing Link for the Public Sector. *Total Quality Management*, 18(1-2), 49–56.

Kaserer, C. (2013). *Auswirkung der CRD IV (Basel III) auf die Unternehmensfinanzierung*. Vereinigung der Bayerischen Wirtschaft.

Katsamitros, A. (2019). *The slow death of global stock markets*. The Slow Death of Global Stock Markets. https://www.worldfinance.com/markets/the-slow-death-of-global-stock-markets

Kebewar, M. (2012). *La structure du capital et la profitabilité: Une étude empirique sur données françaises en panel* (Working Paper No. 2012–08). Documents de Recherche LEO. https://www.econstor.eu/handle/10419/73559

Kebewar, M. (2013). The effect of Debt on Corporate Profitability:Evidence from French Service Sector. *Brussels Economic Review*, *56*(1), 43–59.

Knudsen, T., Levinthal, D. A., & Winter, S. G. (2017). Systematic Differences and Random Rates: Reconciling Gibrat's Law with Firm Differences. Strategy Science, 2(2), 111–120. doi:10.1287/stsc.2017.0031

Kordanuli, B., Barjaktarović, L., Jeremić, L., & Alizamir, M. (2017). Appraisal of artificial neural network for forecasting of economic parameters. *Physica A: Statistical Mechanics and Its Applications*, *465*, 515–519. https://doi.org/10.1016/j.physa.2016.08.062

Kotler, P. (1999). *Kotler on Marketing*. New York: The Free Press.

Kraus, A., & Litzenberger, R. H. (1973). A State-Preference Model of Optimal Financial Leverage. *The Journal of Finance*, *28*(4), 911–922. https://doi.org/10.2307/2978343

Kuč, V., & Kaličanin, Đ. (2021). Determinants of the capital structure of large companies: Evidence from Serbia. *Economic Research-Ekonomska Istraživanja*, *34*(1), 590–607. https://doi.org/10.1080/1331677X.2020.1801484

Kuehnhausen, F., & Stieber, H. W. (2014). Determinants of Capital Structure in Non-Financial Companies. *SSRN Electronic Journal*, 1–57. https://doi.org/10.2139/ssrn.2410741

Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). *Applied Linear Statistical Models* (5th ed.). McGraw-Hill Irwin.

Lamont, O. (1997). Cash Flow and Investment: Evidence from Internal Capital Markets. *The Journal of Finance*, *52*(1), 83–109. https://doi.org/10.1111/j.1540-6261.1997.tb03809.x

Lawrimore, E. W. (2011). *The 5 Key Success Factors: A Powerful System for Total Business Success*. Charlotte: Wrigley.

Leary, M. T. (2009). Bank Loan Supply, Lender Choice, and Corporate Capital Structure. *The Journal of Finance*, *64*(3), 1143–1185. https://doi.org/10.1111/j.1540-6261.2009.01461.x

Leary, M. T., & Roberts, M. R. (2010). The pecking order, debt capacity, and information asymmetry. *Journal of Financial Economics*, *95*(3), 332–355. https://doi.org/10.1016/j.jfineco.2009.10.009

Leland, H. E. (1994). Corporate Debt Value, Bond Covenants, and Optimal Capital Structure. *The Journal of Finance*, *49*(4), 1213–1252. https://doi.org/10.2307/2329184

Lemmon, M. L., & Roberts, M. R. (2010). The Response of Corporate Financing and Investment to Changes in the Supply of Credit. *Journal of Financial and Quantitative Analysis*, *45*(3), 555–587. Cambridge Core. https://doi.org/10.1017/S0022109010000256

Lemmon, M. L., Roberts, M. R., & Zender, J. F. (2008). Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure. *The Journal of Finance*, *63*(4), 1575–1608. https://doi.org/10.1111/j.1540-6261.2008.01369.x

Lemmon, M. L., & Zender, J. F. (2010). Debt Capacity and Tests of Capital Structure Theories. *Journal of Financial and Quantitative Analysis*, *45*(5), 1161–1187. Cambridge Core. https://doi.org/10.1017/S0022109010000499

Lippmann, R. (1987). An introduction to computing with neural nets. *IEEE ASSP Magazine*, *4*(2), 4–22. https://doi.org/10.1109/MASSP.1987.1165576

Loos, N. (2006). *Value Creation in Leveraged Buyouts*. DUV. https://doi.org/10.1007/978-3-8350-9329-4

López-Garcia, P. & Puente, S. (2009). *What Makes A High-Growth Firm? A Probit Analysis Using Spanish Firm-Level Data*. Banco di Espana Working Paper 0920, Madrid.

Lozano, M. B., & Durán, R. F. (2017). Family control and adjustment to the optimal level of cash holding. *The European Journal of Finance*, *23*(3), 266–295. https://doi.org/10.1080/1351847X.2016.1168748

Luo, Y., & Jiang, C. (2022). The Impact of Corporate Capital Structure on Financial Performance Based on Convolutional Neural Network. *Computational Intelligence and Neuroscience*, *2022*, e5895560. https://doi.org/10.1155/2022/5895560

Ma, H. (2000). COMPETITIVE ADVANTAGE AND FIRM PERFORMANCE. *Competitiveness Review: An International Business Journal*, *10*(2), 15–32. https://doi.org/10.1108/eb046396

Mac an Bhaird, C. (2010). *Resourcing Small and Medium Sized Enterprises*. Springer. https://link.springer.com/book/10.1007/978-3-7908-2399-8

Malik, F. (2008). Ende des Blindflugs mit PIMS. *M.O.M.* (Sept.), 146-158.

Malmendier, U., Tate, G., & Yan, J. (2011). Overconfidence and Early-Life Experiences: The Effect of Managerial Traits on Corporate Financial Policies. *The Journal of Finance*, *66*(5), 1687–1733. https://doi.org/10.1111/j.1540-6261.2011.01685.x

Margaritis, D., & Psillaki, M. (2010). Capital structure, equity ownership and firm performance. *Journal of Banking & Finance*, *34*(3), 621–632. https://doi.org/10.1016/j.jbankfin.2009.08.023

Masulis, R. W. (1983). The Impact of Capital Structure Change on Firm Value: Some Estimates. *The Journal of Finance*, *38*(1), 107–126. https://doi.org/10.1111/j.1540-6261.1983.tb03629.x

Maury, B. (2006). Family ownership and firm performance: Empirical evidence from Western European corporations. *Journal of Corporate Finance*, *12*(2), 321–341. https://doi.org/10.1016/j.jcorpfin.2005.02.002

Mertler, C. A., & Reinhart, R. A. (2017). *Advanced and Multivariate Statistical Methods: Practical Application and Interpretation* (6th ed.). Milton Park: Routledge.

Meyer, C. A. (2007). *Working Capital und Unternehmenswert. Eine Analyse zum Management der Forderungen und Verbindlichkeiten aus Lieferungen und Leistungen*. Wiesbaden: Gabler Springer.

Miller, C. C., Washburn, N. T., & Glick, W. H. (2013). PERSPECTIVE—The Myth of Firm Performance. *Organization Science*, *24*(3), 948–964. https://doi.org/10.1287/orsc.1120.0762

Miller, M. H., & Rock, K. (1985). Dividend Policy under Asymmetric Information. *The Journal of Finance*, *40*(4), 1031–1051. https://doi.org/10.2307/2328393

Milosevic, I., & Bass, A. E. (2017). When There Were None: Discovering the Origins of Dynamic Capabilities in a High-Growth Firm. *Academy of Management Proceedings*, *2017*, 10572. https://doi.org/10.5465/AMBPP.2017.10572abstract

Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, *48*(3), 261–297.

Modigliani, F., & Miller, M. H. (1963). Corporate Income Taxes and the Cost of Capital: A Correction. *The American Economic Review*, *53*(3), 433–443.

Morrow, J. L., Johnson, R. A., & Busenitz, L. W. (2004). The Effects of Cost and Asset Retrenchment on Firm Performance: The Overlooked Role of a Firm's Competitive Environment. *Journal of Management*, 30(2), 189–208.

Most, K. S. (1977). *Accounting Theory*. University of Virginia.

Mowen, M. M., Hansen, D. R., & Heitger, D. L. (2018). *Managerial Accounting: The Cornerstone of Business Decision-Making*. Cengage Learning.

Müller, H. E. (2013). *Unternehmensführung: Strategien, Konzepte, Praxisbeispiele*. Munich: Oldenbourg.

Mueller, A. P. (2007). The German Economy: Europe's Faltering Giant. *The Independent Review*, *12*(2), 279–283.

Muhammad, H., Shah, B., & Islam, Z. ul. (2014). The Impact of Capital Structure on Firm Performance: Evidence from Pakistan. *The Journal of Industrial Distribution & Business*, *5*(2), 13–20. https://doi.org/10.13106/jidb.2014.vol5.no2.13

Mwambuli, E. L. (2016). Does corporate capital structure influence corporate financial performance in developing economies? Evidence from East African stock markets. *International Finance and Banking*, *3*(1), 97–123.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, *5*(2), 147–175. https://doi.org/10.1016/0304-405X(77)90015-0

Myers, S. C. (1984). The Capital Structure Puzzle. *The Journal of Finance*, *39*(3), 574–592. https://doi.org/10.1111/j.1540-6261.1984.tb03646.x

Myers, S. C. (2003). Chapter 4—Financing of Corporations. In G. M. Constantinides, M. Harris, & R. M. Stulz (Eds.), *Handbook of the Economics of Finance* (Vol. 1, pp. 215–253). Elsevier. https://doi.org/10.1016/S1574-0102(03)01008-2

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, *13*(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

Naujoks, M. B. (2012). *Restructuring Strategies and Post-Bankruptcy Performance* (PhD Thesis). Munich: Technical University of Munich.

Negishi, T. (2014). Microeconomic Foundations of Macroeconomics. In *Elements of Neo-Walrasian Economics* (pp. 167–184). Springer.

Nguyen, T. D. K., & Ramachandran, N. (2006). Capital Structure in Small and Medium-sized Enterprises: The Case of Vietnam. *ASEAN Economic Bulletin*, *23*(2), 192–211.

Nothardt, F. (2001). *Corporate Turnaround and Corporate Stakeholders: An Empirical Examination of the Determinants of Corporate Turnaround in Germany with Focus on Financial Stakeholder Theory* (PhD Thesis). St. Gallen: University of St. Gallen.

Nunes, P. J. M., Serrasqueiro, Z. M., & Sequeira, T. N. (2009). Profitability in Portuguese service industries: A panel data approach. *The Service Industries Journal*, *29*(5), 693–707. https://doi.org/10.1080/02642060902720188

OECD (2010). *OECD Studies on SMEs and Entrepreneurship: High-Growth Enterprises*. Paris: OECD.

Ogebe, P., Ogebe, J., & Alewi, K. (2013, March 27). *The Impact of Capital Structure on Firms' Performance in Nigeria.* [MPRA Paper]. https://mpra.ub.uni-muenchen.de/46173/

Olson, P. D., & Bokor, D. W. (1995). Strategy process-content interaction: Effects on growth performance in small, start-up firms. *Journal of Small Business Management*, *33*(1), 1–34.

Palepu, K. G., Healy, P. M. & Peek, E. (2007). *Business Analysis and Valuation (IFRS Edition).* London: Thomson.

Palepu, K., Healy, P.., & Peek, E. (2007). *Business Analysis and Valuation: Text and Cases*. Mason: Thomson.

Pant, L. W. (1991). An Investigation of Industry and Firm Structural Characteristics in Corporate Turnarounds. *Journal of Management Studies*, 28(6), 623–643.

Pao, H.-T. (2008). A comparison of neural network and multiple regression analysis in modeling capital structure. *Expert Systems with Applications*, *35*(3), 720–727. https://doi.org/10.1016/j.eswa.2007.07.018

Pedhazur. E. J. (1997). *Multiple Regression in Behavioral Research* (3rd ed.). Victoria: Thomson.

Penrose, E. (1959 [2009]). *The Theory of the Growth of the Firm* (4th ed.). Oxford: Oxford University Press.

Phelps, B., Adams, R., & Bessant, J. (2007). Lifecyles of growing organisations: a review with implications for knowledge and learning. *International Journal of Management Reviews, 9*(1), 1–30.

Porter, M. E. (1980). Competitive Strategy: Techniques for analyzing industries and competitors. New York: The Free Press.

Porter, E. (1996). *What Is Strategy?* https://hbr.org/1996/11/what-is-strategy

Porter, M. E. (1991). Towards a Dynamic Theory of Strategy. *Strategic Management Journal*, *12*, 95–117. JSTOR.

Porter, M. E. (2008). The Five Competitive Forces That Shape Strategy. *Harvard Business Review*, 86(1), pp. 79–93.

Prittwitz, A. G., Joachim von. (2022, May 18). *Economic Key Facts Germany—KPMG Germany*. KPMG. https://home.kpmg/de/en/home/insights/2020/10/international-business/economic-key-facts-germany.html

Psillaki, M., & Daskalakis, N. (2009). Are the determinants of capital structure country or firm specific? *Small Business Economics*, *33*(3), 319–333. https://doi.org/10.1007/s11187-008-9103-4

Quon, T. K., Zeghal, D., & Maingot, M. (2012). Enterprise Risk Management and Firm Performance. *Procedia - Social and Behavioral Sciences*, *62*, 263–267. https://doi.org/10.1016/j.sbspro.2012.09.042

Ramachandra, V. S., & Nageswara Rao, S. V. D. (2008). *Capital Structure, Industry Pricing, and Firm Performance* (SSRN Scholarly Paper No. 1263245). Social Science Research Network. https://doi.org/10.2139/ssrn.1263245

Ramanujam, V. (1984). *Environmental Context, Organizational Context, Strategy, and Corporate Turnaround: An Empirical Investigation* (PhD Thesis). Pittsburgh: University of Pittsburgh.

Rao, N. V., Al-Yahyaee, K. H. M., & Syed, L. A. (2007). Capital structure and financial performance: Evidence from Oman. *Indian Journal of Economics and Business*, *6*(1), 1–14.

Rau, P. R. (2008). The Empirical Evidence on Mergers. In C. Krishnamurti & S. R. Vishwanath (Eds.), *Mergers, Acquisitions and Corporate Restructuring* (pp. 212-247). Thousand Oaks: SAGE.

Rauh, J. D., & Sufi, A. (2010). Capital Structure and Debt Structure. *The Review of Financial Studies*, *23*(12), 4242–4280. https://doi.org/10.1093/rfs/hhq095

Reichstein, T., & Dahl, M. S. (2004). Are firm growth rates random? Analysing patterns and dependencies. *International Review of Applied Economics*, 18(2), 225–246.

Renzetti, M. (2001). Corporate Finance: Financial Control. In N. J. Smelser & P. B. Baltes (Eds.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 2792–2797). Pergamon. https://doi.org/10.1016/B0-08-043076-7/04268-6

Robbins, D. K., Pantuosco, L. J., & Parker, D. F. (2000). An Empirical Assessment of the Contribution of Small Business Employment to US State Economic Performance *Small Business Economics*, 15(4), 293–302.

Robbins, D. K., Pearce, J. A. (1992). Turnaround: Retrenchment and Recovery. *Strategic Management Journal*, 13, 287 - 309.

Rocca, M. L., Rocca, T. L., & Cariola, A. (2011). Capital Structure Decisions During a Firm's Life Cycle. *Small Business Economics*, 37, 107–130

Ross, S. A. (1977). The Determination of Financial Structure: The Incentive-Signalling Approach. *The Bell Journal of Economics*, *8*(1), 23–40. https://doi.org/10.2307/3003485

Ross, A., & Lemkin, J. (2016). *From Impossible to IneviTable: How Hyper-Growth Companies Create PredicTable Revenue*. Wiley Hoboken

Rubio-Misas, M., & Gómez, T. (2015). Cross-Frontier DEA Methodology to Evaluate the Relative Performance of Stock and Mutual Insurers: Comprehensive Analysis. In M. Al-Shammari & H. Masri (Eds.), *Multiple Criteria Decision Making in Finance, Insurance and Investment* (pp. 49–75). Springer International Publishing. https://doi.org/10.1007/978-3-319-21158-9_4

Salim, M., & Yadav, R. (2012). Capital Structure and Firm Performance: Evidence from Malaysian Listed Companies. *Procedia - Social and Behavioral Sciences*, *65*, 156–166. https://doi.org/10.1016/j.sbspro.2012.11.105

Salonen, T. (2010). *Strategies, Structures, and Processes for Network and Resources Management*. Köln: EUL.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (Seventh edition). Pearson Education.

Scheld, A. (2013). *Fundamental Beta: Ermittlung des systematischen Risikos bei nicht börsennotierten Unternehmen*. Wiesbaden: Springer Gabler.

Schipporeit, E. (2001). Externe Eigenfinanzierung bei Kapitalgesellschaften. In R.-E. Breuer (Ed.), *Handbuch Finanzierung* (pp. 437–467). Gabler Verlag. https://doi.org/10.1007/978-3-322-89933-0_17

Schmalen, C., Kunert, M., & Weindlmaier, H. (2006). Erfolgsfaktorenforschung: Theoretische Grundlagen, methodische Vorgehensweise und Anwendungserfahrungen. In Institut für Agrarökonomie Universität Göttingen (Hrsg.), *Unternehmen im Agrarbereich vor neuen Herausforderungen: 45.*

Jahrestagung der Gesellschaft für Wirtschafts- und Sozialwissenschaften (pp. 351-362). Göttingen: Gesellschaft für Wirtschafts- und Sozialwissenschaften.

Schmitt, A. (2009). *Innovation and Growth in Corporate Restructurings: Solution or Contradiction*. Springer Science & Business Media.

Schmuck, M. (2012). *Financial Distress and Corporate Turnaround. An Empirical Analysis of the Automotive Supplier Industry* (PhD Thesis). Munich, Technical University of Munich.

Schneider, H. (2010). *Determinanten der Kapitalstruktur*. Gabler. https://doi.org/10.1007/978-3-8349-8641-2

Schulz, M., & Wasmeier, O. (2012). *The Law of Business Organizations: A Concise Overview of German Corporate Law*. Springer Science & Business Media.

Schumpeter, J. A. (1934). *The Theory of Economic Development, Cambridge, Mass.: Harvard University Press* (Reprint 1997).

Schwenker, B., & Spremann, K. (2008). *Unternehmerisches Denken zwischen Strategie und Finanzen*. Wiesbaden: Springer.

Scott, J. H. (1977). Bankruptcy, Secured Debt, and Optimal Capital Structure. *The Journal of Finance*, *32*(1), 1–19. https://doi.org/10.2307/2326898

Scott, M. & Bruce, R. (1987). Five stages of growth in small business. *Long Range Planning, 20*(3), 45–52.

Senge, P. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday.

Seward, J. K. (2016). *Non-Distressed Corporate Restructurings and Reorganizations: A Valuation Approach*. Cambridge: Academic Press.

Siegel, R., Siegel, E., & Macmillan, I. C. (1993). Characteristics distinguishing high-growth ventures. *Journal of Business Venturing*, *8*(2), 169–180. https://doi.org/10.1016/0883-9026(93)90018-Z

Simerly, R. L., & Li, M. (2000). Environmental dynamism, capital structure and performance: A theoretical integration and an empirical test. *Strategic Management Journal*, *21*(1), 31–49. https://doi.org/10.1002/(SICI)1097-0266(200001)21:1<31::AID-SMJ76>3.0.CO;2-T

Sirkin, R. M. (2006). *Statistics for the Social Sciences* (3rd ed.) Thousand Oaks: Sage.

Smith, M., & Graves, C. (2005). Corporate turnaround and financial distress. *Managerial Auditing Journal*, 20(3), 304–320.

Smolarski, J., & Kut, C. (2011). The impact of venture capital financing method on SME performance and internationalization. *International Entrepreneurship and Management Journal*, *7*(1), 39–55. https://doi.org/10.1007/s11365-009-0128-1

Spremann, K. (2008). Alte und neue Paradigmen der Finance (Old and New Paradigms in Finance). In G. Eilenberger, S. Haghani, A. Kötzle, K. Reding & K. Spremann (Hrsg.), *Finanzstrategisch denken: Paradigmenwechsel zur Strategic Corporate Finance (Financial Strategic Thinking: Paradigm Shift in Strategic Corporate Finance)* (S. 1-28). Berlin: Springer.

Stein, J. C. (1997). Internal capital markets and the competition for corporate resources. *The Journal of Finance*, *52*(1), 111–133.

Stepan, A., & Fischer, E. O. (2008). *Betriebswirtschaftliche Optimierung. Eine Einfuhrung in die quantitative Betriebswirtschaftslehre* (8th ed.). Oldenbourg.

Stiglitz, J. E. (1969). A Re-Examination of the Modigliani-Miller Theorem. *The American Economic Review*, *59*(5), 784–793.

Strebulaev, I. A. (2007). Do Tests of Capital Structure Theory Mean What They Say? *The Journal of Finance*, *62*(4), 1747–1787. https://doi.org/10.1111/j.1540-6261.2007.01256.x

Stolowy, H., & Lebas, M. (2013). *Financial Accounting and Reporting: A Global Perspective.* Andover: Cengage.

Sudarsanam, S., & Lai, J. (2001). Corporate Financial Distress and Turnaround Strategies: An Empirical Analysis. *British Journal of Management*, 12, 183–199.Stehle, R., &

Schmidt, M. H. (2015). *Returns on German Stocks 1954 to 2013* (SSRN Scholarly Paper ID 2497359). Social Science Research Network. https://doi.org/10.2139/ssrn.2497359

Sunder, S., & Yamaji, H. (1999). *The Japanese style of business accounting*. Westport: Quorum.

Sutton, T. (2004). *Corporate financial accounting and reporting*. Pearson Education.

Swaay, H. van, Leleux, B., & Megally, E. (2015). *Private Equity 4.0: Reinventing Value Creation*. John Wiley & Sons.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6th ed.). Pearson.

Taouab, O., & Issor, Z. (2019). Firm performance: Definition and measurement models. *European Scientific Journal*, *15*(1), 93–106.

Tarek Al-Kayed, L., Raihan Syed Mohd Zain, S., & Duasa, J. (2014). The relationship between capital structure and performance of Islamic banks. *Journal of Islamic Accounting and Business Research*, *5*(2), 158–181. https://doi.org/10.1108/JIABR-04-2012-0024

Tirole, J. (2005). *The Theory of Corporate Finance*. Princeton University Press. https://www.beck-shop.de/tirole-theory-of-corporate-finance/product/339052

Tkáč, M., & Verner, R. (2016). Artificial neural networks in business: Two decades of research. *Applied Soft Computing*, *38*, 788–804. https://doi.org/10.1016/j.asoc.2015.09.040

Tomczyk, D., Lee, J., & Winslow, E. (2013). Entrepreneurs' Personal Values, Compensation, and High Growth Firm Performance. *Journal of Small Business Management*, *51*(1), 66–82. https://doi.org/10.1111/j.1540-627X.2012.00374.x

Treyer, O. A. G. (2003). *Business Statistik*. Compendio.

Tsuruta, D. (2017). Variance of Firm Performance and Leverage of Small Businesses. *Journal of Small Business Management*, *55*(3), 404–429. https://doi.org/10.1111/jsbm.12243

Vasiliou, D., & Daskalakis, N. (2009). Behavioral Capital Structure: Is the Neoclassical Paradigm Threatened? Evidence from the Field. *Journal of Behavioral Finance*, *10*(1), 19–32. https://doi.org/10.1080/15427560902719802

Vătavu, S. (2015). The Impact of Capital Structure on Financial Performance in Romanian Listed Companies. *Procedia Economics and Finance*, *32*, 1314–1322. https://doi.org/10.1016/S2212-5671(15)01508-7

Vernimmen, P. (2018). *Corporate Finance* (5. Auflage). Wiley.

Vickers, I., & Lyon, F. (2014). Beyond green niches? Growth strategies of environmentally-motivated social enterprises. *International Small Business Journal*, *32*(4), 449–470. https://doi.org/10.1177/0266242612457700

Vinnell, R., & Hamilton, R. T. (1999). A historical perspective on small firm development. *Entrepreneurship Theory and Practice, 23*(4), 5–18.

Volk, S. K. (2013). *Einfluss der Eigentümerstruktur auf Finanzierungs- und Investitionsentscheidungen in privaten und börsennotierten Unternehmen*. Technische Universität München.

Voon, J. P., Lin, C., & Ma, Yiu. C. (2020). Managerial overconfidence and bank loan covenant usage. *International Journal of Finance & Economics*, *Early View*. https://doi.org/10.1002/ijfe.2388

Wahlen, J. M.,. Jones, J. P., & Pagach, D. (2016). *Intermediate Accounting: Reporting and Analysis*. Boston: Cengage.

Wald, J. K. (1999). How Firm Characteristics Affect Capital Structure: An International Comparison. *Journal of Financial Research*, *22*(2), 161–187. https://doi.org/10.1111/j.1475-6803.1999.tb00721.x

Walker, P. (2017). *The Theory of the Firm: An overview of the economic mainstream*. Routledge. https://www.routledge.com/The-Theory-of-the-Firm-An-overview-of-the-economic-mainstream/Walker/p/book/9780367876791

Walker, P. (2018). *A Brief Prehistory of the Theory of the Firm*. Routledge. https://doi.org/10.4324/9781351041386

Wehrmann, C. D. (2018). *Exploring Internationalisation Effects on Firm Performance Quantitative Empirical Study among German, Swiss and Austrian Listed Companies* (PhD Thesis). Gloucester: University of Gloucestershire.

Wei, Y. (2014). *The determinants of capital structure: Evidence from Dutch listed companies* (White Paper). Twente: University of Twente.

Wei, Z. (2019). *Machine learning applications in finance: Some case studies*. https://doi.org/10.25560/76530

Weill, L. (2008). Leverage and Corporate Performance: Does Institutional Environment Matter? *Small Business Economics*, *30*(3), 251–265. https://doi.org/10.1007/s11187-006-9045-7

Welch, I. (2011). Two Common Problems in Capital Structure Research: The Financial-Debt-To-Asset Ratio and Issuing Activity Versus Leverage Changes. *International Review of Finance*, *11*(1), 1–17. https://doi.org/10.1111/j.1468-2443.2010.01125.x

Wenzelburger, G., Jäckle, S., & König, P. (2014*). Weiterführende statistische Methoden für Politikwissenschaftler: Eine anwendungsbezogene Einführung mit Stata.* Munich: Oldenbourg.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180.

Wiese, H. (2021). *Advanced Microeconomics*. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-34959-2

Wiklund, J., & Shepherd, D. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal*, 24(13), 1307–1314.

Wohlenberg, H., & Plagge, J.-C. (2012). Capital Markets 2.0 – New Requirements for the Financial Manager? In U. Hommel, M. Fabich, E. Schellenberg, & L. Firnkorn (Eds.), *The Strategic CFO: Creating Value in a Dynamic Market Environment* (pp. 109–126). Springer. https://doi.org/10.1007/978-3-642-04349-9_7

Wooldridge, J. M. (2013). *Introductory econometrics: A modern approach* (5. ed., international ed.). South-Western Cengage Learning.

Wu, X., & Au Yeung, C. K. (2012). Firm growth type and capital structure persistence. *Journal of Banking & Finance*, *36*(12), 3427–3443. https://doi.org/10.1016/j.jbankfin.2012.08.008

Yoon, E., & Jang, S. (2005). The Effect of Financial Leverage on Profitability and Risk of Restaurant Firms. *The Journal of Hospitality Financial Management*, *13*(1), 35–47. https://doi.org/10.1080/10913211.2005.10653798

Zambon, S. (2013). Accounting and Business Economics: A Conceptual Revisitation. In Y. Biondi & S. Zambon (Eds.), *Accounting and Business Economics: Insights from National Traditions* (pp. XI-XXII). New York: Routledge. 2013

Zeitun, R., & Tian, G. G. (2014). *Capital Structure and Corporate Performance: Evidence from Jordan* (SSRN Scholarly Paper No. 2496174). https://doi.org/10.2139/ssrn.2496174

Ziebarth, G. (2013). *Wie finanzieren sich Unternehmen in Zeiten der Krise? Neue Antworten der Jahresabschlussanalyse*. Deutsche Bundesbank. https://docplayer.org/10784190-Wie-finanzieren-sich-unternehmen-in-zeiten-der-krise-neue-antworten-der-jahresabschlussanalyse.html

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2009). *Business Research Methods* (8th ed.). South-Western Cengage Learning.

Zimmermann, W. (2013). *Erfolgs- und Kostenrechnung*. Springer.

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Abbreviations

ANN	Artificial neural network
AT	Asset turnover
CAP	CAPEX / Total Assets
CEO	Chief Executive Officer
DE	Debt Equity Ratio
EBIT	Earnings before Interest and Taxes
EI	EBIT / Interest Expense Ratio
GAAP	Generally Accepted Accounting Principles
GW	Generalized weights
IFRS	International Financial Reporting Standards
IPO	Initial Public Offering
LTD	Long-term Debt divided by Total Assets
OM	Operating Margin
PB	Price-to-Book Ratio
PE	Price-to-Earnings Ratio
PPE	Property, Plant and Equipment
PRO	Year on Year Profit Growth
R&D	Research & Development
RBV	Resource-based View
REV	Year on Year Revenue Growth
ROA	Return on Assets

ROE	Return on Equity
ROIC	Return on Invested Capital
SME	Small or Medium-Sized Firm
TOL	Tolerance
VIF	Variance Inflation Factor
YoY	Year on Year