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MASTER'S THESIS

The Impact of a Firm's Profitability and Other Factors on Capital Structure: Evidence from the Czech Republic

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently; using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, August 1, 2022 Lucie Holušová

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Abstract

The aim of this thesis is to provide empirical evidence on determinants of the capital structure of Czech SMEs. Dataset used is different from previous ones in the studied period, characteristics and number of observations. The financials of 2693 companies over 14 years are addressed using panel data estimation methods. This thesis tests the hypotheses addressing the effect of the determinants based on the main theories in the field (pecking order and trade-off theory) and whether the crisis had an impact on the capital structure. Three measures of debt ratios (total, short-term and long-term debt ratio) are included to capture how either of the ten independent variables affects the maturity structure. Regression results of several estimation approaches (FE, RE, Pooled OLS, Difference GMM, System GMM) are provided and after several validity tests inferences based on System GMM estimation are presented. Results report significant differences in estimates of long-term and short-term or total debt ratio models. The most surprising result is that size and crisis are not statistically significant in any model, contrary age, profitability, liquidity, tangibility and growth are significant at least concerning total and short-term debt ratios. Finally, the pecking order theory prevails in the dataset.

JEL Classification	C23, G32, L25, L26
Keywords	capital structure, determinants of capital structure, Czech SMEs, pecking order theory, trade-off theory
Title	The Impact of a Firm's Profitability and Other Factors on Capital Structure: Evidence from the Czech Republic

Abstrakt

Tato práce si klade za cíl zkoumat determinanty kapitálové struktury malých a středních podniků v ČR. Použitý dataset se od předchozích liší ve studovaném období, charakteristice a počtu pozorování. Finanční výkazy 2693 podniků během čtrnáctiletého období jsou zkoumány pomocí metod pro práci s panelovými daty. Hypotézy zkoumající efekt determinantů jsou postaveny na dvou hlavních teoriích v oboru (tedy pecking order a trade-off teorii) a dále je zkoumán vliv krize na kapitálovou strukturu. Tři druhy míry zadlužení (celková, krátkodobá a dlouhodobá) jsou použity jako vysvětlované proměnné, aby zkoumaly, jak každý z deseti determinantů ovlivňuje dluh dle jeho splatnosti. Práce poskytuje výsledky různých metod odhadu (FE, RE, Pooled OLS, Difference GMM, System GMM) a po sérii testů validity prezentuje závěry na základě metody System GMM. Výsledky ukazují signifikantní rozdíly mezi odhady vlivu determinantů na dlouhodobý a krátkodobý nebo celkový dluh. Velikost firmy a ukazatel krize byly shledány statisticky nevýznamnými ve všech třech modelech, naopak profitabilita, likvidita, tangibilita (podíl hmotných aktiv) a růst jsou statisticky významné v modelech s celkovou a krátkodobou mírou zadlužení. Nakonec, z výsledků je zřejmé, že převládá pecking order teorie.

Klasifikace	C23, G32, L25, L26
Klíčová slova	kapitálová struktura, determinanty kapitálové struktury, české male a střední podniky, teorie hierarchického pořádku
Název práce	Vliv ziskovosti a dalších charakteristik na kapitálovou strukturu firem v České republice

Contents

List of Tables

List of Figures

Acronyms

FE	fixed effects
GMM	generalized method of moments
OLS	ordinary least squares
POT	pecking order theory
RE	random effects
SME	small and medium enterprise
TOT	trade-off theory

Master's Thesis Proposal

Author:	**Bc. Lucie Holušová**	**Supervisor**:	Jaroslav Pavlíček M.A.
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Proposed Topic:

The impact of a firm's profitability and other factors on capital structure: Evidence from the Czech Republic
(Vliv ziskovosti a dalších charakteristik na kapitálovou strukturu firem v České republice)

Motivation:

A wide scale of papers was focused on the topic of the nature of the capital structure, capital structure differences, optimal capital structure and the determinants of capital structure at firm, industry, country or even multination level using various methodologies (Basu, 2015; Monteforte and Stagliano, 2015) as the topic of the right capital structure choice is one of the most frequently discussed issues of financial management.

Many works are focusing specifically on the determinants of capital structure (Proenca, Laureano and Laureano, 2014; Svoboda, Poledňáková and Režňáková, 2010; Balios, Daskalakis and Vasiliou, 2016) that have established a positive, negative or no relationship between determinants of capital structure and leverage. Different articles suggest including into the analysis different factors as potential determinants. Moreover, the results of the papers suggest that the relationship between factors that determine capital structure differ with respect to country or region specifics (see for example Psillaki and Daskalakis, 2009). For example, Degryse and Kappert (2012) looked at it from a different angle and pointed out that the industry specifics also play an important role. Taking these conclusions into account, we cannot apply results of these papers therefore the case of the Czech Republic should be analyzed separately.

There are some studies focusing on the capital structure choice in the Czech Republic, however, the number of papers focusing on the topic is limited. Above all, one of the first paper in the field was provided by Krausová (1995), it describes the capital structure of Czech firms in the period from 1990 to 1993. The paper written by Bauer (2004), focused on the analysis of capital structure determinants of 72 listed companies among Visegrad countries in the period from 2000 to 2001, also compares the results of the analysis with the results for the countries of G7. Pinková (2012) dealt with the issue of identification of the determinants influencing the capital structure of 100 large and medium-sized enterprises of the automotive industry in the Czech Republic in the period from 2006 to 2012 and analyzed their effect. The Czech Republic was also analyzed in several studies that were concluded on a multinational level (Hanousek and Shamshur, 2011; Anderloni and Tanda, 2014).

However, so far, no study that would deal with the capital structure determinants including its development before and after the financial crises has been published for the Czech Republic, at least to the extent of author’s knowledge. This thesis will seek to fill this gap by including a crises period dummy. Other expected benefits of the thesis are more precise and up to date outcomes as the analysis will be performed on a wider scale of entities and a larger period.

Overall, the main aim of the paper is to study the factors that influence the capital structure, their effect and to determine whether the financial crises affected the development of the capital structure. More specifically how does the before and after crises development differs. The point of the analysis is to study a wider sample of Czech firms, in comparison to previously mentioned studies dealing with the case of the Czech Republic. The studied period will include the data from 2006 up to recent years based on the availability of the data.

Hypotheses:

Modern finance theories on capital structure are dominated by the following theories: trade-off theory (TOT) and pecking order theory (POT). As each one of them assumes opposite effect of the determinants on capital structure, the hypotheses will be doubled to represent each of the theories, the hypotheses arising from TOT will be marked as *A* and these arising from POT as *B*.

1. $H1_A$: Firm size is positively related to debt.
   $H1_B$: Firm size is negatively related to debt.
2. $H2_A$: Level of tangible assets will be positively related to debt.
   $H2_B$: Level of tangible assets will be negatively related to debt.
3. $H3_A$: Profitability will be positively related to debt.
   $H3_B$: Profitability will be negatively related to debt.

Methodology:

The dependent variable in this study is a firm's debt. As the measures differ in whether the long-term, short-term or total debt is used, this thesis will work with all three types. Independent variables are variables concerning a firm´s performance or proxies for macro environment or crisis period dummy. All of these variables will be obtained either from EMIS database (https://www-emis-com.ezproxy.is.cuni.cz) and companies´ annual reports or from the Czech statistical office.

As newer studies do (Lisboa, 2017, …), this thesis will employ panel data regression. To estimate the effects of explanatory variables on the debt, the thesis will consider three estimation models: pooled ordinary least squares (OLS), the random effects (RE), and the fixed effects (FE) to estimate the effect of firm´s specific factors as well as industry specification on the debt. Pooled OLS estimation could be employed only under the hypothesis that there are no groups or individual effects among the firms included in the sample since panel data contain observations on the same cross-sectional units over several periods, there might be cross-sectional effects on each firm or a set of groups of firms, hence the FE or RE models would be preferred. The Hausman specification test will be used to determine which estimation model, either fixed or random effects, best explains the estimation.

The thesis will also account for the possibility that the expected determinants of capital structure could also be impacted by the capital structure. For instance, it is highly plausible that variables such as profitability or liquidity could also be influenced by the capital structure thus there are a possibility of bidirectional causality and hence endogeneity caused by simultaneity is envisaged. In this instance, the General Method of Moments (GMM) will be employed. To obtain robust results using the system GMM, the lagged values of the explanatory variables will be used as instruments. The validity of the instruments in the model will be checked using the Sargan test for over-identified restrictions.

Expected Contribution:

Existing studies dealing with the issue of factors influencing the capital structure have already been made in the Czech Republic, as mentioned above, however, the number of factors they were controlling for was fairly low, Pinková (2012) analyzed 5 dependent variables (size, profitability, tangibility, growth and liquidity), Bauer (2004) analyzed 6 dependent variables (size, profitability, tangibility, NDTS, volatility and liquidity). Moreover, the results provide mixed evidence for example the effect of tangibility Bauer (2004) concludes to be negative while Pinková (2012) reported statistically significant positive relationship.

The main contribution of this thesis should be the inclusion of more dependent variables based on existing literature concerning other countries, namely size, tangibility, profitability, liquidity, growth, firm´s age, NDTS, tax and GDP or inflation as proxies for macro environment or crisis period dummy while analyzing the effects of these factors using a wider data sample of Czech firms.

Outline:

I. Introduction: The first part will briefly explain the motivation and introduce the structure of the work.
II. Literature review: The theory concerning capital structure, its determinants and previous development in the field will be summarized in this section.
III. Data: This section will include the description of the collection of the data and some detailed information about the data itself.
IV. Methodology: The description of the methods used for analyzing the data will be provided in this section as well as the list of hypotheses that will be tested and description of the whole process of controlling for appropriateness of the model and used variables.
V. Results: Description and comparison to the results provided by already existing studies will be presented in this section.
VI. Conclusion: This section will summarize the outcomes of the study and will provide suggestions for future research in the field.

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1 Introduction

The past century was dedicated to answering several questions concerning the financial management of a firm; how do firms finance their operations and further development or does an optimal way of financing exists? One of the main topics that attract numerous researchers is the relationship between the capital structure of a firm and its performance as the optimal capital structure is of high interest for financial managers in firms since they could directly influence the proportion of own and external sources of financing. It is generally believed that external financing is a better option for a business than utilizing its own resources. That way the risk is spread over owners as well as creditors and tax deductibility of interest could be utilized. However, there is a cut-off level of indebtedness up to which external resources are preferred. Utilization of an excessive portion of external resources could lead to a worse position (credibility and price-wise) when asking for further sources and could affect the decision-making process of managers due to the limitations imposed by creditors' requirements. It is therefore crucial to know and address the determinants of capital structure as one of the important topics to run the company accordingly.

Throughout the years, numerous theories have been made on the topic of capital structure starting with the one done by Modigliani and Miller (1958). Their irrelevance theorem, which implies that the way of financing does neither affect the value of the firm nor the cost of capital, was based on the strict assumption about a perfect and frictionless market. This theory, however, provides a foundation for other theories that relaxed the strict assumptions and allowed for imperfections of the market that exists in the real world like taxes or information asymmetry. Finally, two main theories were developed, trade-off and pecking order theory. These theories both present possible determinants that affect the capital structure as well as their expected impact and provide a basis for an explanation of why the determinants affect the capital structure in respective ways. Nevertheless, none of these theories can fully clarify the relation between capital structure and the performance of the company because all theories are based on some critical assumptions which not all hold in the real world. Therefore, the empirical evaluation of the capital structure and its determinants is a subject of interest to numerous researchers.

Additionally, past empirical research on capital structure and its determinants did not provide unambiguous findings and reported that the results could differ across

countries, industries, size specifications and much more, thereby confirming that generalization of the results must be done only if the questioned objects are like the ones on which the study was made, which is a tricky criterion.

The topic of capital structure in the context of the Czech Republic was assessed by several authors, starting with Bauer (2004) who covered the topic for listed companies in the Czech Republic, followed by Pinková (2012) that focused on automotive or Aulová and Hlavsa (2013) that covered the agriculture. Moreover, the data for the Czech Republic were also included in studies that were focused on more countries at once, such as works by Delcour (2007), Mokhova and Zinecke (2013) or Fenyves et al. (2020). However, none of the existing studies focused on small and medium enterprises in the Czech Republic, which is the topic of this thesis.

This thesis builds on the existing literature with its main objective to find the determinants of capital structure for small and medium enterprises (SMEs) in the Czech Republic. Its goal is to assess the direction and magnitude of effects of individual determinants, while also comparing the obtained results with other empirical studies and existing theories. The hypotheses tested are based on the expected effect of the determinants under either the pecking order or the trade-off theory. More precisely, the thesis employs three dependent variables (total, short-term and long-term debt ratio) representing the capital structure and several capital structure determinants recommended by previous empirical studies, such as size, tangibility, liquidity, profitability, age, etc., as independent variables in the model. The regression analysis is performed on the panel dataset that is based on financials of almost 2,700 companies, that comply with the conditions that define SMEs. In addition to finding the determinants of the capital structure of Czech SMEs, the paper aims to verify whether also the financial crisis had an impact, thus, the thesis is focused on a 14-year long period starting from 2006 and ending in 2019.

It is believed that this thesis could fill the gap in existing literature for SMEs in the Czech Republic and shed light on the determinants that affect the capital structure in this market. Also, thanks to employing a much broader data sample (either in the number of companies or years included compared to the previous studies done based on the data from the Czech Republic) in the empirical research, the author believes that the generalization of the results would be applicable for all SMEs in the market.

The thesis itself starts with a theoretical part, which covers the basics of capital structure, provides a description of existing theories on the topic, presents a literature review, which introduces existing studies focused on Czech or foreign companies, regions or specific industries, and finally gives a brief explanation of capital structure

determinants and their effect. The theoretical part is then followed by the description of the data and methodology used in this thesis. The results of the empirical analysis are compared to the existing literature in the discussion followed by the conclusion where the results, limitations and possible recommendations for future research are summarized.

2 Theoretical Part

This chapter introduces the studied topic through a review of existing literature. The first part covers the general information about capital structure followed by the development of the theories concerning the said topic. Overview of previous empirical research and the specification of determinants of a capital structure suggested by reviewed literature are covered as well.

2.1 Capital Structure

Among the main financial decisions every company is required to take are investment, financing and dividend decisions. The need to establish the source of financing (equity shares, bank loans, debentures, …) is a part of the financing decision. The different composition of sources of financing is referred to as the capital structure of the company.

Firms can choose between several ways how to finance their assets: equity, debt, or mostly used, a combination of both. In fact, both debtholders and shareholders want to be remunerated for the money they invested into the company, the only difference is in the way how they expect it to happen. Equity represents the money the shareholders invested into the firm; it is perceived as long-term financing as the shareholders do not expect an effective repayment. The shareholders expect a return to offset the sustained risk in a form of a dividend that is dependent on the firm's profit, therefore in case the firm is not profitable, it does not right away lead to bankruptcy. In case the firm chooses to finance its operation through debt, it is expected that it will have to fully repay the amount to debtholders. Debt is the form of financing linked with an obligation to fully repay its worth to the creditors. Moreover, the repayment is associated with an interest rate and maturity date. According to its maturity, it is possible to distinguish between short-term and long-term debt. Short-term debt is usually linked with the working capital needs of the company while long-term debt is more frequently used to purchase new equipment or make new investments. While the issue of equity is not closely linked with bankruptcy (even in the case of a firm with low or no profits), the issue of the debt consequently raises the potential risk of bankruptcy. (Renzetti, 2001)

Decisions concerning the optimal level of capital structure should be of great concern for all the firms operating on the market. As the capital structure is a crucial

topic for the firm, the decision should be taken on a management level considering pieces of advice provided by financial specialists, if present and the optimal capital structure should be set in a way that maximizes the firm's value. In the decision-making process concerning the optimal level of capital structure several aspects, such as a balanced proportion of debt and equity securities or the costs and benefits associated with those, should be determined while taking into account the need of the company to be able to pursue its strategic objectives and prevent any potential cash flow shortages and missed opportunities due to the insufficient funding. The severity of the topic is highlighted by the fact that the wrong decision could lead to financial distress and eventually bankruptcy.

The topic of capital structure and its optimal level has been extensively investigated and numerous papers have been written over the past decades. Several theories providing the outline of how to approach the determination of the optimal structure have been developed, however, as the theories differ and are not based on the same assumptions, there is not a clear step-by-step guide to determine an optimal level of debt for managers to follow.

The main difference between the theories is the concept they are emphasizing, while the trade-off theory emphasizes taxes as the major determinant of optimal capital structure for firms, the pecking order theory works with the differences in the information available to managers and investors, in other words, the pecking order theory suggests the existence of information asymmetry to be the crucial determinant of the capital structure.

Both previously mentioned theories help to better understand the financing behaviour of the firm as well as to pinpoint potential factors that could affect the firm's capital structure.

2.2 Development of the Theories on Capital Structure

The first authors to introduce a paper focused on capital structure theory were in the middle of the 20th century Modigliani and Miller (1958). Through this work, the authors laid the foundations for modern financial management. They introduced the concept of so-called "capital structure irrelevance". Their theory suggests that any combination of capital structures could be chosen without influencing the value of the company, however, it should be stressed that they assumed perfect market conditions. The propositions coming up from the work do not hold in reality as there are imperfect market conditions, transaction costs, taxes and heterogeneous expectations. When

these restrictive assumptions are omitted, the choice of the optimal capital structure becomes a relevant factor in the determination of the company's value.

Further studies expand the concept proposed by Modigliani and Miller (1958) by relaxing some of the restrictive assumptions mentioned in their work and introducing different types of market imperfections to answer the questions on the determinants of capital structure decisions.

According to Myers (2001), "there is no universal theory of the debt-equity choice, and no reason to expect one", however, the conditional theories could be of great help to understand the financing decisions of the companies. These theories can be divided into two main groups: the theories that suggest the existence of an optimal debt to equity ratio for each firm, which are referred to as trade-off theories, and the theories that state that there is no precise target, so-called pecking order theories.

2.2.1 Trade-off Theory

The authors of the original work themselves, Modigliani and Miller (1963), followed by Miller (1977) only, introduced taxes into the model and came up with dissimilar conclusions, mainly they concluded that the optimal capital structure exists. The authors argued that in an imperfect market, where taxes are present, the firms could be better off while holding more debt than equity as there is a possibility of getting a tax deduction from interest on debt while gains from the equity in the forms of dividends and capital gains, contrarily, are subject for taxation. Assuming that the interest on debt is tax-deductible and ignoring other frictions, the authors concluded that the value of the company increases in proportion to the amount of the debt used, meaning that the firms are better off with a higher debt ratio. More specifically, a levered firm is of a greater value than an unlevered firm, the difference is equal to the present value of the tax savings that arise from the use of the debt. The work implies that the companies should prefer debt financing to other external sources of financing available. Since no costs were associated with the debt, the authors suggested full debt financing, however, they also indicate possible limitations of this approach.

A real-life version of full debt financing is not cost-free. Two potential costs are associated with debt financing and consequently the trade-off theory: bankruptcy costs or agency costs.

The first ones to add bankruptcy costs into the theory were Kraus and Litzenberger (1973), who came up with a follow-up theory based on the one formed by Modigliani and Miller (1963). The centre point of their work was bankruptcy costs – the costs associated with the legal proceedings from raising a formal request

commonly by a creditor, through the process of measurement and evaluation of debtor´s assets up to repayment of the debt. Bankruptcy costs, as implied by Frank and Goyal (2008), are costs linked with a positive perceived probability of default and could be divided into two groups, direct and indirect bankruptcy costs. Direct costs comprise professional fees, the amount of money paid to the professionals involved in the process such as lawyers, accountants, etc., administrative expenses and restructuring costs. On the other hand, the indirect ones are loss of employees that leads to lost product innovations, loss of customers that implies a loss in sales as well as revenue, less favourable credit terms or the inability to issue securities under favourable conditions. The indirect costs can in many cases be substantial, but it is difficult to measure the exact value associated. Bankruptcy costs vary by both industry and firm.

The increase in the firm's value due to the higher debt, the concept of Modigliani and Miller (1963), leads to an increase in its bankruptcy probability and therefore also bankruptcy costs due to the fear that the firm might not be able to repay its debts (Titman, 1984). Thus, the optimal capital structure, as suggested by Kraus and Litzenberger (1973), corresponds to the level of debt on which benefits arising from debt financing compensate for the bankruptcy costs.

Besides the bankruptcy costs, there are also agency costs associated with the use of debt financing. The first one to include agency costs in the trade-off theory was Meyers (1984b). The costs that are associated with the concept of a conflict of interest are referred to as agency costs. Agency costs usually arise from the separation of ownership and control in firms. More specifically, the agency costs stem from relationships either between managers and shareholders or between shareholders and debtholders. (Jensen, 1976)

Conflict of interest between managers and shareholders occurs because in most cases both sides are represented by two distinct groups of people or even if the managers possess any ownership over the firm, they mostly do not own the whole firm, while they manage the firm on a day-to-day basis. Furthermore, the managers control all the firm's financing resources. Managers tend to make decisions to maximize their interests while not taking into account the interests of shareholders. The described disparity can be reduced with an increase in the amount of equity the managers own in the firm or the shareholders have to come up with some kind of reward system for managers to align the interests on both sides and dodge the unnecessary spending on monitoring managers work. (Jassim, 1988)

According to Myers (2001), the conflict of interest between debtholders and shareholders arises only when the risk of default exists. In case the firm is not in a risky situation that could lead to default, the debtholders are not controlling the actions the managers take to lead the company. On the other hand, when the risk of default is distinct, the managers are acting in the interest of shareholders (maximizing the shareholders' value) while not in the least considering the interests of debtholders and that is when the debtholders try to control the leading of the firm. To increase the shareholders' value, managers tend to participate in riskier projects that benefit shareholders if succeed, but burden creditors in case of failure. The creditors usually to prevent this kind of behaviour are incorporating additional conditions into their debt contracts that will increase the cost of the debt or block the managers' ability to participate in risky projects that will negatively affect the debtholders' position.

Bankruptcy and agency costs together form the basis of the trade-off theory which implies that firms borrow up to a point where the costs that are linked with the increased probability of financial distress are fully compensated by the tax savings from taking an extra debt. This implies that the optimal capital structure to maximize the firm's value exists. To reach the maximal value of the company, the trade-off theory suggests for managers to set a target debt to equity ratio and gradually move towards it. (Frank, 2008)

2.2.2 Pecking Order Theory

An alternative to the trade-off theory is the pecking order theory. The theory was firstly introduced by Myers and Majluf (1984a) and developed further by Myers (1984b). According to pecking order theory, the basis for the optimal choice of capital structure for a firm stems from an adverse selection problem caused by asymmetric information between a firm's management and its new investors. The theory is based on two key assumptions. First, managers act in the best interests of already engaged shareholders. Second, the managers with a higher probability have access to superior information regarding the market value of their firm's assets and could more precisely determine the firm's future growth opportunities than outside investors. In case the conditions are met, the theory suggests the order in which the firm will be choosing between different types of financing. The firm will prefer to use internal funds (retained earnings) over any other source of financing if possible because the said source is the least affected one by information asymmetry. Otherwise, it will choose to take on debt (short term is more preferred to long term) rather than issuing new equities. Issue of new equities is a last resort the firm will use as a financing instrument, sometimes the company will even forgo the projects with positive net present value if pursuing the project forces the firm to issue undervalued equities to new investors since it adds

equity to the firm at the expense of old shareholders. Thus, firms that have retained earnings at disposal will prefer to use internal funds and hence will use less debt.

In general, according to pecking order theory, the optimal capital structure should be chosen based on the firm's financial requirements while minimizing the adverse selection costs, rather than focusing on an optimal debt to equity ratio as is the case for trade-off theory.

2.3 Overview of Previous Empirical Research

The relationship between capital structure and its determinants has been and still is attracting the attention of many researchers. The topic has been studied for a long time, nevertheless, the works generally provide mixed evidence as to which theory holds empirically or which determinants affect the capital structure and to what extent. Also, the existing literature concerning the Czech Republic is scarce and the results are ambiguous, thus the main goal of this study is to bring up-to-date results based on a broader sample with a larger informative value for the Czech Republic.

A concise overview of subsequently reviewed papers is provided in Table 12 and Table 13, those could be found in Appendix A.

2.3.1 International Empirical Research

One of the first research papers on the topic of capital structure determinants was presented by Titman and Wessels (1988). They tested the explanatory power of several determinants on various types of debt. Instead of using one aggregated measure for total debt, they employed in the regression analysis 3 types of debt, i.e.: short-term, long-term and total debt. Asset structure, non-debt tax shields, growth, uniqueness of business (measured by the number of product lines and advertising expenses), industry classification, size, earnings volatility and profitability were used as determinants. The data sample consisted of 496 American companies operating in the period from 1974 to 1982. The study used a two-part factor-analytic technique to estimate the effect of the determinants.

The results suggested, contrary to expectations based on existing theories in the field, that the relationship between five of the studied determinants and the debt ratios was not statistically significant. The remaining determinants were statistically significant and were in favour of the pecking order theory. (Titman, 1988)

At the time when Rajan and Zingales (1995) presented their empirical research almost all of the already published papers focused on companies based in the United

States. They performed the analysis on public firms from highly industrialized G7 countries (United States, Japan, Germany, France, Italy, United Kingdom and Canada) between the years 1987 and 1991. The main goal of this paper was to assess whether results for the United States were valid also for other G7 countries, therefore, the data sample consisted of almost 2,500 American firms, while the companies from the remaining countries amounted in total to circa 2,000. The paper also aimed to examine whether the determinants were related to either of the capital structure theories. To estimate the effect of tangibility, growth, firm size and profitability on leverage (measured in two ways as either market or book value) Tobit regression model was used.

The authors specifically stressed that the best model was able to explain only 30% of the variance in total market leverage for Canada, while the average value was only 19%, indicating possible omitted variable problem as well as possible not included country-specific determinants which should not be a problem in the case when only one country is observed. The authors did not interpret the results for each country, they opted to comment on the pattern across countries and tried to explain possible exceptions. In the majority of the countries, all of the determinants were statistically significant at least at a 10% level for both market and book value of leverage. (Rajan, 1995)

Frank and Goyal's (2009) primary concern was, as suggested by the title of the paper, to find out which determinants are reliably important. They studied a long list of possible determinants on an extensive data sample that consisted of financial data describing 5,000 American public firms in the period from 1950 to 2003. Four different leverage measures were used, i.e.: long-term and total debt over both book and market value of assets.

The results indicated that industry factor, tangibility, profits, firm size, market-to-book assets ratio and expected inflation were statistically significant and had consistent signs in models with the market-based definition of leverage. In the case of book-based definition, only industry factor, tangibility and profits remained significant. The estimates of the statistically significant determinants except for profitability provided support for the implications of trade-off theory. (Frank, 2009)

Lately the empirical research instead of a country or state level of capital structure determinants focuses on smaller and more homogenous subsets such as SME companies, companies in a specific industry, etc. That is the case for Lisboa (2017), Balios et al. (2016), Proenca et al. (2014), Režňáková et al. (2010) or Berkman et al. (2016). The first 3 empirical studies analyzed small and medium enterprises in

Portugal, Greece and Portugal, respectively. The remaining two created a subset based on industry specifics by focusing on Slovak non-financial companies and European energy companies, respectively.

As is the case for most of the recent studies, Lisboa (2017), Režňáková et al. (2010) as well as Berkman et al. (2016), employed panel data regression analysis using pooled OLS, fixed and random effect models. As the dependent variable, they used three types of debt ratios, measured as short-term, long-term or total debt to total assets. Also, the majority of the capital structure determinants used by all three of the papers are the same, suggesting that the extensive literature in the field navigates the authors to account for the same independent variables. Namely, they employed in the regression the determinants such as size, profitability, tangibility, growth, liquidity, age, crisis period dummy and non-debt tax shield.

The important conclusion from all three papers was that except for the crisis period dummy and profitability (measured as return on equity instead of commonly used return on assets) the remaining determinants were statistically significant. None of the capital structure theories explained any of the models entirely, however, in the case of the paper by Režňáková et al. (2010) the results suggest that the trade-off theory prevails. On the other hand, in studies carried out by Lisboa (2017) as well as Berkman et al. (2016) it was not possible to determine with which of the theories were the results in accordance.

Biljana Jovanovic (2015) analyzed the determinants of capital structure in the context of Macedonian companies. The main goal of the paper was to assess the determinants and their effect on leverage and to analyze changes in firms' leverage decisions by comparing the post-crisis outcome with the pre-crisis determinants. The data sample consisted of 194 firms' financial data in two sub-periods – from 2000 to 2009 and from 2013 to 2014. As not all of the observations were available for every year (e.g.: the firm went bankrupt or started operating later than 2000), the dataset used is an unbalanced panel with 1,532 firm-year observations. As an estimation method used to study the effect of size, profitability, growth opportunities, tangibility, lagged leverage, non-debt tax shield and taxes on leverage (measured as total debt to total assets) the system dynamic panel data estimator also known as system-GMM estimator was selected.

The results of the estimation suggested that except for taxes, all of the studied determinants were statistically significant. Moreover, most of the determinants provided support for the pecking order theory. The author also concluded by comparing

the pre and post-crisis period that, as expected, the leverage decision after the crisis were affected by the pre-crisis level of leverage. (Jovanovic, 2015)

2.3.2 Empirical Research Including the Czech Republic

As was previously stated, the number of research papers focusing on determinants of capital structure in the Czech Republic is low and provides mixed evidence, however, it presents valuable local inputs about the selection of the dependent and independent variables, data selection process, etc. that should be considered before further analysis.

Contrary to the western countries, where the researchers started to focus on an analysis of capital structure determinants in the 1980s, the first paper covering this topic based on the data from the Czech Republic, at least to the extent of this thesis' author's knowledge, was written by Patrik Bauer (2004) in early 2000s. Bauer (2004) performed an analysis on the 72 listed companies in the Czech Republic for two consecutive years, 2000 and 2001. The paper studied the relationship between leverage (measured as the ratio of total liabilities to total assets) and eight potential determinants of capital structure – size, profitability, tangibility, growth opportunities, tax, non-debt tax shields, volatility, and industry classification. To analyze how the determinants affect the capital structure, the author used OLS estimation for the two studied years separately. Bauer (2004) concludes that only 4 of the determinants were statistically significant and their effect on leverage was not corresponding with only one of the theories described previously in this thesis, which is a common conclusion in empirical studies from foreign countries (see the Subchapter 2.3.1, International Empirical Research). While the effect of size was in line with the trade-off theory, the remaining significant determinants (profitability, tangibility, and growth opportunities) indicate a negative relationship, thus, subsequently, confirming the superiority of the pecking order theory. (Bauer, 2004)

Other types of studies carried out on the data from the Czech Republic focus on a specific industry, such as the works by Petra Pinková (2012) or Renata Aulová and Tomáš Hlavsa (2013).

Petra Pinková (2012) tried to identify determinants influencing the capital structure of large and medium-sized companies belonging to the Czech automotive industry. The data sample consisted of 100 companies and covered a period from 2006 to 2010. Following the previous studies in the field, this paper employed three types of dependent variables. As a measure of leverage the paper used total, short-term, and long-term debt ratios (measured as total liabilities to total assets, current liabilities to

total assets and non-current liabilities to total assets respectively). The determinants that were considered by this paper were size, tangibility, profitability, liquidity, and growth. To analyze the effect of the determinants, Pinková (2012) worked with the dataset as panel data and performed regression analysis using pooled OLS, fixed effect and random effect models, out of which the fixed effect model was presented as the most accurate. The results of the study suggested that the effect of determinants to a large extent depends on the choice of the dependent variable (total, short-term or long-term debt ratio), while tangibility, profitability and liquidity were statistically significant in all three cases, their impact on the debt ratio differed (e.g.: there was a positive relationship between profitability and total debt ratio, as well as short-term debt ratio, however, between profitability and long-term debt ratio it was negative). Also, the conclusion stated that neither the pecking order theory nor the trade-off theory has been convincingly proved as the effects of the determinants for any of the leverage measures were not all in line with one of them. (Pinková, 2012)

Renata Aulová and Tomáš Hlavsa (2013) focused on agricultural entities in the Czech Republic. To estimate the effect of the determinants the authors used the method of ordinary least squares for seven consecutive years from 2004 separately. For each year they estimated the effect of six determinants (size, profitability, tangibility, non-debt tax shield, retained profit and liquidity) on three different dependent variables (total, short-term or long-term debt ratio) creating in total 21 models that were estimated. The result of the estimation suggested that the size, tangibility and retained profit are statistically significant in models with total and long-term debt ratios while the only statistically significant determinant for short-term debt ratio models is liquidity, thus, the authors emphasize the need to focus on each category of indebtedness, i.e. long-term and short-term, separately. Also, they stress that this characteristic could be industry related and not applicable to other industries in which the common division between short-term and long-term debt could be different, therefore, they suggested further analysis. (Aulová, 2013)

Furthermore, the data for the Czech Republic also appears in research papers that analyze several countries or regions at once, such as works by Delcoure (2007), Mokhova and Zinecke (2013) or Fenyves et al. (2020).

Delcoure's (2007) main goal was to address the determinants of capital structure in the CEE region, more precisely Czech Republic, Slovakia, Poland and Russia, and to assess whether the findings are in line with the results presented by other studies performed on the datasets for Western developed countries. The data sample consisted of 100 to 400 firms in each country between the years 1997 and 2002. The

regression employed three types of debt ratios according to their maturity as a dependent variable and 7 determinants (i.e.: tangibility, size, volatility, profitability, growth opportunities, non-debt tax shield and taxes) as independent variables. The paper utilized three estimation methods—pooled OLS, fixed effect, and random effects— for individual countries and the whole sample. The paper suggested the statistical significance of all of the used determinants except for growth opportunities. Furthermore, the paper concluded that some of the suggested relationships between the determinants and debt ratios did not correspond with the expectations based on the results for Western developed countries. (Delcoure, 2007)

Natalia Mokhova and Marek Zinecke (2013) studied the capital structure determinants of the European countries in the context of the tendency to apply for membership in the EU. They divided 32 European countries into 3 groups (membership wise), i.e. old EU members, new EU members and EU candidates and performed the analysis on manufacturing firms in each country between the years 2006 and 2011 using OLS. They used common dependent and independent variables in their estimation and concluded, that, the majority of the countries follow the pecking order theory in the case of profitability, size and growth opportunities, while for tangibility and non-debt tax shield it was reported inconclusive. (Mokhova, 2013)

Fenyves et al. (2020) aimed to analyze capital structure determinants of agricultural and food companies in Visegrad countries. They performed the analysis on quite an extensive data sample which consisted of circa 2,000 companies from each country between the years 2015 and 2017. The paper assessed the effect of the size, tangibility, profitability and growth opportunities on the debt ratio using the fixed effect estimation method. The regression results were inconclusive for the whole Visegrad group, neither of the theories prevailed, and thus the authors concluded that country-specific factors strongly affect the capital structure and to obtain relevant results, the analysis should be performed on an individual level. (Fenyves, 2020)

One of the key conclusions of all the papers that analyzed multiple countries or regions at once was that the country-specific factors have a nonnegligible influence on the final results and the key to valuable insights is to form as homogenous subsets as possible (a division of EU countries into 3 groups according to the time they applied for membership, etc.). They still made conclusions based on the grouped data, however, they point out that the estimated results should be interpreted cautiously.

2.4 Determinants of Capital Structure

This section presents variables that are responsible for determining capital structure decisions according to empirical studies reviewed in the previous subchapter or suggested by authors of the original theories. Even though not all of them are statistically significant in all countries, the vast majority will be listed below.

As identified by most of the empirical studies, this part will review the following as the capital structure determinants: size, profitability, tangibility, liquidity, growth opportunities, age, tax, non-debt tax shield and the so-called "crisis effect".

Size

Numerous studies suggest that larger companies tend to be more diversified, hence, the probability of going bankrupt is lower. (Rajan, 1995) In this case, the size could be viewed as an inverse proxy for the probability of bankruptcy and therefore the relationship between debt ratios and size should be positive. A positive relationship is supported also by Myers and Majluf (1984a). They state that larger firms are forced to disclose more information than small ones, thus, outside investors have more information and it is simpler for larger firms to issue debt. Despite the simplicity, according to Rajan and Zingales (1995), larger firms tend to prefer equity to debt financing to not disclose unnecessary information to outside investors. Consequently, the relationship between debt ratios and size is expected to be negative.

Empirical studies provide ambiguous findings. While most researchers find support for the trade-off theory and suggest a positive relationship (Lisboa, 2017; Balios, 2016; Proença, 2014; Rajan, 1995), some studies are confirming the opposite (Titman, 1988). Titman and Wessel (1988) suggested that the nature of the relationship depends on the maturity of the debt. According to the finding of several papers (Titman, 1988; Proença, 2014), size is associated negatively with short-term debt ratios, while on the opposite, long-term debt size is associated positively.

Profitability

Profitability is one of the independent variables with the highest significance among all of the determinants of capital structure in previous research. In general, if possible, firms prefer internal funds to external financing, which corresponds with the pecking order theory (Myers, 1984a) which suggests a negative relationship between profitability and debt ratios. The higher the profit of the firm the lower the debt as they are using internal funds to cover the operation. As already discussed, trade-off theory is based on identifying the target debt via comparing its costs and benefits. Frank and

Goyal (2008) claim that the costs of the debt in a form of bankruptcy costs for profitable firms are low, therefore the companies tend to borrow more and expect a higher reduction in their tax burden. Moreover, the creditors are in general more inclined to lend more to profitable firms. This reflects that the trade-off theory suggests a positive relationship between profitability and debt.

The vast majority of existing studies confirm the relationship between profitability and debt in line with the pecking order theory, thus negative (Lisboa, 2017; Proença, 2014; Rajan, 1995; Titman, 1988). Proenca et al. (2014) and Lisboa (2017) additionally stated that the relationship is negative independently of debt maturity. The trade-off theory fails to explain the frequent presence of high profitability firms with low debt ratios, according to the theory the relation should be positive.

Age

Age is perceived to be closely linked with the reputation of the firm (Diamond, 1989). In most cases holds that the longer the firm operates on the market the better the reputation which indicates a better ability to fulfil the debt repayment and a higher probability to obtain debt financing with advantageous conditions. Older firms face a lower cost of debt, therefore the trade-off theory suggests age, as the indicator of creditworthiness, to be positively correlated with debt. On the other hand, it is noted that older firms have a greater ability to finance their operation throughout the retained earnings accumulated over time, while younger firms are forced to rely on external funds as a way of financing. Furthermore, older firms tend to have more experience and try to not harm their good reputation by taking on riskier investments therefore they rely on debt much less than younger firms. The expected relationship between age and debt is therefore negative as suggested by pecking order theory.

Given that the whole topic of capital structure is not unambiguous, the empirical studies including age in the analysis provide mixed evidence. While some of the papers suggest a negative relationship (Mac an Bhaird, 2010; Lisboa, 2017), there are also papers to conclude otherwise (Sogorb-Mira, 2003). Debt maturity could matter also in case of age, Lisboa (2017) suggested a positive relationship with short-term debt and a negative with long-term debt. On the contrary, Nyeadi et al. (2017) concluded that the relationship is negative no matter the maturity.

Tangibility

Tangibility or asset structure is noted to be one of the crucial capital structure determinants. Generally, tangible assets serve as collateral for creditors to prevent

losses caused by conflicts between shareholders and debtholders or by lack of information. A firm offering high collateral in a form of tangible assets is perceived positively by creditors who can request the sale of these assets in case of bankruptcy and perceive such borrowings as relatively safer than the ones without collateral (Frank, 2008). The collateral lowers the effect of information asymmetry, thus firms with a higher proportion of tangible assets tend to access debt financing more easily and tend to exhibit higher debt ratios. That suggests a positive relationship between tangibility and debt in line with trade-off theory. On the contrary, the pecking order theory expects the relationship to be negative as the companies with a higher level of tangible assets tend to be bigger and suffer less from information asymmetry and therefore use debt financing less.

Some empirical studies experience a positive relationship between tangibility and debt (Frank, 2008; Rajan, 1995; Titman, 1988) while others suggested a negative relationship (Lisboa, 2017; Balios, 2016; Proença, 2014). Lisboa (2017), Proenca et al. (2014) and Nyeadi et al. (2017) also focused on the importance of debt maturity in this relationship and concluded that the relationship is negative for short-term debt and positive for long-term debt. As pointed out by Bevan and Danbolt (2002) it is in line with the maturity matching principle (principle of financing long-term assets with long-term debt and short-term assets with short-term debt).

Liquidity

Liquidity, as well as probability, are indicators of a firm's financial position, keeping that in mind, the expected nature of the relationship between liquidity and the debt concerning either one of the theories should be identical. According to the trade-off theory, firms that have at their disposal highly liquid assets are likely to have high debt ratios as they can generate enough cash flow and thus can meet their financial obligations on time without facing the risk of default. It implies that the suggested relationship between liquidity and debt is positive. In line with pecking order theory, firms will choose to finance their operation through internal funds, mostly retained earnings or reserves, if they are available rather than external sources, such as issuing debt or new equities (Myers, 1984b). The suggested nature of the relationship between liquidity and debt is then negative.

A substantial majority of empirical papers confirm a negative relationship (Lisboa, 2017; Proença, 2014; Rajan, 1995; Titman, 1988). This could mean that firms with highly liquid assets and low debt ratios tend to prefer equity issue instead of debt financing. In the case of maturity relevant data, Lisboa (2017) and Nyeadi et al. (2017)

equally propose a negative relationship between liquidity and short-term debt and a positive one between liquidity and long-term debt.

Growth

Growth is perceived to be a significant determinant even though the effect on the debt may be ambiguous. According to trade-off theory, the growth of the firm is negatively related to debt. High growth could provide a firm with a wider range of opportunities to invest in riskier projects, however, investing in riskier projects harms the debt as it leads to an increase in probability of bankruptcy and consequently the cost of financial distress (Myers, 1977). More specifically, higher costs of financial distress lead to a lower optimal debt ratio, hence, limiting the optimal amount of debt. In contrast, pecking order theory suggests a positive relationship between growth and debt. In a period of growth, internal funding could be insufficient to finance growth opportunities, hence, the firm tends to increase its borrowings. A positive relationship is also supported by the idea that the high growth of the firm could be perceived by creditors as a positive sign that the firm is not facing bankruptcy (Proença, 2014) and thus they are more willing to lend money to these entities.

A considerable number of papers agreed on a positive relationship between growth and debt (Lisboa, 2017; Balios, 2016; Proença, 2014; Bevan, 2002), however, there are still papers concluding a negative relationship (Rajan, 1995; Titman, 1988; Myers, 1977). The effect of growth on debt maturity is inconclusive.

Tax

According to Miller (1977), companies prefer to issue more debt as it provides an interest tax shield, consecutively, raising the income after taxes due to the tax deductibility. A company requests debt at most to the point where tax shield benefits equal the cost of the debt. Miller (1977) also pointed out that the effect of tax deductibility is more interesting for larger companies, while larger companies look for possible ways how to reduce tax, smaller firms usually do not consider the tax benefits linked to debt at all.

The results of previous studies are inconclusive. A considerable amount of studies do not include tax at all, such as Rajan and Zingales (1995), who referred to the conclusion provided by Mayer (1990) that taxes do not have any explanatory power, thus, decided to not include the taxes in regression. On the other hand, Fenyves et al. (2020) presented a positive and statistically significant relationship between taxes and debt ratio.

Non-debt tax shield

According to Modigliani and Miller (1958), in case the interest payments on debt are tax-deductible firms tend to issue more debt. Thus, contrarily to the concept concerning advantages of interest tax shields in the trade-off theory, one would suggest a negative relationship between non-deb tax shields and debt. The higher the non-debt tax shield, the lower firm's tendency to use debt financing for tax shield exploitation. Firms with relatively large non-debt tax shield compared to the cash flow tend to use debt financing less (De Angelo, 1980). Non-debt tax shield could be measured as depreciation over total assets and dividends (Salawu, 2008). Proença et al. (2014) pointed out that as the assets could be used as collateral the debt could be accessed more easily for firms with larger amounts of them. As depreciation is a consequence of the ageing of the asset, there could be a positive relationship between non-debt tax shield and debt.

Titman and Wessel (1988) do not find a statistically significant relationship between non-debt tax shield and debt, while some others do, the result is inconclusive. Papers are supporting both, either positive (Lisboa, 2017) or negative (Proença, 2014; De Angelo, 1980) relationships. The effect of the non-debt tax shield on debt concerning its maturity has not been analyzed widely, therefore there could not be any clearly expected relationship. Proenca et al. (2014) suggested a non-deb tax shield to be positively/negatively related to short-term/long-term debt, on the other hand, Lisboa (2017) stated that the maturity of the debt does not matter as the relationship is positive regardless.

Crisis Effect

This thesis includes also the years of recession and of expansion into the studied period, therefore taking into consideration the effect of the crisis seems to be relevant, despite the fact, that there are not many previous authors doing the same, e.g., due to the unavailability of the appropriate dataset. Proenca et al. (2014) incorporated the crisis period dummy into their research and confirmed that it has a statistically significant impact on debt. Suggested positive impact in their case implies that after the financial crisis firms tend to exhibit lower debt levels. It could be explained by the fact that the crisis was followed by lower credit supply and higher difficulties to obtain debt as the banks charged higher spreads. On the other hand, other authors that considered the effect of the crisis, namely Lisboa (2017) or Laureano et al. (2012), concluded that the relationship should be negative, however, the determinant in their case was statistically insignificant.

3 Data

The first part of this chapter describes the conditions that each observed object must fulfil to be included in the dataset. Then the sources of the data are covered. A substantial part of this chapter is dedicated to a description of the whole sample, each variable itself and summary statistics. The latter is included also following the part concerning outliers as its presence and treatment result in slight changes in descriptive statistic values. The last part is dedicated to a discussion about the possible multicollinearity issue.

3.1 The Criteria for Data Collection

The data collection process was based on a set of five criteria. First, the dataset includes only companies that meet the definition of the small and medium-sized enterprise (SME for further reference) defined by the recommendation issued by the EU in 2003. The SMEs definition is based on two factors which determine whether an enterprise belongs to this group. To be perceived as an SME, the staff headcount must be at least 10 and at most 249, while at the same time the company's annual turnover must in total sum up to at least 2 million euros and at most 50 million euros (alternatively its balance sheet total has to be between 2 and 43 million euros) (User guide to the SME Definition, 2015). This thesis employs the staff headcount and annual turnover limits.

Second, the companies in the data sample are not a part of a group of companies, they stand alone and their financial records are not consolidated with e.g.: parent companies or subsidiaries.

Third, the studied period is from 2006 to 2019. One of the thesis goals is to assess whether the global financial crisis between 2007 and 2009 affected the capital structure and its determinants. Thus, the year 2006 is chosen to be the first year of the period. Based on the knowledge obtained during the data collection process, the companies in the Czech Republic frequently lack the last one or two years of financial reports published either in the database the author used or in the financial register. Therefore, the determination of the end year depended on two factors: the tendency to have the longest possible studied period and at the same time not to lose too many studied objects. Finally, the end of the period was set to 2019 as the latest year that the data required for the study is available for most companies.

Fourth, according to Arellano and Bond (1991), types of analysis with possible endogenous variables such as the one performed in this thesis provide more valid estimates if performed on a balanced panel dataset. Furthermore, Flannery and Hankins (2013) stress that in the case of the simultaneous presence of endogenous variables and missing observations in the dataset, estimation and subsequent interpretation of the regression results can be extremely difficult. They conclude that although the balanced panel condition reduces the overall amount of observation in the dataset, the resulting estimates and their interpretation are more accurate. Thus, to acquire a balanced panel dataset, the company must start operating at least before 2005 as some of the variables, such as growth, are calculated using previous year's financial records and continuously operate up to 2019. The data for the period must be available for each year out of the studied period, otherwise, the company must be dropped out of the dataset to avoid missing observations and maintain the balanced panel dataset.

Finally, the thesis includes in the dataset only the companies whose fiscal year ends on December 31 and said setting does not alter during the studied period.

3.2 Data Sources and Sample Description

As a primary source to obtain necessary data about the studied companies this thesis used a database called MagnusWeb, which contains comprehensive data, such as financial statements or data related to the events that they went through (e.g.: declaration of bankruptcy, …) on Czech and Slovak economic entities. The rest of the missing information were supplied using annual reports that were published by the firm itself in the business register and gathered manually to preserve as many studied subjects as possible.

According to the Annual Report on European SMEs 2021/22 (2022) prepared on request for European Commission, as of the end of 2021, the number of SMEs amounted to 36,901 enterprises. It is the lowest number in comparison with the other years in the reviewed period, which was from 2008 to 2021. The most SMEs the Czech Republic had in 2008 when it in total amounted to 42,371 enterprises. As the number of SMEs does not fluctuate much and decreases slowly over time, it is possible to expect that the numbers of SMEs were roughly the same in 2006 and 2007 as in 2008. Therefore, the number of enterprises included in the dataset could at most sum up to approximately 35,000. However, the data collection process faced several limitations, and the final number of studied enterprises is significantly lower.

The main problem was mentioned by a press release of a company Dun & Bradstreet (2021), which is the owner of the MagnusWeb database. According to the

said press release, approximately 50% of the companies operating in the Czech Republic do not fulfil in the long-term their lawful obligation to publish financial statements. Moreover, as of July 21, 2021, the 2020 financial statements, which were supposed to be available by the end of June at the latest, were not published by 85% of the companies stated Dun & Bradstreet (2021).

Furthermore, the companies that provide the financial statements frequently do not disclose the cash flow statement and the attachment of the annual report. That fact is crucial for the final number of companies in the dataset as the attachment of the annual report is the most probable statement from which to obtain the number of employees that is used to determine the pertinence to the SME category.

Considering all the above-mentioned limitations, the final dataset consists of 2,693 companies operating in the Czech Republic throughout the period from 2006 to 2019. Therefore, panel data with 37,702 firm-year observations are used in this thesis.

3.3 Description of Variables

The main goal of this thesis is to examine the relationship between capital structure and its determinants in the case of small and medium-sized enterprises. The measures for both dependent and independent variables employed in the analysis are described in the following subsections.

3.3.1 Dependent Variables

Extant literature normally works either with a common measure of leverage, with two measures of leverage, namely book leverage and market leverage or with more in-depth measurements, specifically total debt ratio, short-term debt ratio and long-term debt ratio as the dependent variable. The discussion of whether to use book-value or market-value-based leverage is still ongoing and remains unresolved. However, studies that used both book-value and market-value-based measures conclude that the results are robust regardless of the measurement type and the inferences are largely identical (see, for instance (Frank, 2008; Rajan, 1995; Titman, 1988), among others). Secondly, the availability of market value data for SMEs is scarce at best, which also speaks in favour of book-value-based measurements. Finally, as the combination of short-term, long-term and total debt ratios is the one most frequently chosen, the thesis employs this approach as well.

All three of the ratios are based on the book value of current liabilities, non-current liabilities, total liabilities and total assets obtained from the company's financial

records in the observed year. The measurements are constructed as the ratio of corresponding liabilities to total assets.

A list of dependent variables and their definitions of measurement are provided in Table 1 as well as shortcuts for each variable as these will be used in model descriptions and regression analysis results.

Table 1: Dependent Variables

Variable name	Shortcut	Definition
Total debt ratio	TD_ratio	The ratio of total liabilities to total assets
Short-term debt ratio	STD_ratio	The ratio of current liabilities to total assets
Long-term debt ratio	LTD_ratio	The ratio of non-current liabilities to total assets

Source: Author's own compilation

3.3.2 Independent Variables

The set of independent variables combines firm-level determinants of capital structure as well as dummy variables. Following the research papers presented in the Subchapter 2.3, Overview of Previous Empirical Research, while considering the availability of the data, nine determinants that were perceived as reliable were chosen. Namely, the determinants are firm size, profitability, past profitability, tangibility, liquidity, non-debt tax shield, tax, growth and firm age. The dummy variable included in the analysis is supposed to capture the effect of the financial crisis between 2007 and 2009.

To measure size, the thesis employed three different approaches, namely the total amount of sales, net revenues or total assets. The next four determinants in a form of commonly used financial ratios, such as profitability, past profitability, tangibility and liquidity, follow the standard way of measurement. Profitability, past profitability and tangibility are defined as the ratio of EBIT, retained earnings and net fixed assets to total assets respectively. Liquidity is calculated as a share of current assets on current liabilities. The ratio of depreciation expenses to total assets is used as a proxy for a non-debt tax shield and the second determinant regarding taxes is defined plainly as the total amount of taxes as stated in the financial records. Growth is calculated as the difference between observed and the previous year's total assets divided by the previous year's total assets. Firm age is presumptively a self-explanatory variable, it is defined as the difference between the observed year and the year when the company started its operation.

All of the measurement definitions presented in the previous paragraph are in line with the ones commonly used in the reviewed literature.

The dummy variable for crisis effect is defined as 1 for the years when the financial crisis occurs and 0 otherwise. According to a statement published by Czech Statistical Office (2011), the financial indicators were severely affected in 2008 and 2009 and from 2010 the Czech economy started to adjust after the crisis, therefore, the crisis years marked as 1 in this thesis are 2008 and 2009.

A comprehensive overview of the independent variables, their shortcuts and measurement definitions is provided in Table 2.

Table 2: Independent Variables

Variable Name	Shortcut	Definition
Firm Size 1	size_sales	The amount of total sales
Firm Size 2	size_net_reve	The amount of net revenues
Firm Size 3	size_assets	The amount of total assets
Profitability	prof	The ratio of EBIT to total assets
Past Profitability	past_prof	The ratio of retained earnings to total assets
Tangibility	tang	The ratio of net fixed assets to total assets
Liquidity	liq	The ratio of current assets to current liabilities
Non-debt Tax Shield	ndts	The ratio of depreciation expenses to total assets
Firm Age	age	Number of years since the establishment of the firm up to the observed year
Tax	tax	The amount of taxes
Growth	growth	Annual percentage change of total assets
Crisis Period Dummy	crisis	1 for crisis year (2008 or 2009), 0 for non-crisis year

Source: Author's own compilation

3.4 Descriptive Statistics of Initial Dataset

Descriptive statistics of the dataset including the number of observations, mean, standard deviation, median, minimum and maximum value of each variable are provided in Table 3.

Table 3: Descriptive Statistics

Variable	# of obs.	Mean	St. Dev.	Median	Min	Max
TD_RATIO	37,702	0.42	0.45	0.38	-0.69	50.00
LTD_RATIO	37,702	0.06	0.14	0.01	-0.12	4.81
STD_RATIO	37,702	0.37	0.43	0.32	-0.69	50.00
PROF	37,702	0.04	0.13	0.01	-15.50	2.65
PAST_PROF	37,702	0.19	1.49	0.19	-207.15	3.15
LIQ	37,702	3.49	21.51	2.02	-195.29	2,107.00
NDTS	37,702	0.04	0.06	0.03	-1.12	7.33
TANG	37,702	0.31	0.23	0.28	-0.20	1.00
GROWTH	37,702	2.79	398.68	0.04	-1.00	75,320.86
CRISIS	37,702	0.14	0.35	0.00	0.00	1.00
AGE	37,702	16.81	6.14	17.00	1.00	47.00
TAX	37,702	4,414.24	10,889.48	1,980.00	-708,378.00	831,724.00
SIZE_SALES	37,702	452,905.48	708,085.49	290,702.00	-63,877.00	38,918,641.00
SIZE_NET_REVE	37,702	484,856.29	796,764.31	307,709.00	-49,136.00	48,121,164.00
SIZE_ASSETS	37,702	334,855.70	645,272.38	182,311.50	10.00	21,583,846.00

Source: Author's own compilation

As mentioned previously in this thesis, the dataset is a balanced panel, therefore the number of observations is the same for all variables. Variables TD_RATIO, LTD_RATIO, STD_RATIO, PROF, PAST_PROF, LIQ, NDTS, TANG and GROWTH are expressed in relative terms while the variables CRISIS, AGE, TAX, SIZE_SALES, SIZE_NET_REVE and SIZE_ASSETS in absolute terms, therefore, there is an obvious disparity between its summary statistic values. Moreover, the values of TAX, SIZE_SALES, SIZE_NET_REVE and SIZE_ASSETS are in thousands of CZK.

Table 3 shows that several observations stand out. There is a large difference between the minimum and maximum values and the standard deviations are large, for example in the case of LIQ, the mean value is 3.49, the minimum value is -195.15 and the maximum value is 2,107.00 while the standard deviation is 21.51. Each of the suspicious observations might be a result of abnormalities in a firm's operations, effects of the financial crisis 2007-2009 or database error. The presence of such observations could indicate the existence of outliers in the dataset, thus, the outlier detection and treatment are presented in the following chapter.

3.5 Outlier Detection and Treatment

As the existence of outliers in the dataset is a frequently encountered problem in capital structure studies, this study employs outlier detection and subsequently deals with extreme observations. A relatively high portion of studies, at least according to the author's knowledge, does not specifically mention how they dealt with the outliers if they were considered. Furthermore, there is no consensus among authors of papers that tried to address this issue on the way how to approach the outlier detection and correction process.

For example, Frank and Goyal (2008) discuss two known procedures – winsorizing and trimming. The trimming is a process during which the outliers are excluded from the dataset. Winsorizing on the other hand does not exclude any observations but replaces the most extreme ones with the last one that remains in the dataset for a given level (e.g.: 1%, 5%, 98%) of winsorization. Winsorization could be one or two-sided.

The author of this thesis, inspired by works of Evrim H. Kahya et al. (2020) or Biljana Jovanovic (2015) among others, which employed the same, opted for winsorizing as the consequence of trimming is an unbalanced panel or lower number of studied companies.

First, the author detected possible outliers in the dataset by drawing boxplots, interquartile ranges, histograms and performing the Grubbs test, which shows whether the lowest and highest observations of each variable in the dataset are outliers or not. No rule says how to treat outliers, the outlier detection and correction are highly dependent on researchers' knowledge of the dataset and ability to draw the line between the outliers that come from the nature of the data – extreme values, e.g.: much higher salary of the only manager than of a common employee in one firm, or from the measurement errors, e.g.: height of 1.8 meters in a dataset that includes only three years old children.

A dummy variable describing crisis years is not considered due to the nature of the variable. Although the boxplot of variable AGE indicates there might be outliers present, the minimum and maximum values (1 and 47 years) seem believable and show only that some firms in the data sample have long operation period. Furthermore, it is crucial not to forget that this thesis works with panel data. It means that if the maximum value of age is 47, then numbers from 34 to 46 are included as well as the length of the studied period is 14 years. Tangibility is the only variable without outliers indicated by either boxplot or histogram.

Boxplots of most variables in the dataset point out the presence of several influential observations laying much further than the rest of the data points. These variables, namely TD_RATIO, STD_RATIO, PROF, PAST_PROF, LIQ, NDTS, GROWTH and TAX, are perceived to be candidates for outlier treatment. On the other hand, boxplots of LTD_RATIO, SIZE_SALES, SIZE_NET_REVE and SIZE_ASSETS indicate that a perceptible number of observations lays outside the area bounded by the end of the whiskers and is a potential outlier. However, as this number is quite large and the distance between each potential outlier is not significant, it might mean that the observations are just extreme values in the dataset (e.g.: the firm that operates for 47 years could in terms of size be bigger than a firm operating third of the period).

Finally, after thorough consideration, the author decided to winsorize the following variables: TD_RATIO, STD_RATIO, PROF, PAST_PROF, LIQ, NDTS, GROWTH and TAX. Winsorization at 1% level was employed.

3.6 Descriptive statistics of Final Dataset

Descriptive statistics of the variables after winsorization are provided in Table 4, winsorized variables are labelled "_w" for clarity. The discussion of the winsorized descriptive statistics follows.

Table 4: Descriptive Statistics after Winsorization at 1% Level

Variable	# of obs.	Mean	St. Dev	Median	Min	Max
TD_RATIO_W	37,702	0.42	0.24	0.38	0.03	1.08
LTD_RATIO	37,702	0.06	0.14	0.01	-0.12	4.81
STD_RATIO_W	37,702	0.36	0.23	0.32	0.02	0.99
PROF_W	37,702	0.04	0.07	0.01	-0.11	0.37
PAST_PROF_W	37,702	0.22	0.29	0.19	-0.89	0.85
LIQ_W	37,702	3.00	3.14	2.02	0.39	21.05
NDTS_W	37,702	0.04	0.03	0.03	-0.01	0.19
TANG	37,702	0.31	0.23	0.28	-0.20	1.00
GROWTH_W	37,702	0.09	0.27	0.04	-0.46	1.47
CRISIS	37,702	0.14	0.35	0.00	0.00	1.00
AGE	37,702	16.81	6.14	17.00	1.00	47.00
TAX_W	37,702	4,256.68	6,786.46	1,980.00	-4,117.98	39,754.69
SIZE_SALES	37,702	452,905.48	708,085.49	290,702.00	-63,877.00	38,918,641.00
SIZE_NET_REVE	37,702	484,856.29	796,764.31	307,709.00	-49,136.00	48,121,164.00
SIZE_ASSETS	37,702	334,855.70	645,272.38	182,311.50	10.00	21,583,846.00

Source: Author's own compilation

A substantial difference between the mean value of the long-term debt ratio and short-term debt ratio indicates that a larger part of total assets is financed through short-

term debt. The short-term debt ratio mean (0.36) is six times higher than the mean value of the long-term debt ratio (0.06). The liquidity ratio measures the firm's ability to cover its short-term obligations by current assets at hand.

The mean value of liquidity amounts to 3 with a minimum value of 0.39 and a maximum value 21.05, which suggests that overall the firms are highly liquid. Liquidity over one indicates that the company can repay the obligations and the excess amount could be used for further financing. Thus, high liquidity of firms could partly explain low debt ratios as the companies tend to finance its operation from available funds instead of seeking external financing.

The average tangibility ratio is 0.31, which indicates that only 31% of total assets are fixed assets. A low level of tangibility might be also linked with a low level of long-term debt ratio as the companies (e.g.: from the finance or retail sector) do not have at disposal sufficient real estate or other tangible means that could serve as collateral without which the long-term debt is usually not granted.

The profitability ratio indicates that out of every CZK of total assets the firm earns on average 4% before interest and taxes. Furthermore, the average past profitability ratio is 0.22. It is almost 6 times higher than the observed year ratio which might imply that firms tend to cumulate their profit in the form of retained earnings to be able to subsequently finance extensive projects outside the business-as-usual activities, such as innovation or expansion of the firm, instead of using external financing.

There is a great dispersion in the variables concerning the size of the firm (no matter the definitions used) as well as tax. The mean values are almost 453,000, 485,000, 335,000 and 4,300 thousand CZK for size defined by total sales, size defined by net revenues, size defined by total assets and tax respectively, while its standard deviations are 1.56, 1.64, 1.93 and 1.59 times larger than its mean value.

Growth has a mean value (0.09) which suggests that in general growth of the companies in the data sample is moderate.

Interpretation of average age is a bit complicated, e.g.: in case a firm started its operation a year before the start of the studied period (which is 14 years long), the average age of this individual firm would be 8 years. Thus, in general, the average age of 16.81 suggests that most of the companies started their operation well before the start of the studied period.

Non-debt tax shield ratio is the most stable variable with a mean value of 0.04, a standard deviation of 0.03 and marginal values of -0.01 and 0.19.

3.7 Correlation and Multicollinearity

The correlation matrix assesses the relationship between every two variables of the dataset and provides information concerning the strength and direction of the association. In absolute terms correlation coefficients vary between 0 and 1, the higher the better the relationship between the two variables, moreover 1 indicates perfect relation. The sign of the coefficient shows whether the relation is positive or negative. The correlation matrix as described is provided in **Error! Reference source not found.** The results are shown with significance levels.

The majority of correlation coefficients between variables is statistically significant at 1% level. The highest correlation coefficients in absolute terms are between individual measures of size (0.95) and between the intended dependent variables (0.97). Gujarati (2003) proposed the threshold of 0.8 which indicates that the presence of these two variables in the regression could be harmful due to the issue of multicollinearity. The thesis employs only one of the debt ratios as a dependent variable and one of the measurements of size at a time, thus, creating several regression models without the simultaneous presence of the highly correlated variables. The next highest absolute correlation is between variables NDTS_W and PROF_W and amounts to - 0.47, which is well within the boundaries proposed by Gujarati (2003).

Overall, the correlation of the variables is either low or the variables will not be used simultaneously in the regression, therefore, the conclusion is that there does not exist multicollinearity issue.

Table 5: Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TD_RATIO_W	1	1.00														
LTD_RATIO	2	0.27***	1.00													
STD_RATIO_W	3	0.95***	-0.04***	1.00												
AGE	4	-0.06***	0.01	-0.06***	1.00											
SIZE_SALES	5	0.05***	-0.03***	0.06***	0.03***	1.00										
SIZE_NET_REVE	6	0.04***	-0.02**	0.05***	0.03***	0.97***	1.00									
SIZE_ASSETS	7	-0.04***	0.10***	-0.08***	0.04***	0.44***	0.48***	1.00								
PROF_W	8	-0.38***	-0.02***	-0.39***	0.14***	0.03***	0.02***	-0.00	1.00							
PAST_PROF_W	9	-0.18***	-0.06***	-0.17***	0.04***	-0.00	-0.00	-0.00	0.03***	1.00						
LIQ_W	10	-0.07***	-0.01*	-0.07***	-0.01**	-0.02***	-0.02***	0.02***	0.01	0.01*	1.00					
NDTS_W	11	0.32***	0.10***	0.30***	-0.03***	-0.01*	-0.00	0.11***	-0.47***	-0.09***	-0.01**	1.00				
TAX_W	12	-0.07***	-0.04***	-0.06***	0.03***	0.25***	0.27***	0.33***	0.15***	0.02***	0.01**	-0.00	1.00			
TANG_W	13	-0.13***	0.23***	-0.21***	0.06***	-0.07***	-0.05***	0.24***	-0.06***	-0.01	-0.02**	0.32***	-0.00	1.00		
GROWTH_W	14	0.00	-0.00	0.01	-0.01*	0.01	0.01	0.01	-0.00	-0.00	0.00	-0.00	0.00	-0.00	1.00	
CRISIS	15	-0.01**	-0.02***	-0.01	-0.27***	-0.03***	-0.03***	-0.02***	-0.09***	-0.01*	-0.00	0.02**	-0.02***	0.01*	-0.00	1.00

Notes: *p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

4 Methodology

This section is devoted to the methodology used in this work. First, the static panel data models are described, followed by the suggested approach how to determine the most appropriate estimation method. Subsequently, the dynamic panel data models are described. The chapter continues with an introduction of the most reliable way to estimate the model that allows for dynamic changes. All of the estimation methods that are considered in this thesis are theoretically described in this chapter. Finally, the hypotheses will be presented in the end.

4.1 Static Panel Data Models

The employed dataset consists of two dimensions – inter-individual (in the case of this thesis firm) and intraindividual dynamics (development in time) – constructing together a panel dataset. Due to the ability to combine both cross-sections and time-series, the panel data approach brings several advantages over cross-sectional or time-series data alone. Panel data are widely used because of their ability to provide more reliable parameter estimates, primarily due to the larger dataset, reduced multicollinearity and more degrees of freedom. Other reasons are the ability to compare individual firm-year observations and thus address dynamics of adjustment, the ability to control for individual heterogeneity and the possibility to remove a certain type of omitted variable bias by using an appropriate effect model.

It is crucial to understand the differences between possible panel data estimation techniques to pick the best approach for different models. Mostly used estimation techniques in the reviewed literature and therefore as well considered by this thesis are pooled OLS, random effects and fixed effects models.

Pooled OLS regression is considered to be the most basic way to address the panel data model. The Pooled OLS regression model is simply a linear regression model assessed by employing a standard OLS estimation approach on a flattened version of the panel dataset. The reliability of the estimates is dependent on the fulfilment of exogeneity and homoskedasticity assumptions. The consistency of OLS estimates depends on the fact whether the individual effect z_i is observed or unobserved for all individuals present in the dataset. In case the z_i is unobserved, the correlation with x_{it} results in omitted variable bias thereby making the estimates biased and inconsistent (Greene, 2012). The model is specified as follows:

$$y_{it} = x'_{it}\beta + z'_i\alpha + \varphi_{it}, where\ i = 1, \dots, N \quad and\ t = 1, \dots, T \tag{4.1}$$

The heteroscedasticity between individuals in the sample is envisaged which results in inconsistent and inefficient estimators due to the violation of underlying assumptions. However, the problem of heterogeneity could be mitigated by the First Difference approach. It is applied on repeated observations over time and therefore eliminates the problem of omitted time-invariant variables z'_i (Greene, 2012). The model is formulated as follows:

$$\Delta(y_{it}) = \Delta(x'_{it})\beta + \Delta(z'_i)\alpha + \Delta(\varphi_{it}), \quad where\ i = 1, \dots, N\ and\ t = 2, \dots, T \tag{4.2}$$

The random effect model assumes that the unobserved individual effects z'_i are uncorrelated with the explanatory variables and variation across entities is expected to be random. The model specification includes the same intercept and slope of regressors across individuals, and differences among individuals are captured by individual-specific error (Greene, 2012). The random effect model is specified as follows:

$$y_{it} = x'_{it}\beta + \alpha + \mu_i + \varphi_{it}, where\ i = 1, \dots, N \quad and\ t = 1, \dots, T \tag{4.3}$$

The fixed effect model is most suitable for analyzing time-variant variables while accounting for the presence of differences between individuals as well. The estimator is based on an underlying assumption that the unobserved individual effects z'_i are correlated with the explanatory variables. The "within" approach is applied in the Fixed effect model, more specifically, the means of each individual during the studied period are subtracted from the original data (Greene, 2012). The model is then derived as follows:

$$y_{it} - \bar{y}_i = (x'_{it} - \bar{x}'_i)\beta + (\varphi_{it} - \bar{\varphi}_i), \quad where\ i = 1, \dots, N\ and\ t = 1, \dots, T \tag{4.4}$$

To ensure that the most appropriate estimation technique to run the regression is selected, the thesis employs several diagnostic tests.

First, the Breusch-Pagan LM test to assess the relevance of unobserved effects is employed. This test the null hypothesis of equally distributed variance across individuals against the alternative hypothesis that there is a significant difference in

variance across individuals. If the null hypothesis is not rejected it is concluded that OLS will produce valid regression analysis estimates. On the contrary, if the null hypothesis is rejected, the OLS estimation should be replaced by a more appropriate estimation method.

Second, if the OLS estimation is not considered to be appropriate, there remain two possible methods: fixed effect and random effect model. The two differ in the assumption of whether the unobserved individual effects and explanatory variables are correlated or uncorrelated. To determine which of the two models is more appropriate Hausmann test is employed. The null hypothesis states that there is no correlation between the unique errors and the regressors in the model (which is in favour of the random effects model), while the alternative hypothesis states that there is a correlation between the two (which corresponds with the underlying assumption of fixed effects model). In case of not rejecting the null hypothesis, the random effects model is the most appropriate way to estimate the studied relationship. Otherwise, the fixed effects model must be used.

Following the results of the previously mentioned tests, the most appropriate estimation technique is determined and applied to the model assessing the relationship between capital structure and its determinants (using dependent and independent variables specified by the literature review provided in Chapter 2). The model is derived as follows:

$$\begin{aligned} LEV_{it} = \beta_0 &+ \beta_1 PROF_{W\,it} + \beta_2 PAST_{PROF\,it} + \beta_3 LIQ_{W\,it} \\ &+ \beta_4 NDTS_{W\,it} + \beta_5 TANG_{it} \\ &+ \beta_6 GROWTH_{W\,it} + \beta_7 CRISIS_{it} \\ &+ \beta_8 AGE_{it} + \beta_9 TAX_{W\,it} + \beta_{10} SIZE_{it} \\ &+ u_i + e_{it}, \end{aligned} \tag{4.5}$$

whereas LEV_{it} is employed either of the debt ratio measures: $TD\_RATIO\_W_{it}$, $LTD\_RATIO\_W_{it}$ or $STD\_RATIO\_W_{it}$ and size is one of the following SIZE_SALES, SIZE_NET_REVE and SIZE_ASSETS.

4.2 Dynamic Panel Data Models

Another approach how to study the capital structure and its determinants is to allow for dynamic changes in a company's decisions when choosing its capital structure. Meaning that companies have a target leverage ratio and their managers attempt to adjust the debt ratios towards the optimal target. Under ideal conditions (i.e.:

non-existence of transaction costs), the actual debt ratio of a company i at time t (denoted LEV_{it}), should be equal to its optimal leverage. However, as the conditions are not ideal and there exist adjustment costs, the difference between current and preceding period leverage is not precisely equivalent to the change that the company needs to make to reach the optimal leverage at time t ($LEV_{it} - LEV_{it-1} \neq LEV_{it}^{*} - LEV_{it-1}$). The disproportion is represented by a parameter λ, which could be described as a coefficient of adjustment or the speed of adjustment. Therefore, the adjustment process could be specified as follows:

$$LEV_{it} - LEV_{it-1} = \lambda(LEV_{it}^{*} - LEV_{it-1}), \tag{4.6}$$

where LEV_{it} is the actual leverage of company i in period t, LEV_{it-1} is the actual leverage of company i in period t-1 and LEV_{it}^{*} is the optimal leverage of company i in period t.

Regrouping the terms, the LEV_{it} is defined as follows:

$$LEV_{it} = \lambda LEV_{it}^{*} + (1 - \lambda)LEV_{it-1}. \tag{4.7}$$

If the coefficient of adjustment is equal to 1, the actual adjustment in leverage is the same as the required adjustment, meaning that there are no transaction costs of adjustment present. A coefficient of adjustment equal to zero indicates no change in the debt level of the company, which could be explained by either excessively high adjustment costs or significantly higher adjustment costs compared to the costs of being off the target (Antoniou, 2008). The higher the coefficient of adjustment (up to one) the closer the proximity of the actual and optimal leverage.

According to trade-off and the agency theory, the target leverage is assumed to be a function of a vector of firm-specific variables as displayed in the following equation:

$$LEV_{it}^{*} = x_{it}'\beta + \mu_i + \eta_t + \varphi_{it}, \tag{4.8}$$

where x_{it}' is a vector of explanatory variables, β is a vector of unknown slope parameters, μ_i represents time-invariant unobserved firm-specific effects, η_t represents time-specific effects, which are the same for all firms but can vary from time to time and φ_{it} is an error term.

The general model specification is thus obtained by substituting equation (4.8) into the equation (4.7) and prescribed as follows:

$$LEV_{it} = (1-\lambda)LEV_{it-1} + \lambda x'_{it}\beta + \lambda\mu_i + \lambda\eta_t + \lambda\varphi_{it}. \quad (4.7)$$

Estimating equation (4.7) using static panel models would lead to biased regression coefficients due to the presence of unobserved individual effect μ_i which might be correlated with the regressors. Moreover, the estimated coefficients would be inconsistent due to the correlation between the lagged regressand and unobserved firm-specific effects.

Employing the fixed-effects estimator on models including lagged variable provides inconsistent estimates as well. The inconsistency is caused by the correlation between the transformed lagged regressand ($y_{it-1} - \bar{y}_i$) and the transformed error term ($\varepsilon_{it} - \bar{\varepsilon}_i$) and between the lagged regressand and the lagged value of the error term.

To mitigate the issue of regressors that are correlated with the error term, Anderson and Hsiao (1982) introduced the use of an instrumental variable (IV) estimator. However, the main drawback of such an approach is that it is difficult to find suitable variables that can serve as valid instruments. Moreover, estimates generated based on poor or invalid instruments are biased and do not have superior informative value compared to the estimates produced by the OLS technique.

Arellano and Bond (1991) proposed a technique that is based on the evaluation of the equation (4.7) with the variables in first differences while using the lags of debt and its determinants at the level as instruments. The proposed technique, thanks to first differencing, eliminates the unobserved individual effects, thus, eliminating the correlation between the lagged variable and firm-specific unobserved effects. On the other hand, the implementation of lags of the debt and its determinants as instruments eliminates the correlation between a lagged variable and the error term due to the utilization of the orthogonality conditions between them (Arellano, 1991). Described estimation framework is called Difference GMM, thanks to the authors also referred to as AB difference GMM estimator (Arellano, 1991). However, there are several limitations of the differenced GMM approach. A high correlation between current and preceding period values of debt combined with a low number of periods leads to inefficient estimates. Furthermore, differencing eliminates the individual effects, as well as possible dummy variables, are cancelled out due to the differencing which could result in off information.

Blundel and Bond (1998), therefore, introduced the system GMM estimator (henceforth referred to as the BB system GMM estimator) – an extension of the original one-step estimator presented by Arellano and Bond (1991) to a two-steps approach. The system is based on two equations, an equation in levels and another one in first

differences. Lagged differences of the dependent variable are used as instruments for equations in levels, whereas for the equation in first differences the lagged levels of the dependent variable are used. As a consequence of the two-step approach, the BB system GMM estimator should be more efficient (Flannery, 2013). However, to be considered robust, two underlying conditions must be fulfilled, first, the validity of instruments, and second, no second-order autocorrelation.

To address the validity of the instrumental variables the Hansen J test is employed. The null hypothesis states that the restrictions imposed by the use of the instruments are valid, while the alternative hypothesis states the contrary.

To test the existence of the first and second-order autocorrelation, the Arellano-Bond test for autocorrelation is employed. The null hypothesis indicates no autocorrelation, alternative hypothesis indicates the presence of autocorrelation. For the estimates to be considered valid, the null hypothesis of no first-order autocorrelation should be rejected while the null hypothesis of no second-order autocorrelation should not be rejected at any significance level.

Flannery and Hankins (2013) compared seven techniques, such as OLS, fixed effects, AB difference GMM, BB system GMM, four-period long differencing, longest differencing and LSDV correction estimator, to determine which one is the most appropriate to estimate dynamic panel models. They concluded that the BB system GMM estimator should be chosen in case the endogeneity issue and persistence of the dependent variable are present.

Overall, the BB system GMM estimator is selected for the dynamic panel model. First, due to the ability to overcome the endogeneity issue via model specification. Second, it is appropriate for panels with few periods and many individuals. Third, the explained variable is dynamic, which means that depends on its past realizations, and the explanatory variables are possibly endogenous. Lastly, it accounts for the presence of fixed individual effects and heteroskedasticity as well as autocorrelation within individuals. (Roodman, 2009)

The final dynamic panel data model for this thesis specification is defined as follows:

$$\begin{aligned} LEV_{it} = \alpha(LEV_{it-1}) + \beta_0 + \beta_1 PROF_{W\,it} \\ + \beta_2 PAST_{PROF\,it} + \beta_3 LIQ_{W\,it} \\ + \beta_4 NDTS_{W\,it} + \beta_5 TANG_{it} \\ + \beta_6 GROWTH_{W\,it} + \beta_7 CRISIS_{it} \\ + \beta_8 AGE_{it} + \beta_9 TAX_{W\,it} + \beta_{10} SIZE_{it} \\ + u_i + v_t + e_{it}, \end{aligned} \tag{4.7}$$

whereas LEV_{it} is employed either of the debt ratio measures: $TD\_RATIO\_W_{it}$, $LTD\_RATIO\_W_{it}$ or $STD\_RATIO\_W_{it}$ and size is one of the following SIZE_SALES, SIZE_NET_REVE and SIZE_ASSETS.

4.3 Hypotheses

The effect of determinants on capital structure is predicted by either trade-off theory (TOT) or pecking order theory (POT). As each one of them assumes the opposite effect of the determinants on capital structure, the hypotheses will be doubled to represent each of the theories. The hypotheses arising from TOT will be marked as A and these arising from POT as B. The signs as predicted by the theories are summarized in Table 11.

Based on the data availability and previously mentioned theories on capital structure, the following hypotheses will be examined throughout the empirical analysis.

$H1_a$: Profitability is positively related to debt.

$H1_b$: Profitability is negatively related to debt.

$H2_a$: Past profitability is positively related to debt.

$H2_b$: Past profitability is negatively related to debt.

$H3_a$: Liquidity is positively related to debt.

$H3_b$: Liquidity is negatively related to debt.

$H4_a$: Non-debt tax shield is negatively related to debt.

$H5_a$: Tangibility is positively related to debt.

$H5_b$: Tangibility is negatively related to debt.

$H6_a$: Growth is negatively related to debt.

$H6_b$: Growth is positively related to debt.

$H7_a$: Age is positively related to debt.

$H7_b$: Age is negatively related to debt.

$H8_a$: Tax is positively related to debt.

$H9_a$: Size is positively related to debt.

$H9_b$: Size is negatively related to debt.

H10: Financial crisis influences the debt.

5 Empirical Analysis

This chapter starts with the selection of the most appropriate estimation technique to employ on static panel data models, followed by validity and robustness check of the system GMM estimation technique, which was proposed in Chapter 4, Methodology. The last part of this chapter presents the regression results.

Note that after the actual regression analysis of the models was done, the author concluded that the estimation coefficients of size were roughly the same, thus, there is no need to report 9 models. The author decided to employ only the variable SIZE_SALES as it is the less correlated variable with other variables included.

5.1 Estimation Framework Selection for Static Panel Data Models

Chapter 4, Methodology, mentioned three main approaches how to analyze static panel data models (Pooled OLS, Fixed-effects and Random-effects model). Several tests were employed to choose the most appropriate among them. Test statistics, as well as corresponding p-values, are reported in Table 6 for models that differ in the dependent variable employed (TD_RATIO_W, LTD_RATIO, STD_RATIO_W).

Table 6: Diagnostic Tests (Static Models)

	Dependent variable:		
	TD_RATIO_W	LTD_RATIO	STD_RATIO_W
Breusch-Pagan LM Test for Random-Effects versus OLS	1093.90	1950.00	1205.90
	(< 2.2e-16)	(< 2.2e-16)	(< 2.2e-16)
F-test for Fixed-Effects versus OLS	23.27	21.25	26.12
	(< 2.2e-16)	(< 2.2e-16)	(< 2.2e-16)
Hausman Test	283.47	17.72	458.49
	(< 2.2e-16)	(0.0399)	(< 2.2e-16)
Breusch-Godfrey Test	247.38	315.02	192.56
	(< 2.2e-16)	(< 2.2e-16)	(< 2.2e-16)

Notes: Test statistics and p-values (reported in brackets) for each test are reported.

Source: Author's own calculations using R software

First, the Breusch-Pagan LM test was employed. The BP LM test p-value reported is much less than 0.05 for all three models. Hence, the null hypothesis is rejected implying that the difference in variance across companies is significant. In

other words, that random effects are present, therefore, the pooled OLS method should be replaced by random effect model estimation.

Second, before performing the Hausmann test, the F-test was used to check that also the fixed effect model is more appropriate than the pooled OLS method. The test confirmed the expectations by rejecting the null hypothesis due to the p-value of the reported test statistic being much smaller than 0.05 for all models. In the presence of fixed effects, the pooled OLS estimation would produce inconsistent and inefficient coefficients and therefore the fixed effects framework is preferred.

Third, to discern whether to use random effects or fixed effects model the Hausmann test was employed. The p-value of the Hausmann test reported in the Table 6 is almost zero in the case of TD_RATIO_W and STD_RATIO_W models and 0.039 for LTD_RATIO model, however, all of the values are less than 0.05. The rejection of the null hypothesis implies that the fixed effects model is favoured over the random effects model.

Lastly, to detect possible problems in the models, stationarity, autocorrelation and heteroskedasticity were tested. The Dickey-Fuller test (with its null hypothesis of the presence of unit root) proved that all variables included in the models are stationary. Autocorrelation was tested using the Breusch-Godfrey test. The null hypothesis, which states that there is no serial correlation of any order was rejected, thus implying an autocorrelation problem in the model. And finally, the null hypothesis of the Breusch-Pagan test implies that heteroskedasticity is not present, however, for all three models the null hypothesis was rejected, therefore it is concluded that all three models suffer from heteroskedasticity.

To account for autocorrelation and heteroskedasticity in the fixed-effect model, which was selected as the most appropriate estimation method for all of the static models, the HAC (heteroskedasticity and autocorrelation consistent) standard errors were applied to overcome both problems.

5.2 Validity of System GMM Estimator

As the most appropriate estimation approach to assess dynamic models the methodology suggests the system GMM method. There are several tests to ensure the consistency of said estimator. The key is to address the validity of instrumental variables used in the model and consider second-order correlation. As indicated in Chapter 4, Methodology, Hansen J test and Arellano Bond test for first-order and second-order correlation were employed. Additionally, the Wald test for the overall

significance of the model was checked. The results of the tests performed on three models that differ in dependent variable employed (TD_RATIO_W, LTD_RATIO, STD_RATIO_W) and are estimated using the system GMM approach are presented in Table **7**.

Table 7: Diagnostic Tests (Dynamic Models)

	Dependent variable:		
	TD_RATIO_W	LTD_RATIO	STD_RATIO_W
Hansen J test	13.92	12.64	18.70
	(0.2373)	(0.3178)	(0.0667)
AR(1)	-5.02	-2.06	-4.35
	(5.2e-07)	(0.0398)	(1.3e-05)
AR(2)	0.98	1.16	1.11
	(0.3284)	(0.2461)	(0.2689)
Wald test	7563.86	34.27	2014.25
	(< 2.2e-16)	(0.0003)	(< 2.2e-16)

Notes: Test statistics and p-values (reported in brackets) for each test are reported.

Source: Author's own calculations using R software

First, Hansen J test p-values for TD_RATIO_W, LTD_RATIO and STD_RATIO_W model are higher than 0.05, more specifically, amount to 0.24, 0.32 and 0.07 respectively. This indicates that the null hypothesis cannot be rejected, thus, implying that the instrumental variables used in the system GMM estimation are valid as a group.

Second, Arellano Bond tests were employed. The p-values of AR(1) for all three models (0.00000052, 0.0398 and 0.000013) are below the 0.05 threshold, therefore, indicating that the null hypothesis of no first-order serial correlation is rejected at least at 5% level. On the other hand, the p-values of AR(2) state otherwise. The p-values amount to 0.33, 0.25 and 0.27 for TD_RATIO_W, LTD_RATIO and STD_RATIO_W model respectively. The null hypothesis of no second-order correlation cannot be rejected. Chapter 4, Methodology, mentioned that to be well-specified, the null hypothesis of AR(1) must be rejected while the null hypothesis of AR(2) cannot. The results shown in Table 7 confirm that.

Finally, the Wald test was considered as well. It tests the null hypothesis of the overall non-significance of the parameters of the explanatory variables against the alternative hypothesis of the overall significance of the parameters of the explanatory variables. The p-values of all three models are either close to zero or very low, therefore, the null hypothesis without a doubt has to be rejected, indicating the overall

significance of the regression. The tests discussed above indicate that the system GMM estimation approach is appropriate for models with any of the dependent variables.

5.3 Robustness check

The GMM estimation techniques are sensitive to instruments specification. Employment of too many instruments could lead to overfitting of endogenous variables in the model, thereby could make the GMM estimators biased and the Hansen J test less powerful as it could result in a perfect p-value amounting to 1 (Roodman, 2009). It is necessary to ensure that the regression results do not vary significantly with the reduction of instrument variables. Also, high variation between AB difference GMM (denoted also as one-step GMM) and BB system GMM estimation (denoted also as two-step GMM) is perceived as an indicator of inconsistency, thus, the estimates produced by both methods should be checked.

Table 8: GMM Regression Results Comparison for TD_RATIO_W model

	Dependent variable:			
	TD_RATIO_W			
	One-step GMM	Robust One-step GMM	Two-step GMM	Robust Two-step GMM
lag(TD_RATIO_W, 1:1)	0.803***	0.803***	0.771***	0.771***
	(0.037)	(0.093)	(0.028)	(0.042)
AGE	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.002)	(0.001)	(0.001)
SIZE_SALES	0.007	0.007	0.005	0.005
	(0.015)	(0.019)	(0.013)	(0.019)
PROF_W	−0.641***	−0.641***	−0.611***	−0.611***
	(0.030)	(0.148)	(0.030)	(0.098)
PAST_PROF_W	−0.031*	−0.031	−0.042*	−0.042
	(0.017)	(0.023)	(0.018)	(0.029)
LIQ_W	−0.008***	−0.008***	−0.006***	−0.006***
	(0.001)	(0.003)	(0.001)	(0.002)
NDTS_W	0.120	0.120	0.096**	0.096
	(0.096)	(0.096)	(0.034)	(0.085)
TAX_W	0.001**	0.001*	0.001*	0.001
	(0.000)	(0.001)	(0.000)	(0.001)
TANG	−0.097***	−0.097***	−0.084***	−0.084***
	(0.025)	(0.029)	(0.019)	(0.028)
GROWTH_W	0.143***	0.143***	0.155***	0.155***
	(0.020)	(0.018)	(0.015)	(0.022)
CRISIS	−0.012	−0.012	0.003	0.003
	(0.013)	(0.019)	(0.008)	(0.011)
Notes:				*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

Table 8 provides estimation results of one-step and two-step GMM approaches applied to a model with TD_RATIO_W as the dependent variable, including both the normal and heteroskedasticity and autocorrelation robust errors. The results show that statistical significance and signs of the estimates generally remained unchanged and there is usually only slight variation in the magnitude. All of the statistically significant estimates from robust two-step GMM are statistically significant at 1% level under all estimation approaches and their effect (either positive or negative) on the dependent variable does not alter as well. The estimated coefficient of lagged dependent variable declined from 0.803 to 0.771 when comparing the one-step and two-step approach. The extent of variation in the estimates of the remaining statistically significant variables is either nonexistent (in the case of AGE) or minimal. Thus, the results are perceived as stable under both estimation approaches.

To reveal whether the system GMM estimation is consistent, both the OLS and fixed-effect estimation methods are employed on the dynamic model. Despite the inconsistency caused by the presence of lagged dependent variable, the results provide valuable insights. The OLS estimator of the lagged regressand is biased upward due to the correlation between the lag of the dependent variable and disturbance term, while the fixed-effect estimator is biased downward due to the negative correlation between the transformed disturbance term and the transformed lagged variable. Taking into account the direction of OLS and fixed-effects estimation biases, the consistent estimator should lie in between the lower bound formed by the fixed-effects estimator and the upper bound represented by the OLS estimator (Roodman, 2009). Thus, the OLS and fixed effects estimation results for dynamic models are used only to decide whether the system GMM estimates of lagged dependent variables lie between the above-mentioned boundaries, thereby indicating that the system GMM estimator is consistent.

As shown in Table 9, the estimate corresponding with the one-year lag of the dependent variable TD_RATIO_W produced by the system GMM estimation (in the table denoted as Two-step GMM) is highly statistically significant and amounted to 0.771, which lies between the estimates produced by fixed-effects estimation (0.573) and Pooled OLS estimation (0.802). The results indicate that the estimates generated using the system GMM approach should be valid. This result also indicates that, as expected, the past values of the leverage influence the current leverage level and therefore the use of dynamic models with proper estimation techniques as indicated in Chapter 4, Methodology, is highly recommended.

As mentioned at the beginning of this chapter, it is crucial to examine how much the estimation coefficients change with the reduction of instruments used in the model. Table 9 provides the comparison of the dynamic model with dependent variable TD_RATIO_W estimated using system GMM (denoted as Two-step GMM) and system GMM estimation with a lower number of instrumental variables employed (compared to the original model) which is denoted as Two-step GMM_R.

Table 9: Different Regression Results Comparison for TD_RATIO_W model

	Dependent variable:			
	TD_RATIO_W			
	Fixed Effects	Two-step GMM	Two-step GMM_R	Pooled OLS
lag(TD_RATIO_W, 1:1)	0.573***	0.771***	0.765***	0.802***
	(0.030)	(0.042)	(0.065)	(0.022)
AGE	0.013***	0.006***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
SIZE_SALES	−0.035	0.005	0.037	−0.006
	(0.023)	(0.019)	(0.028)	(0.012)
PROF_W	−0.720***	−0.611***	−0.646***	−0.639***
	(0.024)	(0.098)	(0.078)	(0.024)
PAST_PROF_W	−0.266***	−0.042	−0.034	−0.052***
	(0.029)	(0.029)	(0.038)	(0.015)
LIQ_W	−0.008***	−0.006***	−0.005***	−0.008***
	(0.001)	(0.002)	(0.002)	(0.001)
NDTS_W	0.173**	0.096	0.118	0.109
	(0.080)	(0.085)	(0.095)	(0.077)
TAX_W	0.001***	0.001	0.001	0.001***
	(0.0005)	(0.001)	(0.001)	(0.0004)
TANG	−0.155***	−0.084***	−0.081**	−0.117***
	(0.039)	(0.028)	(0.046)	(0.021)
GROWTH_W	0.109***	0.155***	0.164***	0.131***
	(0.016)	(0.022)	(0.027)	(0.016)
CRISIS	0.008	0.003	−0.180	−0.029***
	(0.010)	(0.011)	(0.101)	(0.010)
Notes:				*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

The regression results remained almost unchanged with the reduction of instrumental variables, indicating that there is no sensitivity to a decrease in the number of instruments. More precisely, statistically significant variables from the original model remained significant, all except for variable TANG remained highly statistically significant at 1% level. Statistical significance of TANG decreased from 1% to 5% level. The signs of their coefficients remained the same and the variation in the magnitude of effect on the dependent variable stayed reasonably low (e.g.: -0.611 and -0.646 in the case of PROF_W) for all statistically significant variables.

This chapter confirmed that the system GMM estimation approach is valid and well specified for the dynamic model with dependent variable TD_RATIO_W. In order not to reiterate the same steps, robustness checks for dynamic models with dependent variables either LTD_RATIO or STD_RATIO_W are included in Appendix D, which concluded that both models are valid and well specified.

5.4 Estimation results

Inferences presented in this thesis are based on BB system GMM (two-step GMM) estimation as it is considered the most appropriate based on the suggested methodology, tests and robustness checks presented previously and is able to overcome previously mentioned problems comparing to fixed effects estimation approach. Regression analysis was performed on three models that differ in the dependent variable. The most common dependent variable generally used by researchers is the total debt ratio, however, there are tendencies to capture the differences due to the variation in the maturity of the debt. To assess whether the determinants differ in sign, magnitude or statistical significance in the case of different maturity of the debt, models with long-term and short-term debt ratios as dependent variables were estimated as well. Estimation results are presented in Table 10, which provides the results for all three models based on the dependent variable used.

Results of regressions following static model estimation techniques (Pooled OLS, Random-effects, Fixed-effects) are reported in Appendix C for reference.

In general, the results provided in Table 10 indicate a huge difference between long-term (LTD_RATIO) and short-term (STD_RATIO_W) debt ratio models. More specifically, the results of the short-term debt ratio model are nearly identical to the results of the total debt ratio model (TD_RATIO_W). This is not an unexpected conclusion for the dataset employed since the mean value of TD_RATIO_W is 0.42, STD_RATIO_W 0.36 while LTD_RATIO is only 0.06. Moreover, the TD_RATIO_W model has five highly statistically significant determinants, STD_RATIO_W model

reported as statistically significant all five determinants indicated by the previously mentioned model and added an extra one with low statistical significance. On the other hand, the LTD_RATIO model reported as statistically significant only one determinant, which is not totally unusual. Congenerous results were found by Lisboa (2017), out of ten studied determinants six were reported statistically significant for total and short-term debt ratio models, while only two were statistically significant in the case of the long-term debt ratio model.

A more in-depth discussion of the variables used in the model follows. To make the comparison between the predicted effects of determinants arising from trade-off (denoted as TOT) or pecking order theory (denoted as POT) own regression results and conclusions made by other authors more transparent, Table 11 is presented. (Note that Table 11 presents conclusions of other researchers that are focused either on the Czech Republic or on SME companies to make the comparison of the results more valuable.)

Lagged dependent variable

The regression results show that lagged dependent variable (in general leverage, more precisely total, long-term or short-term debt ratio) has a positive and highly statistically significant effect on the current level of leverage. This confirms the expectation that the company's past leverage considerably influences its current level, moreover, the company's current leverage ratios converge to an optimal level of leverage over time as suggested by the dynamic model approach. The estimated coefficient of lagged total debt ratio is 0.771, thus, the speed of adjustment is 0.229. After recalculating the speed of adjustment using formula $\frac{1}{\lambda}$, we can refer to the speed in terms of years (Antoniou, 2008). Meaning that in the case of the total debt ratio, the company can reach its target leverage in 4.37 years.

Age

Age is the only capital structure determinant that is statistically significant in all three models regardless of the debt ratio specification, in the case of total and short-term debt ratios the estimates are highly statically significant (1% level), the estimate of age in long-term debt ratio model has much lower statistical significance, but still is statistically significant at least at 10% level. Furthermore, the estimates indicate a positive relationship between each one of the debt ratios and age, which makes it even more unique among other results reported by this thesis because the positive relationship is suggested by trade-off theory. The estimate of age is the only one that supports the trade-off theory which explains the positive relationship as a consequence of the good reputation that companies gain over the years of operation. The longer the

company operates on the market, the higher probability of obtaining debt financing with better conditions than new companies on the market as the creditworthiness of the stable and older ones is higher.

Above-described results confirmed the $H7_a$ hypothesis for all 3 models.

Profitability

According to the estimation results, there is an inverse relationship between profitability and leverage. It is in line with suggestions made by pecking order theory which states that highly profitable companies are likely to earn more and thus fund the operations from resources at hand. All three models predicted a negative impact of profitability on leverage, however, only the total and short-term debt ratio model estimates are marked as statistically significant. With the estimates amounting to - 0.611 and - 0.632 for total and short-term debt ratios respectively, profitability is the most influential determinant in corresponding regressions.

A negative relationship between profitability and leverage (regardless of maturity) is typical, all of the authors mentioned in Table 11 concluded the same. Moreover, same as in the case of this thesis' regression results, Lisboa (2017) found a statistically significant relationship only with the total and short-term debt ratios. The null hypothesis $H1_b$ is therefore confirmed for total and short-term debt ratio models.

Past profitability

Similarly, to current profitability, past profitability has a negative impact on respective debt ratios as expected. However, the estimates are statistically insignificant. These results deviate from the implications of pecking order theory which considers past profitability to be an important determinant of capital structure. The reasoning behind the negative relation is that highly profitable companies are expected to be able to cumulate retained earnings and finance its standard operations and further development using their own resources primarily.

The importance of this determinant was confirmed by several studies (e.g.: the one by Titman and Wessel (1988), however, the results presented above are not unique, for example, Frank and Goyal (2008) concluded also statistical insignificance. As the variable is not statistically significant, either of the hypothesis (POT or TOT) cannot be confirmed.

Liquidity

As shown in Table 10, the relationship between the total debt ratio or short-term debt ratio and liquidity is negative, while its relationship with the long-term debt ratio is positive. Both negative liquidity coefficients are highly statistically significant while the positive one is not statistically significant even at 10% level, meaning that liquidity does not contribute to explain the long-term debt ratio of studied companies. The liquidity ratio is defined as current assets scaled by current liabilities which indicates a much closer link to short-term debt than to long-term one. The negative relationship follows the expectations of pecking order theory which implies that liquid companies tend to create reserves from retained earnings and opt to use them to finance their operation and investment opportunities if the internal funds are sufficient rather than requesting external financing.

A negative relationship between total or short-term debt and liquidity was confirmed by numerous researchers already, namely Lisboa (2017) and Proenca et al. (2014) among others. Also, as stated above, a statistically significant negative relationship is in line with pecking order theory, therefore, hypothesis $H3_b$ is confirmed for total and short-term debt ratio models.

Tangibility

Tangibility estimate indicates negative relation with the respective debt ratio in total and short-term debt ratio models, contrary, the relation between tangibility and long-term debt is positive. These results are consistent with conclusions of previous empirical studies, one among others done by Lisboa (2017), that suggests a negative relationship between tangibility and short-term debt and the opposite for long-term debt. A negative effect of tangibility on short-term debt could be caused by the fact that companies with a high tangibility ratio could prefer long-term to short-term debt as they have enough fixed assets to provide as collateral. Moreover, the variation in sign is consistent also with the maturity matching principle (companies match the duration of assets with the maturity of liabilities). While the direction of the impact of tangibility on respective debt ratios is consistent with other empirical research, only in the case of the total and short-term debt ratio models are the estimates statistically significant, therefore, reliable inferences concerning the relation between tangibility and long-term debt could not be drawn.

The effect of tangibility is ambiguous. While Proenca et al. (2014) suggested the same effect as above mentioned results, Delcour (2007) found the opposite. As the results suggest a statistically significant positive effect of tangibility on total and short-

term debt, the pecking order theory is supported thereby confirming the $H5_b$ hypothesis in respective models.

Growth

The last statistically significant estimate at least in the case of total and short-term debt ratio models is the growth coefficient. In both statistically significant cases, the reported relationship is positive. Which could indicate that the higher the growth of the company, the higher the need to finance the investment opportunities, hence, the higher need for external financing, or that creditors perceive growing companies as potentially less risky in case of facing bankruptcy and thus they grant the financing more willingly.

Previously mentioned explanations of positive relation follow the suggestions made by the pecking order theory. The same results were concluded also in the case of Portuguese (Proença, 2014) and Greek (Balios, 2016) SMEs. Finally, hypothesis $H6_b$ is confirmed for total and short-term debt ratio models.

Tax

Estimated models show a positive relationship between tax and total or short-term debt ratio, and a negative between tax and long-term debt ratios. The effect of tax on all of the debt ratios is considerably low compared to other determinants. Furthermore, the estimate is statistically significant at 10% level only in the case of the short-term debt ratio model. It is probably linked to the fact that a company with higher taxes could take advantage of debt financing in a form of tax deductibility (it could shield more income from taxes) as suggested by trade-off theory. However, the previous researches, such as the one done by Mayer (1990), find the effect of taxes marginal. Even in the case of the Czech Republic, Bauer (2004) found the significant effect of taxes only in one year out of separately studied two years and just for one out of four dependent variable specifications, thus, overall reported tax as insignificant.

The above mentioned proves that the null hypothesis of positive relationship indicated by trade-off theory holds only in the case of the short-term debt ratio model, thus, the null hypothesis $H8_a$ is confirmed only in the model where the dependent variable is the short-term debt ratio.

NDTS

The effect of a non-debt tax shield on the debt ratio is positive in all three models, however, neither one of them is statistically significant. Bauer (2004) also

concluded a statistically insignificant effect, however, in contrast, the rest of the compared authors found the effect statistically significant even if they did not agree on the sign of the said effect. Neither $H4_a$ nor $H4_b$ is confirmed.

Size

Total and short-term debt ratio models suggest a positive relationship between size and the debt ratio, while the long-term debt ratio model suggests the opposite. However, all three models show that the size is not statistically significant even at 10% level. The results indicate that, based on the thesis dataset, size should not be considered a capital structure determinant for SME companies in the Czech Republic.

Either hypothesis $H9_a$ or $H9_b$ cannot be confirmed. The reported conclusion is in contrast with Bauer (2004) that found the relationship positive and statistically significant but only for Czech listed companies.

Crisis

The dummy variable representing the crisis period is statistically insignificant as shown in Table 10. Several reasons could explain the low impact in magnitude as well as statistical significance. To obtain reliable results from GMM estimation, the dataset was constructed as a balanced panel, therefore, the companies affected by the crisis to the extent that they had to drop out of the market were excluded. Furthermore, the pre-crisis period in the dataset is only 2 years long, thus the ability to capture the difference could be lower than in the case of a longer pre-crisis period included in the data. This thesis included the data from 2006 as a result of a trade-off between a longer period and a lower number of observed companies. Finally, the statistically insignificant relationship was reported by other researchers as well, for example, Lisboa (2017) suggested studying longer period marked as crisis period as the effect on markets could have persisted.

Finally, hypothesis H10 that financial crisis influences debt cannot be confirmed based on presented regression results.

Table 10: System GMM Regression Results

	Dependent variable:		
	TD_RATIO_W	LTD_RATIO	STD_RATIO_W
	Robust Two-step GMM		
lag(TD_RATIO_W, 1:1)	0.771***		
	(0.042)		
lag(LTD_RATIO, 1:1)		0.757***	
		(0.149)	
lag(STD_RATIO_W, 1:1)			0.781***
			(0.060)
AGE	0.006***	0.001*	0.005***
	(0.001)	(0.001)	(0.001)
SIZE_SALES	0.005	−0.002	0.009
	(0.019)	(0.011)	(0.021)
PROF_W	−0.611***	−0.002	−0.632***
	(0.098)	(0.014)	(0.093)
PAST_PROF_W	−0.042	−0.038	−0.006
	(0.029)	(0.024)	(0.027)
LIQ_W	−0.006***	0.0001	−0.007***
	(0.002)	(0.001)	(0.002)
NDTS_W	0.096	0.022	0.141
	(0.085)	(0.075)	(0.089)
TAX_W	0.001	−0.0005	0.001*
	(0.001)	(0.0005)	(0.001)
TANG	−0.084***	0.006	−0.114***
	(0.028)	(0.031)	(0.026)
GROWTH_W	0.155***	−0.013	0.171***
	(0.022)	(0.019)	(0.026)
CRISIS	0.003	0.005	−0.002
	(0.011)	(0.005)	(0.013)
Notes:			*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

Table 11 : Overview of signs of capital structure determinants

	Theories		Own regression results Czech SMEs			Lisboa (2017) Portuguese SMEs			Proenca et al. (2014) Portuguese SMEs			Balios et al.(2016) Greece SMEs	Bauer (2004) Czech listed c.	Delcoure (2007) Including Czech c.		
	TOT	POT														
	Predicted signs		TD	LTD	STD	TD	LTD	STD	TD	LTD	STD	TD	TD	TD	LTD	STD
AGE	+	-	+***	+*	+***	-***	+	-***	/	/	/	/	/	/	/	/
SIZE_SALES	+	-	+	-	+	+**	+***	-	+***	+***	-***	+***	+***	+*	-**	+*
PROF_W	+	-	-***	-	-***	-***	-	-***	-***	-***	-***	-***	-*	-***	-**	-*
PAST_PROF_W	+	-	-	-	-	/	/	/	/	/	/	/	/	/	/	/
LIQ_W	+	-	-***	+	-***	-***	+***	-***	-***	+***	-***	/	/	/	/	/
NDTS_W	-	/	+	+	+	-***	+	-**	-***	-***	+*	/	-	+***	+*	+*
TAX_W	+	/	+	-	+*	/	/	/	/	/	/	/	+	+*	+*	+*
TANG	+	-	-***	+	-***	-	+***	+***	-***	+***	-***	-***	-***	+**	+*	+**
GROWTH_W	-	+	+***	-	+***	/	/	/	+***	+***	+***	+***	/	-	+	+
CRISIS	/	/	+	+	-	-	-	+	+***	+**	+***	/	/	/	/	/

Notes: *p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software compiled with previous research results and signs predicted by TOT and POT

6 Conclusion

6.1 Summary

The financing of companies is an important topic in corporate finance that continues to attract the attention of many researchers and practitioners. To explain the financing patterns of firms, capital structure theory has evolved. The main theories focusing on capital structure are trade-off and pecking order theory, which was discussed throughout the thesis.

The main aim of this study is to specify and examine possible determinants of capital structure as the understanding of key determinants of a firm optimal capital structure is crucial for creating an effective strategy for its operation.

The dataset employed consists of 2,693 companies located and operating in the Czech Republic, covers a 14-year long period from 2006 to 2019 and the companies used in the dataset fulfil the criteria for SMEs.

Three different measures; total, short-term and long-term debt were used as dependent variables to quantify the capital structure of Czech companies. As suggested by previous empirical studies, this thesis employed the following as the capital structure determinants: size, profitability, past profitability, tangibility, liquidity, growth opportunities, age, tax, non-debt tax shield and dummy variable representing the so-called "crisis effect".

Two general estimation frameworks were considered in this thesis, either the static panel data models (estimated using Pooled OLS, Fixed Effects or Random Effects model) or dynamic panel data models (estimated using Difference GMM or System GMM estimator). After employing a battery of tests (such as LM test, F test, Hausmann test, Wald test, AR(1), AR(2) or Hansen J test) and performing robustness checks, the system GMM estimator was presented as the most appropriate estimation technique due to its ability to overcome endogeneity problem arising from the persistence of dependent variable by including the lagged regressand into the model.

The hypothesis stated in this thesis followed the implications of either trade-off theory (TOT) or pecking order theory (see Subchapter 4.3) and included one additional concerning the impact of financial crises on the capital structure of companies.

The empirical results provided by this thesis show that there exist significant differences in the magnitude and statistical significance of determinants with respect to the three measures of debt. Overall, out of ten studied capital structure determinants, the total debt ratio model found five of them highly statistically significant (except for one all in accordance with pecking order theory), the short-term debt ratio model reported six of them as statistically significant, of which four follow the implications of pecking order theory and two follow the trade-off theory, finally, the long-term debt ratio model presented only one of the studied determinants as statistically significant. It could be concluded that the same determinants are not able to fully explain all of the debt ratio specifications.

Furthermore, the results indicate that among capital structure theories, the pecking order theory is the one that prevails. It means that the companies prioritize their own sources of financing (as retained earnings) over debt financing and consider theoretical equity financing as a last resort. The pecking order theory signals what is the performance of the company. It is believed that if a company finances its operation internally, the company is perceived to be strong and reliable, same as in the case of debt financing, in which case it signals that the managers believe in their ability to fulfil the obligations and repay the debt.

All of the debt ratios are significantly related to age, which indicates that firms with longer operation period tend to use more debt financing. A positive relationship is found also between growth and total or short-term debt ratio and between tax and short-term debt ratio. Contrary, the results presented a statistically significant negative relationship between profitability, tangibility and liquidity and two of the debt ratios (either total or short-term debt ratio). The results show that the remaining determinants, such as size, past profitability, non-debt tax shield and crisis period dummy variable, are statistically insignificant with respect to all of the dependent variable measures.

6.2 Contribution

The author believes that this thesis's empirical research contribution to existing capital structure literature is twofold.

First, although previous theoretical, empirical, and statistical evidence suggests that the relationship between companies' capital structure and its determinants should be studied in the context of dynamic adjustments to an optimal level, most of the prior studies employed the static model approach to address the relationship. As discussed in the methodology part, although the fixed effect model estimation seems to be best among the static panel data models framework, they are expected to be misspecified

due to the persistence of the dependent variable. Contrary, this thesis combines the lagged value of the dependent variable along with the system GMM estimation technique to tackle the endogeneity problem. Therefore, it is believed that the inferences made based on this thesis empirical research are more reliable.

Second, at least to the extent of this thesis' author's knowledge, this is the first study to focus solely on a wide scale of Czech SME companies while studying them by employing the dynamic panel data model approach. The dataset consists of 2,693 companies studied over a 14-year long period, which is multiple times higher number of studied firms than in the case of other works concerning Czech market (Bauer, 2004; Aulová, 2013; Pinková, 2012). Thus, the research could provide robust empirical findings that could be generalized for a much wider scale of companies as the SME companies represent 99% of Czech companies according to the Ministry of Industry and Trade (2018).

6.3 Limitations and recommendations for future studies

Even though this thesis was able to provide answers to all the research questions proposed and robust and reliable inferences were drawn, there still are some limitations present. These limitations are summarized and if possible, recommendations for future studies are presented as well.

As in all the previous studies on capital structure, the dataset could suffer, to some extent, from selection bias and survivorship (either concerning the data sample or selection of the determinants of capital structure studied).

Even though the data sample employed in this thesis is much wider than those used by other authors to assess the Czech environment, there was still a considerable number of firms that were excluded from the study due to either incomplete or totally missing annual reports and/or financial statements. The inability of companies to meet the lawful criteria for disclosing the financial results could indicate lower transparency and worse managerial competence (which could be linked with worse firm performance) when compared to the properly disclosing ones thereby weakening the interpretation and generalization of the research result.

As opposed to numerous empirical studies carried out prior, this thesis employed a wider scale of firm-specific determinants, however, only firm-specific determinants were included. Several authors, Frank and Goyal (2008) among others, considered also macroeconomic determinants, such as inflation or GDP, to be able to

explain an additional portion of capital structure. These could be included in further studies.

Furthermore, this thesis did not capture many statistically significant determinants of capital structure when measured as long-term debt ratio, therefore, further research on the topic with respect to the maturity of the debt should be done.

This thesis focuses on results for the dataset as a whole rather than on results for industries separately since in some industries there are only several firms and other groups are wide. Thus, future research could be based on a comparison of several main industries to be able to reliably conclude whether the results vary across industries or results provided for the sample regardless of industry specifications are sufficient.

Finally, as many of the previous studies, the thesis focuses on the determinants (that represent the performance of the companies among others) influencing the capital structure, however, there could be also a reverse effect of capital structure influencing the performance of the company present. In other words, the regression of firms' performance on their leverage possibly confuses the impact of leverage level on firms' performance with the impact of firms' performance on leverage. Further research, thus, should pay attention to both causal and reverse causal relationships between capital structure and company performance.

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Appendix A: Overview of Empirical Research

Table 12 and Table 13 provide a concise overview of research papers reviewed in Subchapter 2.3, Overview of Previous Empirical Research. Both tables present the main topic, studied period, dependent and independent variables and methods used in each one of the research papers indicated by the author.

Table 12: Overview of International Empirical Research

	Titman et al. (1988)	Rajan et al. (1995)	Frank et al. (2009)	Režáková et al. (2010)	Proenca et al. (2014)
Topic	American manufacturing companies	public companies in G7 countries	American public companies	Slovak non-financial companies	Portuguese SMEs
Studied Period	1974-1982	1987-1991	1950-2003	2002-2007	2007-2010
Dependent Variable(s)	short-term, long-term and total debt ratio	total debt ratio (both book and market value based measure)	total and long-term debt ratio (both book and market value based measure)	total, short-term or long-term debt ratio	total, short-term or long-term debt ratio
Independent Variables	asset structure, non-debt tax shield, growth, uniqueness, industry classification, size, volatility and profitability (8)	tangibility, growth, size and profitability (4)	profit, assets, age, capex, tangibility, uniqueness, tax, inflation, ... (25)	tangibility, growth, liquidity, size, uniqueness, volatility and non-debt tax shield (7)	asset structure, non-debt tax shield, size, profitability, growth, liquidity, cash flow and crisis dummy (8)
Regression Methods	two-part factor-analytic technique	tobit regression model	clustered OLS regression	Pooled OLS, RE, FE	OLS regression

	Jovanovic (2015)	Balios et al. (2016)	Berkman et al. (2016)	Lisboa(2017)
Topic	Macedonian companies	Greece SMEs	European energy companies	Portuguese SMEs
Studied Period	2000-2009 & 2013-2014	2009-2012	2009-2012	2008-2014
Dependent Variable(s)	total debt ratio	total debt ratio	total, short-term or long-term debt ratio	total, short-term or long-term debt ratio
Independent Variables	size, profitability, growth, tangibility, lagged leverage, non-debt tax shield and taxes (7)	asset structure, size, growth, profitability and risk (5)	asset structure, return on equity, liquidity and turnover (4)	export volume, size, profitability, asset structure, non-debt tax shield, growth, liquidity, age and crisis dummy (9)
Regression Methods	system GMM estimator	Period SUR-pooled EGLS	Pooled OLS, RE, FE	Pooled OLS, RE, FE

Source: Author's own compilation

Table 13: Overview of Empirical Research including CZ

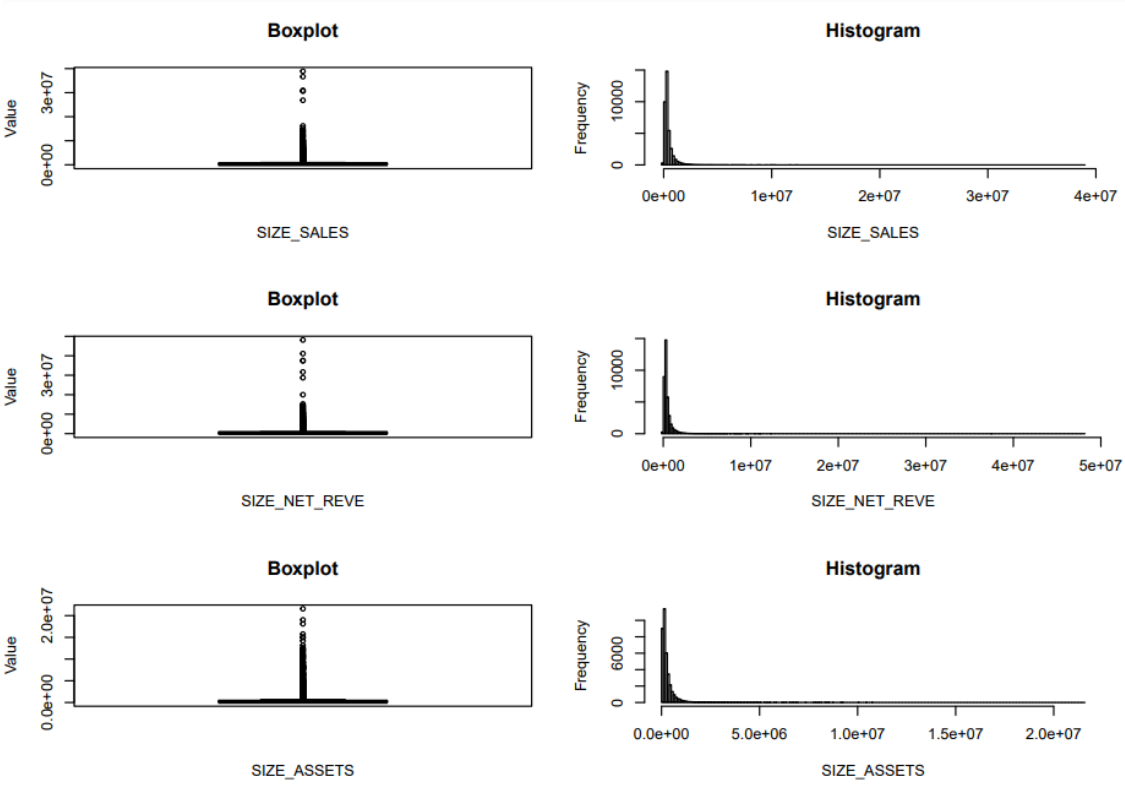
	Bauer (2004)	Pinková (2012)	Aulová et al. (2013)	Delcoure (2007)	Mokhova et al. (2013)	Fenyves et al. (2020)
Topic	Czech listed companies	Czech large and medium sized companies in automotive	Czech agricultural companies	CEE companies (Czech Republic, Slovakia, Poland and Russia)	manufactring companies from 32 european countries (divided into 3 groups membership wise)	agricultural and food companies in Visegrad countries
Studied Period	2000-2001	2006-2010	2004-2010	1997-2002	2006-2011	2015-2017
Dependent Variables	total debt ratio (both book and market value based measure)	total, short-term, and long-term debt ratio	total, short-term or long-term debt ratio	total, short-term or long-term debt ratio	total, short-term or long-term debt ratio	total debt ratio
Independent Variables	size, profitability, tangibility, growth opportunities, tax, non-debt tax shields, volatility, and industry classification (8)	size, tangibility, profitability, liquidity, and growth (5)	size, profitability, tangibility, non-debt tax shield, retained profit and liquidity (6)	tangibility, size, volatility, profitability, growth , non-debt tax shield and taxes (7)	profitability, tangibility, growth , non-debt tax shield and size (5)	size, tangibility, profitability and growth (4)
Regression Methods	OLS estimation for each year separately	Pooled OLS, RE, FE; FE presented as the best approach	OLS estimation for each year separately	Pooled OLS, RE, FE	OLS	FE

Source: Author's own compilation

Appendix B: Basis for Outlier Detection

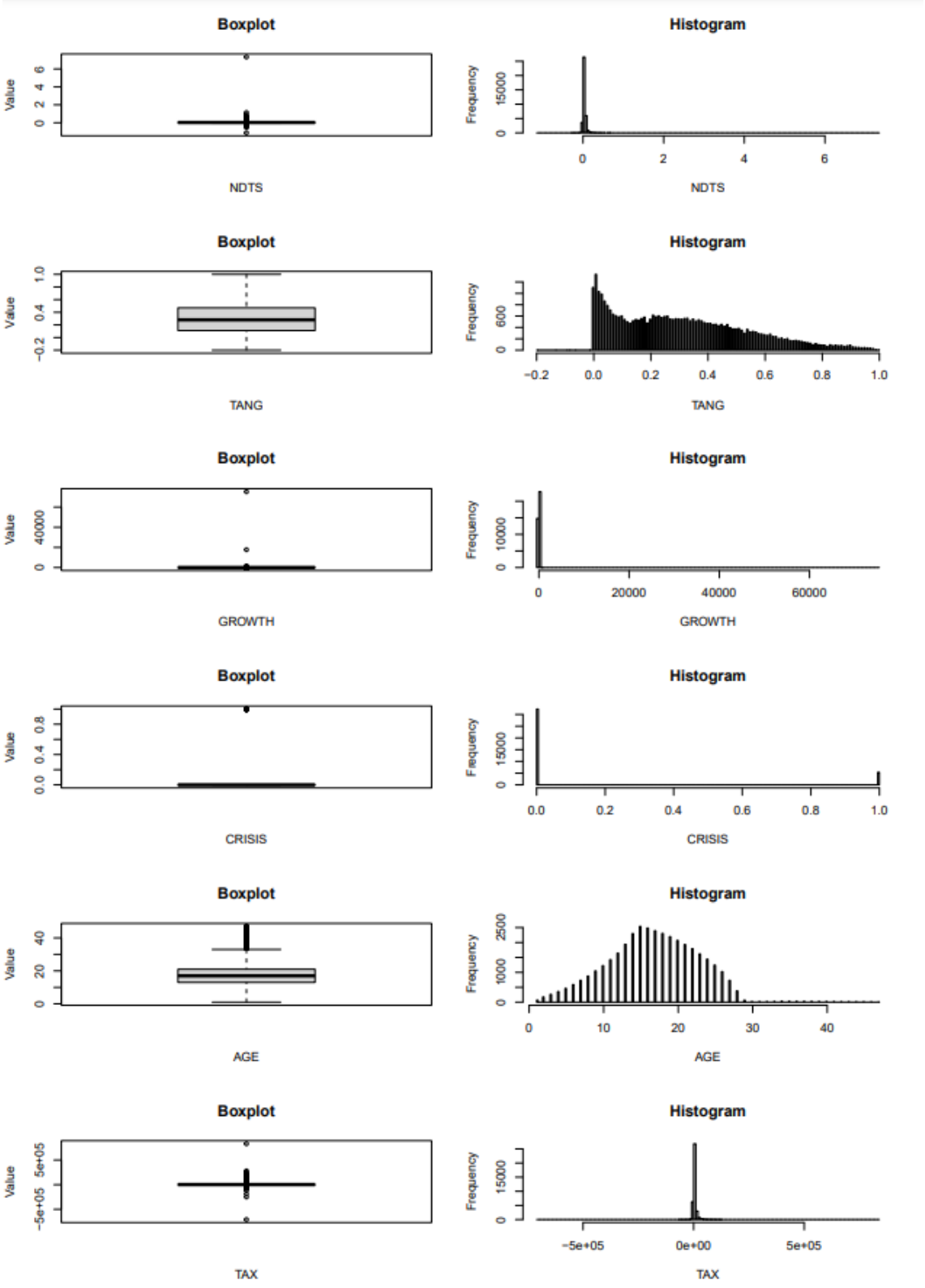
Figure 1,Figure 2 and Figure 3 present the histogram and boxplot of each variable in the dataset. These plots were used as a part of the decision-making process concerning outliers.

Figure 1: Summary of Graphs for Outlier Detection (part 1)



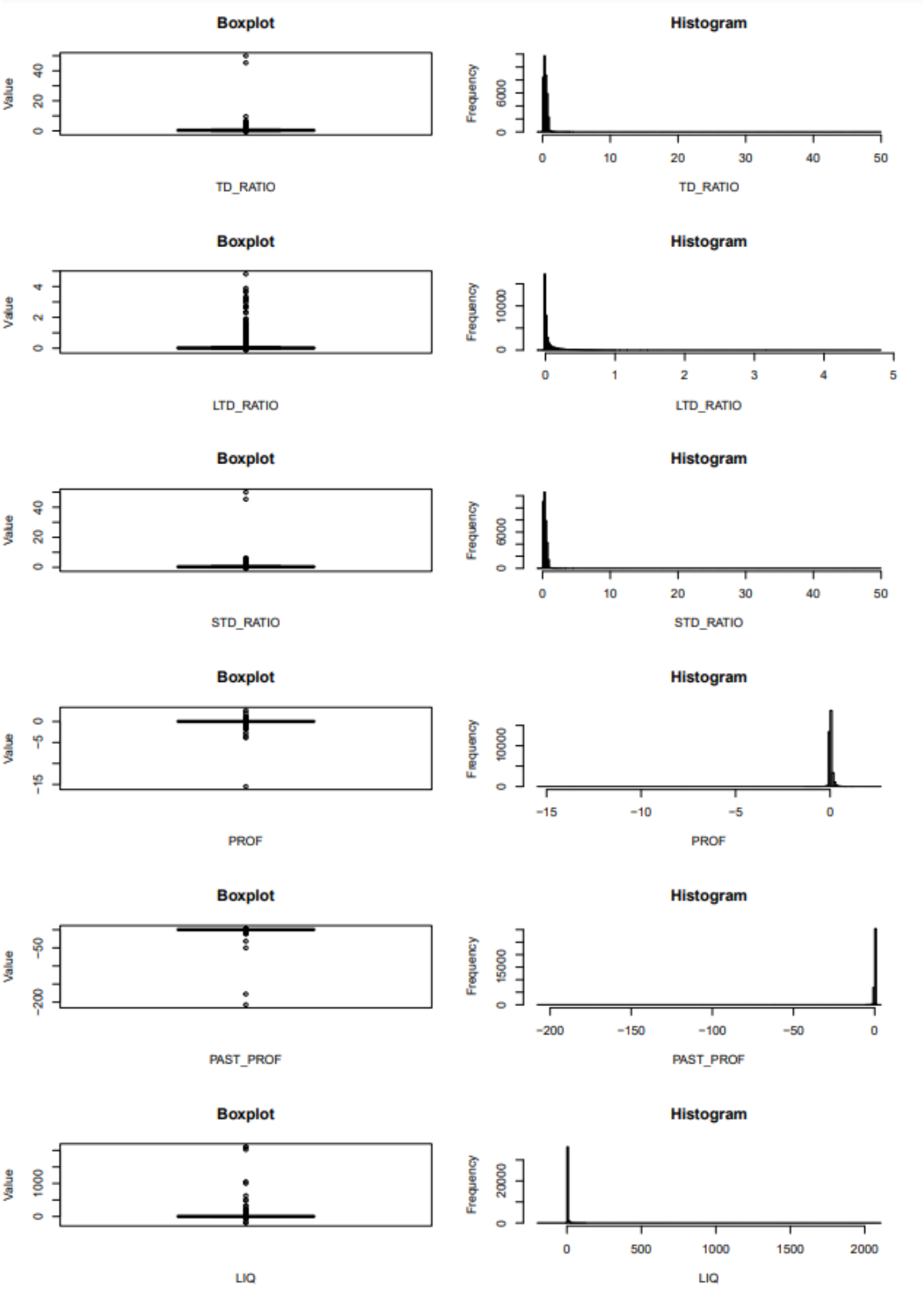
Source: Author's own compilation using R software

Figure 2: Summary of Graphs for Outlier Detection (part 2)



Source: Author's own compilation using R software

Figure 3: Summary of Graphs for Outlier Detection (part 3)



Source: Author's own compilation using R software

Appendix C: Static Model Regression Results

Table 14: Pooled OLS, Fixed Effects Regression Results

	Dependent variable:					
	TD_RATIO_W	LTD_RATIO	STD_RATIO_W	TD_RATIO_W	LTD_RATIO	STD_RATIO_W
	Pooled OLS			Fixed Effects		
AGE	0.003***	0.001**	0.002*	0.014***	0.004***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SIZE_SALES	0.006	0.007	−0.0003	−0.051**	−0.036**	−0.013
	(0.019)	(0.012)	(0.018)	(0.025)	(0.015)	(0.024)
PROF_W	−0.611***	−0.001	−0.610***	−0.750***	−0.014	−0.737***
	(0.040)	(0.025)	(0.038)	(0.030)	(0.018)	(0.028)
PAST_PROF_W	−0.333***	−0.113***	−0.219***	−0.655***	−0.066***	−0.588***
	(0.021)	(0.013)	(0.020)	(0.025)	(0.015)	(0.024)
LIQ_W	−0.030***	−0.001	−0.029***	−0.014***	0.0004	−0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NDTS_W	0.215*	0.072	0.141	0.229**	0.030	0.198**
	(0.123)	(0.078)	(0.118)	(0.097)	(0.059)	(0.091)
TAX_W	−0.001	−0.002***	0.001	0.001**	0.00004	0.001**
	(0.001)	(0.0004)	(0.001)	(0.001)	(0.0003)	(0.0005)
TANG	−0.454***	0.072***	−0.525***	−0.227***	0.006	−0.234***
	(0.030)	(0.019)	(0.028)	(0.044)	(0.027)	(0.041)
GROWTH_W	0.024	−0.024	0.048**	0.005	−0.015	0.018
	(0.025)	(0.016)	(0.023)	(0.018)	(0.011)	(0.017)
CRISIS	−0.024	−0.005	−0.019	0.0003	0.008	−0.008
	(0.016)	(0.010)	(0.015)	(0.012)	(0.007)	(0.011)
R^2	0.572	0.137	0.574	0.636	0.056	0.637
Adjusted R^2	0.567	0.127	0.569	0.604	−0.028	0.605
Notes:						*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

Table 15: Random Effects Regression Results

	Dependent variable:		
	TD_RATIO_W	LTD_RATIO	STD_RATIO_W
	Random effects		
AGE	0.011***	0.003***	0.007***
	(0.001)	(0.001)	(0.001)
SIZE_SALES	−0.025	−0.031**	0.006
	(0.024)	(0.014)	(0.023)
PROF_W	−0.713***	−0.013	−0.698***
	(0.031)	(0.018)	(0.030)
PAST_PROF_W	−0.561***	−0.071***	−0.477***
	(0.024)	(0.014)	(0.023)
LIQ_W	−0.018***	0.0003	−0.019***
	(0.001)	(0.001)	(0.001)
NDTS_W	0.222**	0.036	0.182*
	(0.101)	(0.058)	(0.097)
TAX_W	0.001	−0.0001	0.001*
	(0.001)	(0.0003)	(0.0005)
TANG	−0.336***	0.018	−0.368***
	(0.040)	(0.024)	(0.038)
GROWTH_W	0.007	−0.015	0.021
	(0.019)	(0.011)	(0.018)
CRISIS	−0.006	0.007	−0.012
	(0.012)	(0.007)	(0.012)
R^2	0.591	0.059	0.584
Adjusted R^2	0.587	0.049	0.579
Notes:		*p<0.1; **p<0.05; ***p<0.01	

Source: Author's own calculations using R software

Table 14 and Table 15 provide the results of Pooled OLS, fixed effects and random effects estimation approaches employed on static panel data model specifications. As stated in Chapter 5, Empirical Analysis, static panel data models suffer due to the persistence of dependent variables in respective models, the dynamic models proved that all of the three used debt ratios are affected by the previous year's values, thus, the estimates presented below are deemed inconsistent.

However, these approaches are widely used by other authors even nowadays, thus, a brief comparison of the results provided by system GMM and Pooled OLS, fixed effects and random effects estimation approaches follows.

All of the estimation approaches agree on substantial differences in the statistical significance of determinants between short-term or total and long-term debt ratio models. However, the number of statistically significant determinants varies among estimation approaches for each dependent variable specification. While system GMM reported 5, 1 and 6 statistically significant determinants in total, long-term and short-term debt ratio models respectively, the Pooled OLS reported 6, 3 and 6 significant determinants, the FE reported 8, 3 and 7 significant determinants and the RE reported 6, 3 and 7 significant determinants. The only determinant that is perceived as statistically insignificant across all estimation approaches and model specifications

is the crisis dummy, the remaining determinants are at least under one specification statistically significant. The sets of statistically significant determinants differ.

Appendix D: Remaining Robustness Checks

Table 16: GMM Regression Results Comparison for LTD_RATIO model

	Dependent variable:			
	LTD_RATIO			
	One-step GMM	Robust One-step GMM	Two-step GMM	Robust Two-step GMM
lag(LTD_RATIO, 1:1)	0.647***	0.647***	0.757***	0.757***
	(0.139)	(0.148)	(0.096)	(0.149)
AGE	0.001	0.001	0.001**	0.001*
	(0.001)	(0.001)	(0.0004)	(0.001)
SIZE_SALES	0.011	0.011	−0.002	−0.002
	(0.018)	(0.013)	(0.008)	(0.011)
PROF_W	−0.004	−0.004	−0.002	−0.002
	(0.034)	(0.010)	(0.007)	(0.014)
PAST_PROF_W	−0.036*	−0.036*	−0.038*	−0.038
	(0.020)	(0.018)	(0.013)	(0.024)
LIQ_W	0.0002	0.0002	0.0001	0.0001
	(0.001)	(0.001)	(0.0004)	(0.001)
NDTS_W	0.011	0.011	0.022	0.022
	(0.099)	(0.055)	(0.036)	(0.075)
TAX_W	−0.001	−0.001*	−0.0005	−0.0005
	(0.001)	(0.0004)	(0.0003)	(0.0005)
TANG	0.060	0.060	0.006	0.006
	(0.048)	(0.038)	(0.019)	(0.031)
GROWTH_W	−0.020	−0.020	−0.013	−0.013
	(0.020)	(0.015)	(0.011)	(0.019)
CRISIS	−0.066	−0.066	0.005	0.005
	(0.099)	(0.063)	(0.003)	(0.005)
Notes:				*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

Table 17: Different Regression Results Comparison for LTD_RATIO model

	Dependent variable:			
	LTD_RATIO			
	Fixed Effects	Two-step GMM	Two-step GMM_R	Pooled OLS
lag(LTD_RATIO, 1:1)	0.621***	0.757***	0.797***	0.851***
	(0.029)	(0.149)	(0.173)	(0.019)
AGE	0.002***	0.001*	0.001*	0.0004
	(0.001)	(0.001)	(0.001)	(0.0004)
SIZE_SALES	−0.015	−0.002	0.001	−0.0003
	(0.014)	(0.011)	(0.011)	(0.007)
PROF_W	−0.003	−0.002	−0.011	0.008
	(0.014)	(0.014)	(0.013)	(0.013)
PAST_PROF_W	−0.021*	−0.038	−0.030	−0.019**
	(0.012)	(0.024)	(0.019)	(0.008)
LIQ_W	0.001	0.0001	0.0002	−0.0002
	(0.001)	(0.001)	(0.001)	(0.001)
NDTS_W	0.002	0.022	−0.029	−0.024
	(0.046)	(0.075)	(0.040)	(0.042)
TAX_W	0.0001	−0.0005	−0.0003	−0.0003
	(0.0003)	(0.0005)	(0.0003)	(0.0002)
TANG	0.029	0.006	0.024	0.017
	(0.022)	(0.031)	(0.037)	(0.011)
GROWTH_W	−0.015*	−0.013	−0.017	−0.020**
	(0.009)	(0.019)	(0.017)	(0.009)
CRISIS	0.011*	0.005	−0.028	0.004
	(0.006)	(0.005)	(0.042)	(0.006)
Notes:				*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

Table 18: GMM Regression Results Comparison for STD_RATIO_W model

	Dependent variable:			
	STD_RATIO_W			
	One-step GMM	Robust One-step GMM	Two-step GMM	Robust Two-step GMM
lag(STD_RATIO_W, 1:1)	0.784***	0.784***	0.781***	0.781***
	(0.035)	(0.115)	(0.029)	(0.060)
AGE	0.006***	0.006***	0.005***	0.005***
	(0.001)	(0.002)	(0.001)	(0.001)
SIZE_SALES	0.008	0.008	0.009	0.009
	(0.015)	(0.020)	(0.013)	(0.021)
PROF_W	−0.648***	−0.648***	−0.632***	−0.632***
	(0.030)	(0.143)	(0.024)	(0.093)
PAST_PROF_W	−0.010	−0.010	−0.006	−0.006
	(0.016)	(0.026)	(0.016)	(0.027)
LIQ_W	−0.008***	−0.008***	−0.007***	−0.007***
	(0.001)	(0.003)	(0.001)	(0.002)
NDTS_W	0.139	0.139*	0.141***	0.141
	(0.096)	(0.081)	(0.044)	(0.089)
TAX_W	0.002***	0.002**	0.001***	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
TANG	−0.125***	−0.125***	−0.114***	−0.114***
	(0.026)	(0.036)	(0.014)	(0.026)
GROWTH_W	0.159***	0.159***	0.171***	0.171***
	(0.020)	(0.018)	(0.015)	(0.026)
CRISIS	−0.014	−0.014	−0.002	−0.002
	(0.013)	(0.021)	(0.007)	(0.013)
Notes:				*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

Table 19: Different Regression Results Comparison for STD_RATIO_W model

	Dependent variable:			
	STD_RATIO_W			
	Fixed Effects	Two-step GMM	Two-step GMM_R	Pooled OLS
lag(STD_RATIO_W, 1:1)	0.557***	0.781***	0.780***	0.782***
	(0.030)	(0.060)	(0.069)	(0.021)
AGE	0.010***	0.005***	0.005***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
SIZE_SALES	−0.017	0.009	0.033	−0.005
	(0.022)	(0.021)	(0.029)	(0.012)
PROF_W	−0.718***	−0.632***	−0.652***	−0.646***
	(0.023)	(0.093)	(0.073)	(0.023)
PAST_PROF_W	−0.252***	−0.006	0.001	−0.031**
	(0.027)	(0.027)	(0.030)	(0.014)
LIQ_W	−0.009***	−0.007***	−0.005**	−0.009***
	(0.001)	(0.002)	(0.002)	(0.001)
NDTS_W	0.170**	0.141	0.157*	0.128*
	(0.077)	(0.089)	(0.087)	(0.074)
TAX_W	0.001**	0.001*	0.001*	0.001***
	(0.0005)	(0.001)	(0.001)	(0.0004)
TANG	−0.184***	−0.114***	−0.099**	−0.146***
	(0.037)	(0.026)	(0.045)	(0.021)
GROWTH_W	0.119***	0.171***	0.166***	0.147***
	(0.016)	(0.026)	(0.028)	(0.016)
CRISIS	−0.003	−0.002	−0.158*	−0.032***
	(0.010)	(0.013)	(0.094)	(0.010)
Notes:				*p<0.1; **p<0.05; ***p<0.01

Source: Author's own calculations using R software

Table 16, Table 17, Table 18 and Table 19 provide either the comparison of robust and non-robust results of one and two-step GMM estimation or the comparison of final robust system GMM with fixed effects and pooled OLS for respective models. For both models, the estimates of lagged dependent variables lie in between bounds constructed by fixed effects as the lower bound and pooled OLS as the upper bound, thus supporting, the reliability of the system GMM.

The comparisons of one and two-step approaches with robust or non-robust standard errors show that all of the statistically significant determinants presented by robust two-step GMM are statistically significant among all of the approaches, there is

no difference in the direction of the effect and there is usually only slight variation in the magnitude.

Based on the remarks stated above and the results of tests presented in Subchapter 5.2, Validity of System GMM Estimator, the models are considered to be well specified.