



UNIVERSIDADE CATÓLICA PORTUGUESA

Capital Structure: Impact of COVID-19 and war in Ukraine on Portuguese SME's

Mário Vasco Morgado Pereira

Católica Porto Business School
Abril 2025



UNIVERSIDADE CATÓLICA PORTUGUESA

Capital Structure: Impact of COVID-19 and war in Ukraine on Portuguese SME's

Trabalho Final na modalidade de Dissertação
apresentado à Universidade Católica Portuguesa
para obtenção do grau de mestre em Finanças

por

Mário Vasco Morgado Pereira

sob orientação de
Ricardo Cunha

Católica Porto Business School
Abril 2025

Acknowledgements

This dissertation represents the culmination of a journey that began in 2019, when I first embarked on my academic path. It is with great pride and gratitude that I present this work to the academic community.

I would like to express my sincere thanks to Professor Ricardo Cunha, whose guidance, insightful feedback, and generous sharing of knowledge were instrumental throughout this process. I am equally grateful to Professor Ricardo Ribeiro, whose support in handling the data and refining the empirical model greatly enhanced the quality of this dissertation.

Finally, as this marks the conclusion of my journey through higher education, I would like to sincerely thank my family. Their support, encouragement, and belief in me made this journey possible, and for that, I am deeply grateful.

Abstract

This dissertation studies how the capital structure of Portuguese small and medium-sized enterprises (SMEs) was affected by two major recent crises: the COVID-19 pandemic and the Russia–Ukraine war. Using a panel dataset covering the period from 2013 to 2023, the study applies a linear regression model to examine the impact of these crises on firms' financial leverage, measured by the debt-to-asset ratio. Control variables include profitability, size, asset tangibility, liquidity, and debt structure, while crisis-specific dummy variables account for external shocks.

The analysis is grounded in the main capital structure theories: Modigliani & Miller (1965), Trade-Off Theory (Myers, 1984), Pecking Order Theory (Myers & Majluf, 1984), and Agency Theory (Jensen & Meckling, 1976), which provide a comprehensive framework for interpreting the results in the context of SMEs. The findings reveal a significant increase in leverage during the COVID-19 period, largely driven by firms' access to government guarantees and loan stand stills. In contrast, the effects of the Ukraine war on capital structure appear more moderate, possibly due to its indirect impact on the Portuguese economy. By examining SMEs, this study offers insights into how small and medium-sized firms adjusted their financing structures in response to specific crises, such as the COVID-19 pandemic and the war in Europe and highlights how firm-level characteristics and crisis-specific policies influence financing decisions. Additionally, it underscores the importance of public support mechanisms in times of economic uncertainty.

Keywords: COVID-19, Ukraine war, Capital Structure, Small Medium Enterprises, Crisis.

Total word count: 7994 words

Resumo

Esta dissertação analisa de que forma a estrutura de capital das pequenas e médias empresas (PME) portuguesas foram afetadas por duas crises recentes: a pandemia de COVID-19 e a guerra na Ucrânia. Com base num painel de dados que abrange o período de 2013 a 2023, o estudo aplica um modelo de regressão linear para examinar o efeito destas crises na alavancagem financeira das empresas, medida pelo rácio dívida/ativo. As variáveis de controlo incluem a rentabilidade, a dimensão, a tangibilidade, a liquidez e a estrutura da dívida, enquanto variáveis *dummy* específicas das crises captam os choques externos.

A análise assenta nas principais teorias da estrutura de capital: Modigliani & Miller (1965), Teoria do *Trade-Off* (Myers, 1984), Teoria da *Pecking Order* (Myers & Majluf, 1984) e Teoria da Agência (Jensen & Meckling, 1976), que fornecem um enquadramento teórico para a interpretação dos resultados no contexto das PME. Os resultados revelam um aumento da alavancagem durante o período da COVID-19, impulsionado sobretudo pelo acesso das empresas a garantias estatais e moratórias de crédito. Em contraste, os efeitos da guerra na Ucrânia sobre a estrutura de capital revelam-se mais moderados, possivelmente devido ao seu impacto indireto na economia portuguesa. Ao centrar-se nas PME, este estudo oferece uma perspetiva sobre a forma como estas empresas ajustaram as suas estruturas de financiamento em resposta a crises específicas, como a pandemia e a guerra na Europa. O estudo destaca, ainda, de que forma as características das empresas e as políticas adotadas durante períodos de crise influenciam as decisões de financiamento, sublinhando a importância dos mecanismos de apoio público em contextos de incerteza económica.

Palavras-chave: COVID-19, Guerra na Ucrânia, Estrutura de Capitais, Pequenas e médias empresas, Crises.

Nº total de palavras: 7994

Table of Contents

Acknowledgements.....	v
Abstract.....	vii
Resumo.....	ix
Abbreviations.....	xv
Chapter 1 – Introduction.....	1
Chapter 2 – Capital Structure.....	4
2.1. Modigliani-Miller Theorem.....	4
2.2. Agency Theory.....	5
2.3. Trade-off Theory.....	6
2.3.1. Static Trade-off Theory.....	6
2.3.2. Dynamic Trade-off Theory.....	7
2.3.3. Complementary Concepts in Trade-Off Theory.....	7
2.3.4. Empirical Evidence.....	8
2.4. Pecking Order Theory.....	8
2.4.1. Information asymmetry and adverse selection.....	8
2.4.2. Challenges and limitations of Pecking Order.....	9
2.4.3. Applicability.....	10
2.5. Empirical Evidence – Capital Structure.....	10
Chapter 3 - Capital in COVID-19 and Ukraine war.....	12
Chapter 4 – The Model.....	15
4.1 Dependent variable.....	16
4.2 Independent Variables.....	16
4.2.1. Firm Size (Ln of Total Asset).....	16
4.2.2. Asset Growth Rate.....	17
4.2.3. Liquidity (Current Ratio).....	17
4.2.4. Tangibility.....	18
4.2.5. Debt Structure.....	18
4.2.6. Asset Turnover Ratio.....	19
4.2.7. Return on Assets (ROA).....	20
4.2.8. COVID-19 Dummy.....	20
4.2.9. Ukraine War Dummy.....	21
Chapter 5 – Data.....	23
Chapter 6 - Results.....	25

6.1 Interpretation of the Results	26
Chapter 7 – Conclusion.....	28
Declaration of generative AI and AI-assisted technologies in the writing process	30
Prompts List	30
Bibliography	32

Table index

Table 1: <i>Formulas and expected signal</i>	22
Table 2: <i>Descriptive Statistics of the Variables</i>	24
Table 3: <i>Criteria for SMEs</i>	24
Table 4: <i>Results of the FGLS regression</i>	25

Abbreviations

RE - Random effects

FE - Fixed effects

FGLS – Feasible Generalized Least Squares

ROA – Return on Assets

GAAP – Generally Accepted Accounting Principles

SME's – Small and medium enterprises

M&M – Modigliani & Miller

POT – Pecking Order Theory

OECD - Organisation for Economic Co-operation and Development

Chapter 1 – Introduction

Understanding how firms choose between debt and equity remains a central question in corporate finance. This decision, known as capital structure choice, plays a vital role in determining a firm's financial health, risk exposure, and long-term sustainability. Over the years, various theoretical frameworks have emerged to explain what drive firms' financing behavior.

This research is inspired by foundational studies in capital structure literature, including the work of Modigliani and Miller (1958), which laid the groundwork for understanding firm value under different financing conditions. Further theoretical depth is provided by subsequent frameworks such as the trade-off theory (Myers, 1984), the pecking order theory (Myers & Majluf, 1984), and agency theory (Jensen & Meckling, 1976). Additionally, empirical contributions by Rajan and Zingales (1995), and Frank and Goyal (2009), have been central in identifying the determinants of capital structure in various contexts.

While the theoretical debate remains, empirical studies have highlighted that capital structure is shaped by macroeconomic conditions, institutional frameworks, and firm-specific characteristics. This becomes especially evident during economic downturn when access to external financing is reduced and firms face increased uncertainty.

The motivation behind this dissertation arises from the increasing relevance of capital structure decisions in SMEs, particularly during times of economic instability. In recent years, COVID-19 and the war in Ukraine have significantly disrupted global financial systems, access to credit, and firm-level financial strategies. SMEs, due to their limited resources and dependency on external financing, are particularly susceptible to these disruptions. Understanding how these firms adapt their capital structures in response to such adverse conditions is both timely and significant as it informs policymakers on how SMEs reacted to

support mechanisms and contributes to academic literature by providing insights into firm behavior during COVID-19 and Ukraine war.

This dissertation studies how COVID-19 pandemic and war in Ukraine influenced the capital structure of Portuguese SMEs. It examines whether firms altered their financing strategies in response to these shocks and whether public measures, such as government guarantees, and loan standstills affected their capital structure. The study is built on established capital structure literature but extends the analysis by incorporating crisis-specific variables and applying them to a dataset of panel data from 2013 to 2023.

By focusing on a segment of firms that is crucial to the Portuguese economy, this study aims to contribute to a deeper understanding of how capital structure determinants evolve under external events.

The study applies a linear regression model using a panel dataset from 2013 to 2023. The dependent variable is leverage defined as debt-to-asset ratio, while the explanatory variables include firm-specific financial indicators such as profitability, size, tangibility, liquidity, debt structure and crisis-specific dummy variables. The model also accounts for econometric issues including heteroskedasticity, serial autocorrelation, and cross-sectional dependence to ensure robust results.

Preliminary findings suggest that the COVID-19 crisis had a statistically significant impact on firms' capital structure, especially through increased use of short-term debt and reliance on state-backed financial support mechanisms. Interestingly, the effects of the Ukraine war, while present, appear to be less pronounced, possibly due to the indirect nature of the economic shock in the Portuguese context.

The dissertation is structured as follows. Firstly, chapter 1 introduces the topic, motivation, research objectives and sheds light on the methods used. Then, chapter 2 reviews the main theories and empirical findings in capital structure

literature. Next, chapter 3 presents the literature about COVID-19 and Ukraine war shocks. Afterwards, chapter 4 presents the model, details about the regression and variables. In Chapter 5 the dataset is presented. Chapter 6 shows the results and finally Chapter 7 presents the conclusion to this dissertation.

Chapter 2 – Capital Structure

Capital structure is a crucial topic for every company, especially in economic downturns. In SME's, the balance between equity and debt it is directly linked to companies' capacity to deal with those economical external events, such as COVID-19 breakdown and most recently Russian invasion in Ukraine. This literature review aims to present both classical and recent approaches to capital structure, with a specific focus on adapting these theories to the context of Portuguese SMEs in today's economic environment.

Firstly, we need to know the theoretical approaches that help to explain companies' decisions between equity and debt financing. In particular, the review examines foundational models, such as the Modigliani-Miller Theorem, Trade-Off Theory, and Pecking Order Theory, each offering unique insights into the factors influencing a firm's capital structure. Additionally, the review incorporates concepts like agency costs and information asymmetry, which further refine these models to better capture real-world complexities.

2.1. Modigliani-Miller Theorem

Foundations of capital structure began with Modigliani & Miller (1958), who demonstrated that in a world of perfect markets capital structure does not affect the value of the company. According to Modigliani & Miller (1958), in an idealized scenario without taxes, bankruptcy costs or information asymmetry, financing decisions are irrelevant to a firm's value, there would be no advantage in choosing debt over equity. This theory does not reflect real-world scenarios, especially in SME's, which have restricted access to credit, face information asymmetry, and bankruptcy risks. Modigliani & Miller (1965) later reply to a comment made by two other professors, acknowledging

that tax deductibility of interests may increase firm value. In their comments they say that the objective of the Modigliani & Miller (1958) was to construct a theoretical framework that could later be modified as real market imperfections were introduced. However, the assumptions of the Modigliani & Miller (1958) Theorem rarely apply to small and medium-sized enterprises, which often face significant bankruptcy costs, limited access to credit, and information asymmetry. These limitations highlight the need for alternative theories, such as the Trade-Off Theory and Pecking Order Theory, which account for real-world imperfections and provide a more practical framework for capital structure decisions in SMEs.

2.2. Agency Theory

Agency theory was first introduced by Jensen & Meckling (1976). It examines how relations between managers and shareholders within a firm can create potential conflicts with financial impact, through some decisions of the agents. Debt, through the eyes of this theory, is seen as a tool to impose financial discipline, encouraging managers to make investment choices that align with shareholders' interests. The firm, by having debt, normally must make regular payments, thus, managers must use resources wisely, prioritizing profitability and minimizing waste (Harris & Raviv, 1991).

However, while debt can mitigate shareholder-manager conflicts, agency costs can still arise, particularly in conflicts between shareholders and creditors (Harris & Raviv, 1991). Creditors, concerned about the potential risk-taking behavior of shareholders, may impose restrictive covenants (Smith & Warner, 1979) which can impact the firm's financial flexibility and, ultimately, its capital structure choices (Rajan & Zingales, 1995).

In SMEs it is often observed that conflict between managers and shareholders is reduced, because owners normally play that dual role (Fama & Jensen, 1983). Although this conflict is minimized, SMEs may yet encounter agency costs arising from tensions between shareholders and creditors.

Effective capital structure decisions account for these dynamics, ensuring that debt levels do not compromise the firm's liquidity and stakeholder relationships (Harris & Raviv, 1991).

2.3. Trade-off Theory

In capital structure, the term "trade off theory" was presented by Myers (1984) it allowed for a greater understanding of how firms balance the benefits of debt with the potential costs associated with financial distress. It is an extension of the seminal work of Modigliani & Miller (1958), that includes real world variables like tax deduction on interest payments.

2.3.1. Static Trade-off Theory

The Static Trade-Off Theory of capital structure suggests that firms can optimize their debt-to-equity ratio by balancing the benefits of debt, like tax shields, against the costs associated with financial distress. According to Kraus and Litzenberger (1973), companies benefit from debt through tax deductibility on interest payments, which can enhance firm value up to the point where additional debt increases the risk of bankruptcy. This model assumes a static "optimal" level of debt where the marginal benefit from tax shields matches the marginal cost of financial distress, creating a target debt ratio that maximizes value.

The theory's limitations include its assumption of no transaction costs in adjusting the capital structure, as noted by Dudley (2007). These costs can delay adjustments to the target debt ratio, meaning firms often deviate temporarily from their optimal structure due to economic shifts. Additionally, Myers (1984) argued that, while the static model provides a foundation, it oversimplifies by not accounting for fluctuating market conditions and agency costs. Higher profitability, for example, generally allows firms to sustain higher debt levels while minimizing bankruptcy risk, which further adjusts their optimal debt-to-equity balance.

2.3.2. Dynamic Trade-off Theory

The Dynamic Trade-Off Theory builds on the limitations of the static model by considering the costs of adjusting debt levels. Dudley (2007) and Hovakimian et al. (2001) present the notion that not always a company immediately wants to adjust their debt to the target debt ratio when there is a deviation. This idea is based on the fact that issuing additional debt involves transaction costs related to adjusting or repurchasing it. Rather than making constant adjustments, firms operate within a target range, only making changes when the benefits outweigh these adjustment costs. This dynamic approach suggests that firms' leverage have an optimal range instead of a static point.

2.3.3. Complementary Concepts in Trade-Off Theory

Trade-Off Theory is enriched by considering agency costs and information asymmetries. As previously mentioned, Jensen and Meckling (1976) introduce agency costs, highlighting that as firms increase debt, conflicts between shareholders and creditors emerge, which influences capital structure choices. Higher debt imposes discipline on managers, aligning their actions with shareholder interests, but also increases agency costs due to potential riskier decisions that benefit shareholders at creditors' expense (Harris & Raviv, 1991).

Similarly, Myers and Majluf (1984) show that information asymmetry can make managers prefer debt over equity to avoid signaling undervaluation to the market, especially in SMEs where transparency is limited. These concepts enhance Trade-Off Theory by reflecting real-world factors, indicating that capital structure decisions must also consider agency and informational conflicts beyond basic tax and bankruptcy considerations.

2.3.4. Empirical Evidence

Empirical evidence supports the Trade-Off Theory in the case of Spanish SMEs. Sogorb and López (2003) found that these firms tend to follow a partial adjustment process toward an optimal debt ratio, consistent with the theory's predictions. Their results suggest that larger and more profitable SMEs are more likely to use debt to benefit from tax shields, although credit constraints may still limit access to optimal leverage levels. In Portugal, Serrasqueiro and Nunes (2011) observed that while SMEs aim to balance debt and equity as the theory suggests, high transaction costs slow adjustments in long-term debt.

2.4. Pecking Order Theory

The Pecking Order Theory, originally developed by Myers and Majluf (1984), suggests that firms follow a specific hierarchy of financing choices to reduce the impact of adverse selection caused by information asymmetry between managers and external investors. According to this theory, companies prefer to finance investments using internal funds first, followed by debt, and only issue equity as a last resource. This behavior reflects the idea that managers have better knowledge about the firm's value than outside investors. As a result, the Pecking Order Theory emphasizes the crucial role of informational asymmetries in shaping corporate financing decisions.

2.4.1. Information asymmetry and adverse selection

Myers and Majluf (1984) propose that managers, by having a better knowledge of a firm's value and prospects than external investors, prefer using financing methods that do not reveal or reveal the minimal information about the firm's situation. When internal funds fall short, managers tend to prefer debt over equity, as issuing debt can signal confidence in the investment's profitability and suggest that the stock may be undervalued in signaling theory (Ross, 1977). In contrast, issuing equity may imply the stock is overvalued, potentially signaling to the market that management is willing to dilute shares to raise capital (Myers & Majluf, 1984).

The use of external financing demands a higher return by the creditor because of that information asymmetry, creditors do not know as much as the managers do, so they demand returns to cover that risk (Akerlof, 1970).

In considering the pecking order theory, it is important to factor in the hierarchy of claims on assets. Debt holders require a lower return than shareholders because they have a higher claim on assets in the event of bankruptcy (Jensen & Meckling, 1976). Consequently, when evaluating financing options, the most cost-effective source is retained earnings, followed by debt, with equity as the last resort due to its higher associated costs.

Financing hierarchy:

- 1st. **Internal Funds:** Retained earnings are the first choice, as they avoid external scrutiny and associated costs.
- 2nd. **Debt:** When internal funds are lacking, firms opt for debt.
- 3rd. **Equity:** Issuing equity is the last option, as it is highly visible and may signal overvaluation to investors.

2.4.2. Challenges and limitations of Pecking Order

The study by Frank and Goyal (2009) contributes to capital structure literature by identifying a set of variables such as industry median leverage, asset tangibility, market-to-book ratio, and expected inflation that consistently explain leverage decisions across firms. While not a direct test of the Pecking Order Theory (POT), their findings suggest that real-world financing choices are influenced by both firm-specific and macroeconomic conditions, implying that capital structure decisions may deviate from the strict hierarchy proposed by POT.

Fama and French (2002) further challenge POT by showing that more profitable firms do not consistently reduce their debt levels. Contrary to the theory's assumptions, some profitable firms

maintain or even increase their leverage, suggesting that other motivations such as tax considerations or agency-related factors may influence financing decisions.

Similarly, Lemmon and Zender (2010) argue that financially constrained firms may prioritize equity over debt due to limited access to credit markets. This behavior contradicts the central assumption of POT that firms universally prefer internal funds, then debt, and finally equity.

Taken together, these findings indicate that the Pecking Order Theory may oversimplify the complexity of capital structure decisions. Empirical evidence shows that broader economic conditions, market imperfections, and firm-specific constraints often shape financing behavior in ways that extend beyond the scope of information asymmetry alone.

2.4.3. Applicability

The Pecking Order Theory provides valuable insights into how adverse selection and information asymmetry influence capital structure decisions, though it presents notable limitations, as previously discussed. The hierarchy suggested by POT favoring internal financing, followed by debt, and lastly equity may shift significantly under conditions of economic volatility, as shown by Shyam-Sunder and Myers (1999). This flexibility in the financing order is particularly relevant to this dissertation, given the focus on decision-making in volatile economic scenarios.

2.5. Empirical Evidence – Capital Structure

This section presents key empirical contributions that have shaped academic debate, focusing on the role of asset tangibility, firm characteristics, and financing patterns across different contexts. The selected studies provide a solid basis for evaluating how theoretical models perform when confronted with real-world data. Three foundational studies Harris & Raviv (1991), Rajan & Zingales (1995), and Shyam-Sunder & Myers (1999) offer strong empirical support for the idea that collateral value influences a firm's ability to access debt.

Harris and Raviv (1991) present a structured survey of capital structure theories, focusing on agency costs, asymmetric information, product market interactions and control issues. Although

they do not conduct original empirical analysis, they summarize key theoretical models and compare their predictions with existing empirical evidence. One of their main conclusions is that asset tangibility is consistently linked to higher leverage, as collateral reduces agency conflicts and facilitates debt financing.

In their cross-country empirical study, Rajan and Zingales (1995) identify four main firm-level factors that significantly influence capital structure decisions: tangibility, market-to-book ratio, firm size, and profitability. Tangibility is positively associated with leverage, as tangible assets serve as collateral and reduce agency costs. Conversely, the market-to-book ratio is negatively related to leverage, suggesting that firms with strong growth opportunities avoid debt to reduce the risk of underinvestment. Firm size shows a generally positive correlation with leverage, possibly reflecting better access to credit markets and lower default risk, although the relationship is not fully understood. Lastly, profitability is negatively correlated with leverage, consistent with the pecking order theory more profitable firms prefer internal funds over external debt. These relationships, while generally consistent across countries, reveal nuances shaped by institutional contexts and financial systems.

Shyam-Sunder and Myers (1999) advance empirical research by testing the pecking order and trade-off theories as competing models. Their results show that the pecking order theory better explains firms' financing behavior, especially in mature firms, and that firms tend to use debt to finance both expected and unexpected deficits. Moreover, when both models are tested jointly, the explanatory power of the pecking order remains robust, while the trade-off model's performance deteriorates, suggesting that firms do not actively target an optimal leverage ratio in the short term.

These studies confirm that tangible assets facilitate debt financing by reducing risk for lenders and increasing access to credit. Although not focused exclusively on SMEs, the implications are especially relevant for smaller firms, where collateral often determines whether external finance is available at all.

Chapter 3 – Capital Structure in COVID-19 and Ukraine war

The COVID-19 pandemic severely disrupted corporate cash flows, forcing many firms to increase their reliance on debt to sustain operations. Government-backed loans and stimulus programs played a crucial role in providing liquidity during the crisis, particularly for small and medium-sized enterprises (SMEs), which typically face greater financial constraints. According to Carletti et al. (2020), firms in highly affected sectors, such as hospitality and retail, were particularly dependent on debt financing, largely driven by loan guarantees provided by the Italian government. These measures facilitated access to credit but also led to a significant rise in leverage, particularly for already indebted firms.

In addition to loan guarantees, debt moratorium programs were widely implemented to prevent a wave of corporate bankruptcies. These stand stills allowed firms to temporarily suspend principal and interest payments on outstanding debt, thereby reducing short-term liquidity pressures. While this measure provided immediate relief, its long-term effects on corporate financial health were more complex.

During the COVID-19 pandemic, public guarantee schemes played a crucial role in improving SME access to financing while minimizing the fiscal burden on governments. According to Corredera-Catalán, di Pietro, and Trujillo-Ponce (2021), Spain implemented a mutual guarantee society (MGS) model, where regional governments collaborated with financial institutions to provide loan guarantees to SMEs facing liquidity constraints. Similar systems were also implemented in Portugal.

These guaranteed schemes enabled banks to extend credit with reduced risk exposure, leading to a significant increase in debt financing among SMEs. Unlike direct financial aid, these instruments allowed firms to access necessary funds without imposing excessive pressure on public budgets, reinforcing the effectiveness of public-private partnerships in times of economic distress.

Research by Demmou et al. (2021) indicates that moratoriums helped viable firms survive the initial shock by ensuring continued access to credit and preventing liquidity crises from turning into

solvency crises. However, for firms that were already financially fragile before the pandemic, these measures delayed inevitable restructuring or liquidation, increasing the risk of corporate zombification, highlighting that firms heavily reliant on moratoriums tended to accumulate unsustainable levels of debt, leading to financial distress once support measures were lifted. (Helmerrsson et al., 2021)

Furthermore, moratorium programs significantly influenced firm-level financial decisions, as many companies delayed cost-cutting measures and operational efficiency improvements, assuming that economic conditions would stabilize before repayments resumed. This temporary relief mechanism provided firms with short-term liquidity, but in sectors such as tourism and retail, where demand recovery was sluggish, many businesses experienced severe financial distress once moratoriums expired (OECD, 2021).

Thus, while moratoriums played a crucial role in preventing immediate financial collapse, they also introduced long-term financial risks by increasing firm leverage, distorting market selection mechanisms, and delaying necessary structural adjustments. As highlighted by Helmerrsson et al. (2021) prolonged financial support may have led to the survival of unproductive firms, increasing the risk of "corporate zombification."

To conclude, Fahlenbrach, Ragoth, and Stulz (2020) highlight that firms with greater cash reserves were more resilient during the COVID-19 crisis, experiencing smaller stock price declines and greater operational stability. Their findings emphasize the importance of financial flexibility, as firms with strong liquidity buffers were less dependent on costly external financing during revenue shocks. This effect was particularly crucial for SMEs and firms in financially constrained industries, reinforcing the role of cash holdings in mitigating crisis-induced financial distress.

The Russian invasion of Ukraine intensified geopolitical uncertainties, leading to a sharp increase in global inflation driven by surging energy and commodity prices. In response, central banks tightened monetary policies by raising interest rates to curb inflation.

Geopolitical crises heighten investor risk perceptions, increasing the cost of capital. Rising geopolitical tensions often trigger abrupt capital outflows, particularly from emerging markets, as

investors demand higher risk premiums. This, in turn, reduces access to external financing, contributes to currency depreciation and exacerbates financial instability. (Hodula et al., 2024).

In line with the pecking order theory (Myers & Majluf, 1984), firms prioritized internal financing by preserving liquidity and postponing major investments to mitigate risks associated with inflationary pressures. This strategic shift was particularly evident among SMEs, which historically face greater financial constraints and have limited access to alternative funding sources (Beck & Demirgüç-Kunt, 2006).

Crises impact firms' capital structures unevenly, with financially constrained firms being more adversely affected. During the 2008 financial crisis, firms with higher constraints were forced to cut investments significantly, while those with greater financial flexibility managed to maintain or even expand their investment levels. Larger firms, benefiting from stronger credit histories and more diversified financing options were better positioned to withstand financial shocks (Campello, Graham & Harvey, 2010).

The Russian invasion of Ukraine, though less globally disruptive than the COVID-19 pandemic, had an immediate impact on inflation expectations. The unexpected start of the war led to a rise in both short and long-term inflation expectations, mainly due to concerns over rising energy prices and worsening economic outlooks. This shift increased the risk of inflation by rising in early March 2022, as households and businesses adjusted their expectations in response to growing geopolitical uncertainty (Afunts, Cato & Schmidt, 2024).

The resulting inflationary pressures led to deteriorating financing conditions, forcing firms to either deleverage or postpone investments to maintain liquidity. (Kalemli-Özcan et al., 2018).

Across these crises, the vulnerabilities of SMEs low liquidity, constrained credit access, and sectoral dependencies and low collateral asset value have repeatedly underscored their heightened sensitivity to economic downturns.

Chapter 4 – The Model

A regression model was implemented to study two central research hypotheses, that aim to assess whether periods of crisis significantly influenced firms' debt decisions.

H1: Did debt financing in Portuguese SME's increased during COVID-19?

H2: Did debt financing in Portuguese SME's decreased during Ukraine war?

The COVID-19 pandemic and the Ukraine war are incorporated as control variables (dummy variables), while firm-specific factors act as independent explanatory variables to account for structural differences among firms.

To ensure the robustness of the model, several diagnostic tests were performed to assess potential econometric issues¹. Since the tests indicated heteroscedasticity, serial correlation, and cross-sectional dependence, the Feasible General Least Square model was chosen. This model corrects these issues, ensuring more reliable statistical inference. All statistical tests and results presented were generated using R.

The final specification of the model is:

$$\begin{aligned}Leverage_{i,t} = & \beta_0 + \beta_1 Ln(Total Asset)_{i,t} + \beta_2 Growth Rate_{i,t} + \beta_3 Current Ratio_{i,t} + \beta_4 Tangibility_{i,t} \\ & + \beta_5 Debt structure_{i,t} + \beta_6 Asset Turnover Ratio_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Dummy Covid_{i,t} \\ & + \beta_9 Dummy War_{i,t} + \epsilon_{i,t}\end{aligned}$$

where:

- i represents each firm,
- t represents the year,
- ϵ_{it} is the error term adjusted for heteroscedasticity and serial correlation.

Table 1 presents all formulas and expected signals for every variable.

¹ Heteroskedasticity and serial correlation were detected through the Breusch-Pagan (Breusch & Pagan, 1979), Durbin-Watson (Durbin & Watson, 1951), and Breusch-Godfrey/Wooldridge tests (Breusch, 1978; Wooldridge, 2002). Cross-sectional dependence was also confirmed by the Pesaran test (Pesaran, 2004).

4.1 Dependent variable

The dependent variable in this study is Leverage defined as Debt-to-Assets ratio (Rajan & Zingales, 1995; Harris & Raviv, 1991), calculated for each firm and year between 2013 and 2023. This ratio measures the proportion of a firm's total assets that is financed through debt. To capture the firm's financial debt position at each point in time, the numerator includes both current and non-current financial liabilities, divided by the firm's total assets. This approach ensures that the measure reflects the accumulated financial obligations of each firm relative to its asset base each year.

$$Leverage_{i,t} = \frac{Financial\ Debt_{i,t}}{Total\ Assets_{i,t}}$$

where t represents the current year and i the firm.

4.2 Independent Variables

4.2.1. Firm Size (Ln of Total Asset)

Firm size is measured as the natural logarithm of total assets (Fan, Titman, & Twite, 2012) for each firm in each year of the study period. The use of the logarithmic transformation aims to normalize the distribution of asset values, reducing skewness and dispersion in the data. This transformation was adopted in empirical studies (Rajan & Zingales, 1995) and it is used for more stable comparisons across firms of different sizes, improving the robustness of the regression analysis.

Larger firms tend to have greater access to credit markets (Frank and Goyal, 2009), more diversified revenue streams and lower perceived risk from lenders, leading to a positive relationship between firm size and leverage. According to Rajan and Zingales (1995) plus Frank and Goyal (2009), firm size is positively correlated with debt ratios, as larger firms face lower bankruptcy costs and enjoy better borrowing conditions.

4.2.2 Asset Growth Rate

The asset growth rate measures the annual percentage change in total assets for each firm (Titman & Wassels, 1988). This variable is calculated using a simple growth formula, where the total assets of the current year are compared to those of the previous year. To ensure the calculation of growth rates for the entire study period (2013–2023), data from 2012 was used as the baseline for computing the growth rate of 2013. The formula applied is:

$$Growth Rate_{i,t} = \frac{Total Assets_{i,t} - Total Assets_{i,t-1}}{Total Assets_{i,t-1}}$$

where t represents the current year, $t-1$ the previous year and i the firm.

A positive relationship is expected between growth and leverage. Firms experiencing asset growth may require additional external financing to support expansion, especially if internal funds are insufficient, often rely on debt financing to sustain their investments, leading to higher leverage levels (Frank and Goyal, 2003).

4.2.3 Liquidity (Current Ratio)

Liquidity is measured using the Current Ratio, which represents a firm's ability to cover its short-term liabilities with its short-term assets (Ozkan, 2001). It is calculated as the ratio between current assets and current liabilities. The formula applied is:

$$Current Ratio_{i,t} = \frac{Current Assets_{i,t}}{Current Liabilities_{i,t}}$$

This ratio is widely used in financial analysis to assess a company's short-term solvency. A higher current ratio indicates that the firm has more liquid assets available to meet its short-term obligations, which can reduce financial distress risk (Ozkan, 2001).

4.2.4 Tangibility

Tangibility is measured as the proportion of tangible fixed assets relative to total assets (Rajan & Zingales, 1995). This variable reflects the extent to which a firm's assets are composed of physical, long-term resources that can serve as collateral for debt financing. The formula applied is:

$$Tangibility_{i,t} = \frac{Tangible\ Fixed\ Assets_{i,t}}{Total\ Assets_{i,t}}$$

where t represents the current year and i the firm.

Firms with a higher proportion of tangible assets typically have greater borrowing capacity, as these assets can serve as collateral, reducing the risk perceived by lenders. This aligns with the Trade-Off Theory (Myers, 1984), which suggests that companies with more tangible assets can secure loans more easily and at better terms, leading to higher leverage levels (Rajan & Zingales, 1995; Harris & Raviv 1991). Additionally, tangible assets provide greater financial stability, as they retain value even in times of economic uncertainty, further strengthening the firm's ability to access external financing.

4.2.5 Debt Structure

Debt structure is measured as the proportion of short-term debt relative to total debt (Barclay and Smith, 1995), reflecting the firm's reliance on short-term financing. The calculation follows the formula:

$$Debt\ structure_{i,t} = \frac{Short\ term\ Debt\ (Current\ Liabilities\ from\ financing)_{i,t}}{Total\ Debt\ (Current\ +\ Non\ Current\ Liabilities\ from\ financing)_{i,t}}$$

where t represents the current year and i the firm.

This ratio provides insights into a firm's debt maturity profile, indicating whether it primarily relies on short-term or long-term financing. According to Barclay and Smith (1995), firms with higher credit quality and greater access to capital markets tend to issue long-term debt and firms with greater growth options in their investment often rely more on short term debt. Therefore, a higher debt structure ratio may be associated with higher overall leverage. Firms with higher growth tend to have higher leverage (Frank & Goyal, 2003).

4.2.6 Asset Turnover Ratio

The Asset Turnover Ratio measures a firm's efficiency in utilizing its assets to generate revenue. It is calculated as the ratio between total sales and services provided and total assets (Patin, Rahman, & Mustafa, 2020).

The formula applied is:

$$\text{Asset Turnover Ratio}_{i,t} = \frac{\text{Sales and services provided}_{i,t}}{\text{Total Assets}_{i,t}}$$

where t represents the current year and i the firm.

This ratio is a key indicator of operational efficiency, showing how effectively a firm converts its asset base into revenue. A higher asset turnover ratio suggests that the firm is efficient in generating sales relative to its asset investment, whereas a lower ratio may indicate underutilization of assets or operational inefficiencies.

In the context of capital structure, the expected impact of asset turnover on leverage is ambiguous. On one hand, higher efficiency can signal a firm's strong revenue-generating capacity, making it more attractive to lenders and leading to higher leverage (Lemmon & Zender, 2010). On the other hand, highly efficient firms may generate sufficient internal positive cash-flows, reducing their reliance on external financing and leading to lower debt levels, as suggested by the Pecking Order Theory (Myers & Majluf, 1984).

Given these contrasting perspectives, the empirical analysis will determine whether higher asset turnover is associated with increased or decreased leverage in the context of Portuguese SMEs.

4.2.7 Return on Assets (ROA)

The ROA measures a firm's profitability relative to its total assets, indicating how efficiently a company utilizes its assets to generate profit. It is calculated as the ratio between net income and total assets. (Rajan & Zingales, 1995).

The formula applied is:

$$ROA_{i,t} = \frac{Net\ Income_{i,t}}{Total\ Assets_{i,t}}$$

where t represents the current year and i the firm.

ROA is one of the most used indicators of a firm's financial performance. A higher ROA suggests that the firm is more efficient in generating profits from its asset base, while a lower ROA may indicate weaker profitability or inefficiencies in asset utilization.

Return on Assets (ROA) is expected to have a negative relationship with leverage (Rajan & Zingales, 1995). According to the pecking order theory (Myers & Majluf, 1984), firms with higher profitability prefer internal financing over debt, leading to lower leverage levels. Empirical studies confirm that more profitable firms tend to accumulate retained earnings, reducing their dependence on external financing (Frank & Goyal, 2009).

4.2.8 COVID-19 Dummy

The COVID-19 Dummy is a binary variable that identifies the years affected by the COVID-19 pandemic, allowing for an assessment of its impact on companies' capital structure. This variable takes value 1 for the years 2020 and 2021, when the pandemic had the most significant economic consequences, and 0 for all other years.

One of the most significant financial relief measures was the moratorium on debt repayments, which allowed firms to defer their loan obligations. These stand stills remained in place until late 2021, providing temporary liquidity relief to SMEs and reducing the immediate pressure to raise

additional financing (Demmou et al., 2021; Helmersson et al., 2021). While these measures helped prevent widespread bankruptcies, they also altered normal leverage patterns, as some firms may have delayed debt restructuring or avoided taking on new loans while benefiting from deferred payments (OECD, 2021).

Empirical evidence from the COVID-19 crisis suggests that firms facing liquidity constraints relied more on government-backed loans and credit guarantees, increasing their dependence on debt financing (Carletti et al., 2020; Corredera-Catalán, di Pietro & Trujillo-Ponce, 2021).

Given these dynamics, it is crucial to assess whether Portuguese SMEs increased, stabilized, or reduced their leverage levels compared to non-crisis periods. Additionally, firms with stronger liquidity buffers were better positioned to weather the crisis with less reliance on costly external financing, reinforcing the importance of financial flexibility (Fahlenbrach, Rageth & Stulz, 2020).

4.2.9 Ukraine War Dummy

The Ukraine War Dummy is a binary variable that captures the economic effects of the Russia-Ukraine conflict on Portuguese SMEs. It takes value 1 for the years impacted by the war (2022 and 2023) and 0 for all other years.

The Ukraine war introduced significant geopolitical and economic instability, particularly affecting energy prices, supply chains, and investor confidence. Companies faced higher operational costs, inflationary pressures, and increased market uncertainty, all of which could have influenced their financing decisions. Geopolitical crises heighten investor risk perceptions and increase capital costs, leading to restricted credit access and financial instability (Hodula et al., 2024).

In line with the pecking order theory, firms tend to prioritize internal financing in uncertain periods, preserving liquidity and postponing major investments to mitigate risk (Myers & Majluf, 1984; Beck & Demirgüç-Kunt, 2006). During financial crises, financially constrained firms have historically cut investments and faced greater difficulties accessing external financing (Campello, Graham & Harvey, 2010). Similarly, the Russian invasion of Ukraine led to rising inflation expectations and deteriorating financing conditions, which may have pushed SMEs to adopt more conservative financial strategies (Afunts, Cato & Schmidt, 2024; Kalemli-Özcan et al., 2018).

However, some firms may have sought additional financing to cope with rising costs, particularly those in energy-intensive industries or businesses reliant on disrupted supply chains. The extent to which SMEs increased or reduced leverage during the Ukraine war remains an empirical question, which this study seeks to address.

4.2.10. Summary table

Table 1
Formulas and expected signal

Variables	Formula	Expected Signal
<i>Leverage</i>	$\frac{\text{Financial Debt}_{i,t}}{\text{Total Assets}_{i,t}}$	
<i>Ln (Total Asset)</i>	$\text{Ln}(\text{Total Assets}_{i,t})$	+
<i>Growth Rate</i>	$\frac{\text{Total Assets}_{i,t} - \text{Total Assets}_{i,t-1}}{\text{Total Assets}_{i,t-1}}$	+
<i>Current Ratio</i>	$\frac{\text{Current Assets}_{i,t}}{\text{Current Liabilities}_{i,t}}$	+
<i>Tangibility</i>	$\frac{\text{Tangible Fixed Assets}_{i,t}}{\text{Total Assets}_{i,t}}$	+
<i>Debt Structure</i>	$\frac{\text{Short term Debt}_{i,t}}{\text{Total Debt}_{i,t}}$	+
<i>Asset Turnover Ratio</i>	$\frac{\text{Sales and services provided}_{i,t}}{\text{Total Assets}_{i,t}}$	+/-
<i>ROA</i>	$\frac{\text{Net Income}_{i,t}}{\text{Total Assets}_{i,t}}$	-
<i>Dummy COVID</i>	1 or 0	+
<i>Dummy War</i>	1 or 0	-

Note: Asset Turnover expected signal is ambiguous

Chapter 5 – Data

The data used in this study was extracted from the SABI (Sistema de Análise de Balanços Ibéricos) database, which provides detailed financial information on Portuguese firms. The sample consists exclusively of Portuguese SMEs, following the European Commission (2003) definition (Commission Recommendation 2003/361/EC) of SMEs as firms who had between 11 and 250 employees and either a turnover below 50 million euros or a balance sheet total below 43 million euros, as mentioned in table 3. The dataset covers the period from 2013 to 2023. Firms with missing financial information or inconsistent data were excluded to ensure robustness in the analysis. The accounts used are from the balance sheet and income statement, considering Portuguese GAAP, ensuring standardization and comparability of financial information across companies and years.

Table 2 displays the descriptive statistics of the variables in the analysis. The Debt to Asset Ratio has a mean of 0.2278 and a median of 0.1774. The logarithm of total assets, used as a proxy for firm size, ranges from 7.854 to 23.139, with a mean of 14.638, reflecting the presence of firms with different asset scales.

The growth rate exhibits a mean of 0.0715, with values from -0.974 to 36.523 and a standard deviation of 0.3257 , capturing considerable variation in firms' expansion dynamics. The current ratio, an indicator of liquidity, has a mean of 2.4581 and a standard deviation of 4.3584 , suggesting dispersed liquidity positions across firms.

Both tangibility and debt structure have means of 0.2758 and 0.3589 , respectively, and show observations between 0 and 1, which is consistent with the type of ratio used. The asset turnover ratio presents a mean of 1.4432 and a wide range up to 83.598 , indicating substantial differences in operational efficiency. The return on assets (ROA) varies from -15.941 to 26.505 , with a mean of 0.0373 , capturing both losses and profitable outcomes among the sample firms.

Table 2*Descriptive Statistics of the Variables*

Variables	Mean	Max	Min	Medium	Standard Errors
Leverage	0.2278	83.439	0	0.1774	0.4028
Ln (Total Asset)	14.638	23.139	7.854	14.608	1.3128
Growth Rate	0.0715	36.523	-0.974	0.0325	0.3257
Current Ratio	2.4581	650.89	-192.76	1.6803	4.3584
Tangibility	0.2758	1	0	0.22013	0.22798
Debt Structure	0.3589	1	0	0.25223	0.3704
Asset Turnover Ratio	1.4432	83.598	0	1.1369	1.5548
ROA	0.0373	26.505	-15.941	0.0288	0.16001
Dummy COVID	0.1818	1	0	0	0.3857
Dummy War	0.1818	1	0	0	0.3857

Note: The Log of Total Assets (Ln Total Asset) is expressed in natural logarithms. The variables "Dummy COVID" and "Dummy War" are binary (0 or 1).

Table 3*Criteria for SMEs*

	Number of employees	Turnover or Total Balance Sheet (€)
Small Firms	Greater than 10 and lower than 50	>10 000 000
Medium Firms	Greater than 51 and lower than 250	>50 000 000 or >43 000 000

Note: For medium firms Turnover must be less than 50 million € and Total Balance Sheet must be less than 43 million €
Source: Portugal 2020

Chapter 6 - Results

To analyze the determinants of SMEs' capital structure during the COVID-19 pandemic and the Ukraine war, a Feasible Generalized Least Squares (FGLS) regression was estimated, addressing heteroskedasticity and serial autocorrelation issues identified in preliminary tests. Table 4 presents the estimated coefficients, standard errors, t-values, and p-values for the explanatory variables in the model. The estimated Feasible Generalized Least Squares model is applied to a balanced panel dataset of 13,746 firms over 11 years (N = 151 206 observations).

Table 4
Results of the FGLS regression

Independent Variable	Coefficient	Standard Error	t-value	p-value
<i>Intercept</i>	-0.1355	0.0188	-7.22	<0.001 ***
<i>Ln (Total Asset)</i>	0.0197	0.0013	15.63	<0.001 ***
<i>Growth Rate</i>	0.0173	0.0011	15.02	<0.001 ***
<i>Current Ratio</i>	0.00034	0.0001	3.11	0.0019 ***
<i>Tangibility</i>	0.2238	0.0048	46.98	<0.001 ***
<i>Debt Structure</i>	0.0081	0.0014	5.81	<0.001 ***
<i>Asset Turnover Ratio</i>	0.01	0.0007	15.03	<0.001 ***
<i>ROA</i>	-0.2758	0.003	-90.59	<0.001 ***
<i>Dummy COVID</i>	0.02996	0.0015	20.47	<0.001 ***
<i>Dummy War</i>	-0.0121	0.0018	-6.78	<0.001 ***
<i>R²</i>	0.0677			
<i>N</i>	151 206			

Note: Significance levels: p < 0.01 (***), p < 0.05 (**), p < 0.10 (*).

6.1 Interpretation of the Results

The regression results provide empirical evidence on the determinants of SMEs' capital structure, emphasizing the role of macroeconomic shocks as decision variables. The COVID-19 pandemic and the Ukraine war are incorporated as control variables (dummy variables), while firm-specific factors act as independent explanatory variables to account for structural differences among firms.

The analysis confirms that the COVID-19 Dummy has a positive and statistically significant coefficient. Based on the regression results, the COVID-19 Dummy is associated with an increase in leverage, indicating that SMEs significantly expanded their debt levels during the pandemic. This result aligns with previous studies (Carletti et al., 2020; Corredera-Catalán et al., 2021), which highlight the role of government-backed loans, debt moratorium, and credit guarantees in easing access to external financing. Given the severe cash flow disruptions caused by lockdown measures and declining demand, many SMEs were forced to seek external financing to sustain operations. The availability of state-supported credit facilities and deferred loan payments mitigated liquidity constraints, making debt financing a more viable option. Consequently, SMEs increased their reliance on leverage, reflecting the effectiveness of government interventions in preventing mass insolvencies. However, while these measures provided short-term relief, they also contributed towards higher debt accumulation, raising concerns about firms' post-pandemic financial sustainability (Helmersson et al., 2021).

In contrast, the Ukraine-Russia War Dummy shows a decrease in leverage, suggesting that SMEs reduced their leverage during the war period. The geopolitical instability, rising inflation, and higher interest rates associated with the war (Afunts, Cato & Schmidt, 2024; Kalemli-Özcan et al., 2018) likely discouraged firms from taking on additional debt, leading to a more cautious approach to financing decisions. Unlike the COVID-19 crisis, where government-backed financial support programs encouraged debt accumulation, the Ukraine war led to tighter monetary policies, increasing borrowing costs and making credit less accessible.

Additionally, heightened economic uncertainty and market volatility probably made firms prioritize liquidity preservation over investment. The results suggest that SMEs adopted a more risk-averse financial strategy, potentially postponing investments and reducing leverage to avoid exposure to volatile credit conditions (Hodula et al., 2024).

These contrasting effects highlight how firms respond differently depending on the nature of the crisis. While the COVID-19 pandemic led to a surge in external financing due to liquidity support measures, the Ukraine war induced financial conservatism, as firms faced higher borrowing costs and an unpredictable macroeconomic environment. This distinction underscores the importance of crisis-specific financial policies and the role of external conditions in shaping SMEs' capital structure decisions.

Regarding independent variables, the firm size ($\ln(\text{Total Assets})$) coefficient is positive and statistically significant, confirming that larger firms tend to have greater leverage, in line with previous empirical findings (Rajan & Zingales, 1995; Frank & Goyal, 2009). Similarly, the growth rate has a positive impact on leverage, suggesting that firms experiencing higher growth rely more on external financing. The current ratio presents significant positive coefficient, indicating that firms with higher liquidity levels may still engage in debt financing, although the magnitude of this effect is limited.

The tangibility variable shows the largest positive effect on leverage, reinforcing the argument that firms with more tangible assets can secure higher debt levels due to better collateral availability (Myers, 1984; Lemmon & Zender, 2010). Debt structure is also positively associated with leverage, confirming that firms with a higher proportion of short-term debt tend to have greater overall leverage.

Conversely, profitability (ROA) is negatively related to leverage, which is consistent with the pecking order theory, as more profitable firms tend to use internal funds instead of external debt (Rajan & Zingales, 1995). Finally, the asset turnover ratio exhibits a positive effect, indicating that firms with higher operational efficiency are more likely to take on debt, as they can generate sufficient returns to cover financing costs.

Chapter 7 – Conclusion

The capital structure debate began with Modigliani and Miller (1958), who argued that financing choices are irrelevant in perfect markets. Later theories introduced real-world imperfections: the Trade-Off Theory (Kraus & Litzenberger, 1973; Modigliani & Miller, 1963) emphasizes balancing tax benefits and bankruptcy costs, while the Pecking Order Theory (Myers & Majluf, 1984) highlights the role of information asymmetry in firms' financing preferences. Agency theory (Jensen & Meckling, 1976) adds further insight into conflicts between stakeholders. Despite their limitations, these frameworks remain relevant for understanding how SMEs make financing decisions, particularly during periods of economic crisis.

Our objective was set to examine how the capital structure of SMEs was affected by two major recent crises: COVID-19 pandemic and Ukraine-Russia war. By Using a panel dataset covering the period from 2013 to 2023 and applying a linear regression model with firm-level financial ratios and dummy variables for those events, the study aimed to identify shifts in SMEs leverage.

Our results align with the main capital structure theories by showing that SMEs adjust their financing strategies according to the nature and intensity of the crisis they face. During the COVID-19 pandemic, firms increased their leverage, which is consistent with both the Pecking Order Theory and the Trade-Off Theory. The Pecking Order Theory suggests that in times of uncertainty, firms prefer debt over equity, especially when internal funds are insufficient. Given the availability of public guarantees and loan standstills, debt became a relatively accessible and less risky option. Similarly, the Trade-Off Theory explains this behavior by highlighting that when the perceived risk of financial distress is reduced, such as through government support, firms are more likely to increase their debt levels to benefit from tax shields.

In contrast, during the Ukraine war, leverage declined. This outcome reflects a more cautious financial posture, likely driven by increased uncertainty, inflation, and tighter monetary conditions. Such behavior is, once more, in line with the Pecking Order Theory, as firms avoided new debt due to greater risk aversion and limited access to favorable financing. These findings are also supported

by empirical studies, which show that in times of high macroeconomic uncertainty, SMEs tend to preserve liquidity and postpone investment, rather than increase their debt exposure.

Overall, the observed differences in leverage between the two crises confirm that SMEs do not adopt a one-size-fits-all strategy. Instead, they respond flexibly to external conditions, which reinforces the relevance of theoretical frameworks that account for information asymmetry, financial constraints, and crisis-specific dynamics.

Control variables such as profitability, firm size, tangibility, and liquidity remained statistically significant and consistent with theoretical expectations and prior empirical literature. These findings reinforce the validity of traditional capital structure theories namely the trade-off theory and the pecking order theory, even in periods of severe economic disruption.

This dissertation attempts to highlight how crisis-specific policies and firm-level characteristics influence financing behavior and underscores the need for differentiated policy tools to address the vulnerabilities of smaller firms.

Nonetheless, it is important to mention that the sample is restricted to Portuguese SMEs, which may limit external validity. In addition, the quantitative approach does not capture managerial perceptions or qualitative aspects of financing decisions. Further research could compare results across countries or examine how crisis-related debt affects firms in the long term.

Overall, the findings of this dissertation shed light on how SMEs adapted their capital structure when faced with two events that significantly impacted the economy recently, COVID-19 and Ukraine-Russia war.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of my written thesis, *Impact of COVID-19 and war in Ukraine on Portuguese SME's*, ChatGPT by OpenAI was used for the following tasks:

- Clarifying theoretical concepts related to capital structure;
- Rewriting and improving grammar in English for selected sections;
- Providing guidance on statistical concepts and tests used in the econometric analysis;
- Assisting in the development and interpretation of R code for regression models;
- Explaining econometric corrections for heteroskedasticity, autocorrelation, and cross-sectional dependence;
- Suggesting representative academic references on capital structure theories and empirical studies;

with the prompts used listed at the end of the document in the Prompts List section. After using this tool, I reviewed and edited the content as necessary, and I take full responsibility for the content of the work presented.

I also declare that I am aware of and respect the Artificial Intelligence Rules of Conduct of (...).

Prompts List

Below is a summary of representative prompts used during the writing process with AI-assisted tools. These prompts were used for language, structural and coding assistance, and for identifying key literature. All outputs were reviewed and edited before inclusion in the final document.

"Can you explain the trade-off theory of capital structure in academic terms?"

"Rewrite this paragraph using formal academic English."

"Suggest a formal way to describe the methodology used in a panel data regression."

"Give examples of how to phrase acknowledgements in a thesis."

"Simplify this sentence while maintaining an academic tone."

"Show how to describe fixed effects vs random effects in an econometric model."

"What are the most cited papers about capital structure determinants in SMEs?"

"Suggest good academic references about firm leverage during economic crises."

"Summarize the key ideas of Rajan and Zingales (1995) in simple academic English."

"What is the Breusch-Pagan test and how is it used in panel regression?"

"Give an example of R code for testing heteroskedasticity in panel data."

"How to correct for autocorrelation and heteroskedasticity in panel regression in R?"

"Example of R code for a linear regression with clustered standard errors."

"What packages in R are best for panel data analysis?"

"Generate R code for running a fixed effects model using plm package."

"Explain the difference between between, fixed, and random effects estimators in panel data."

"Suggest a way to describe the variable transformation process in R."

Bibliography

- Afunts, G., Cato, M., & Schmidt, T. (2024). Inflation expectations in the wake of the war in Ukraine. *Journal of Behavioral and Experimental Economics*, 113, 102303. <https://doi.org/10.1016/j.socec.2024.102303>
- Akerlof, G. A. (1970). The market for “lemons”: Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3), 488–500. <https://doi.org/10.2307/1879431>
- Barclay, M. J., & Smith, C. W. (1995). The Maturity Structure of Corporate Debt. In *Source: The Journal of Finance* (Vol. 50, Issue 2).
- Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics*, 97(3), 470–487. <https://doi.org/10.1016/j.jfineco.2010.02.009>
- Carletti, E., Oliviero, T., Pagano, M., Pelizzon, L., & Subrahmanyam, M. G. (2020). The COVID-19 Shock and Equity Shortfall: Firm-level Evidence from Italy. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3613343>
- Corredera-Catalán, F., di Pietro, F., & Trujillo-Ponce, A. (2021). Post-COVID-19 SME financing constraints and the credit guarantee scheme solution in Spain. *Journal of Banking Regulation*, 22(3), 250–260. <https://doi.org/10.1057/s41261-021-00143-7>
- Dudley, E. (2007). *Testing Models of Dynamic Trade Off Theory*. <https://ssrn.com/abstract=1030119>
- European Commission. (2003). Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises. *Official Journal of the European Union*, L 124, 36–41. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003H0361>
- Fama, E. F., & French, K. R. (2002). Testing Trade-Off and Pecking Order Predictions about Dividends and Debt. *Source: The Review of Financial Studies*, 15(1), 1–33. <https://www.jstor.org/stable/2696797>

- Fama, E. F., & Jensen, M. C. (1983). Separation of Ownership and Control. *Source: The Journal of Law & Economics*, 26(2), 301–325.
- Fan, J. P. H., Titman, S., & Twite, G. (2012). An international comparison of capital structure and debt maturity choices. *Journal of financial and Quantitative Analysis*, 47(1), 23–56. <https://doi.org/10.1017/S0022109011000597>
- Francisco Sogorb Mira, & José Lopez Gracia. (2003). ESTUDIO DE LOS DETERMINANTES DE LA ESTRUCTURA DE CAPITAL DE LAS PYMES: APROXIMACIÓN EMPÍRICA AL CASO ESPAÑOL. *REVISTA ESPAÑOLA DE FINANCIACIÓN Y CONTABILIDAD*, 32, 615–619.
- Franco Modigliani, & Merton H. Miller. (1958). THE COST OF CAPITAL, CORPORATION FINANCE AND THE THEORY OF INVESTMENT. *The American Economic Review*, 48, 261–297.
- Franco Modigliani, & Merton H. Miller. (1965). The cost of capital, Corporation Finance, and the Theory of Investment: Reply. *The American Economic Review*, 524–527.
- Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure \$. *Journal of Financial Economics*, 67, 217–248.
- Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management*, 38(1), 1–37. <https://doi.org/10.1111/j.1755-053X.2009.01026.x>
- Harris, M., & Raviv, A. (1991). The Theory of Capital Structure. *The Journal of Finance*, 46(1), 297–355.
- Helmersson, T., Mingarelli, L., Mosk, B., Pietsch, A., Ravanetti, B., Shakir, T., & Wendelborn, J. (2021). *Corporate zombification: post-pandemic risks in the euro area*. https://www.ecb.europa.eu/press/financial-stability-publications/fsr/special/html/ecb.fsrart202105_01~f9b060744e.en.html
- Hodula, M., Janku, J., & Malovana, S. (2024). Geopolitical Risks and Their Impact on Global Macro-Financial Stability: Literature and Measurements. Czech National Bank Working Paper No. 8/2024

Hovakimian, A., Opler, T., & Titman, S. (2001). The Debt-Equity Choice. *JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS*, 36(1).

<https://doi.org/10.1787/edfbca02-en>.

Jeanne-Claire Patin, Matur Rahman, & Muhammad Mustafa. (2020). Impact of Total Asset Turnover Ratios on Equity Returns: Dynamic Panel Data Analyses. *Journal of Accounting, Business and Management (JABM)*, 27(1).

Kalemli-Ozcan, S., Laeven, L., & Moreno, D. (2018). *DEBT OVERHANG, ROLLOVER RISK, AND CORPORATE INVESTMENT: EVIDENCE FROM THE EUROPEAN CRISIS*.
<http://www.nber.org/papers/w24555>

Kraus, A., & Litzenberger, R. H. (1973). A State-Preference Model of Optimal Financial Leverage. In *Source: The Journal of Finance* (Vol. 28, Issue 4).

Lemmon, M. L., & Zender, J. F. (2010). Debt capacity and tests of capital structure theories. *Journal of financial and Quantitative Analysis*, 45(5), 1161–1187. <https://doi.org/10.1017/S0022109010000499>

Lilas Demmou, Guido Franco, Sara Calligaris, & Dennis Dlugosch. (2021). *Liquidity shortfalls during the COVID-19 outbreak: Assessment and policy responses* (OECD Economics Department Working Papers, Vol. 1647. <https://doi.org/10.1787/581dba7f-en>

Michael C. Jensen, & William H. Meckling. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3(4), 305-360.

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

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

Myers, S. C., & Majluf, N. S. (1984). *CORPORATE FINANCING AND INVESTMENT DECISIONS WHEN FIRMS HAVE INFORMATION THE INVESTORS DO NOT HAVE*, *Journal of Financial Economics*, 13(2), 187–221

- OECD (2021), OECD Economic Outlook, Volume 2021 Issue 1, No. 109, OECD Publishing, Paris,
- Ozkan, A. (2001). Determinants of capital structure and adjustment to long run target: Evidence from UK company panel data. *Journal of Business Finance and Accounting*, 28(1–2), 175–198. <https://doi.org/10.1111/1468-5957.00370>
- Rageth, K., Stulz, R. M., & Fahlenbrach, R. (2020). How Valuable is Financial Flexibility When Revenue Stops? Evidence from the COVID-19 Crisis. 34 (11), 5474–5521. <http://www.ssrn.com/abstract=3586540><http://www.ssrn.com>
- RAJAN, R. G., & ZINGALES, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data. *The Journal of Finance*, 50(5), 1421–1460.
- Ross, S. A. (1977). DETERMINATION OF FINANCIAL STRUCTURE: THE INCENTIVE-SIGNALING APPROACH. *Bell J Econ*, 8(1), 23–40. <https://doi.org/10.2307/3003485>
- Serrasqueiro, Z. & Nunes, Z. M. (2011). The Capital Structure of Portuguese SMEs: Empirical Evidence Using Dynamic Panel Data. *Transformations in Business & Economics*, 10(1), 62–80.
- Shyam-Sunder, L., & C. Myers, S. (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics*, 51(2), 219–244. [https://doi.org/10.1016/S0304-405X\(98\)00051-8](https://doi.org/10.1016/S0304-405X(98)00051-8)
- Smith, C. W., & Warner, J. B. (1979). On financial contracting: An analysis of bond covenants. *Journal of Financial Economics*, 7(2), 117–161. [https://doi.org/10.1016/0304-405X\(79\)90011-4](https://doi.org/10.1016/0304-405X(79)90011-4)
- TITMAN, S., & WESSELS, R. (1988). The Determinants of Capital Structure Choice. *The Journal of Finance*, 43(1), 1–19. <https://doi.org/10.1111/j.1540-6261.1988.tb02585.x>