



Does Digital Transformation Reflect the Adjustment of Capital Structure?

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DECLARATION

I hereby confirm that my thesis, ***(Does Digital Transformation Reflect the Adjustment of Capital Structure?)*** is the result of my own independent research and has not been submitted in whole or in part to any university for credit toward another degree or certification.

All concepts and materials that I did not develop have been properly acknowledged and referenced. This work adheres to the academic and ethical research guidelines established by ***University of Doha for Science and Technology***

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ABSTRACT

The thesis examines the influence of digital transformation on capital structure adjustment in non-financial firms' enterprises throughout Europe (Southern Europe, Western Europe and Eastern Europe). It seeks to evaluate the impact of digital adoption on enterprises financial decision-making and capital structure adjustment by integrating essential control variables like firm characteristics (Firm size, tangibility, profitability, non-debt tax shield), board characteristics (board size, board gender diversity and board meeting), and macro-economic characteristics (GDP and Inflation). The analysis utilizes a dataset of 514 non – financial enterprises selected from an original pool of firms across 51 European countries from 2010 to 2023. The data was obtained from Refinitiv Eikon (LSEG) platform to guarantee relevant and reliable financials and digital transformation metrics. Equally important, a comprehensive analytical methodology is utilized to assess the relationship between digital transformation and capital structure adjustment, incorporating descriptive analysis, correlation analysis, Panel GMM regression analysis, and Robustness of results. The Panel GMM technique allows to account for endogeneity and to evaluate the dynamic adjustment organizational undertaking in response to digital improvements. The outcomes indicated that digital transformation had a positive and substantial effect on capital structure adjustment, as positive relationships between board size, frequency of board meetings, tangibility, and firm size. However, profitability, board gender diversity, and inflation all had negative effects; and the non-debt tax shield and GDP were found to be statistically insignificant. In addition, this thesis advances significant insights into company management, policymakers and researchers, clarifying the effects of digitalization on financial resilience and decision making within the European non-financials' firms. It also utilizes publicly accessible data on digital transformation adoption and firm non-financial, which could not reflect internal corporate strategies and difficulties. Because the

thesis is restricted to European businesses, it is less applicable to non-financial firms' and may not be fully applicable to firms with different economic contexts or legal environment; as well as its timeframe may not represent long-term patterns in the CSA and digital usage. For future studies, it is highly recommended to incorporate supplement qualitative findings perspectives from case studies. The results can be more broadly applicable if the research is conducted on a worldwide scale. Moreover, it is important to evaluate how various sectors adjust to the digital transformation in financial decision-making industry and to carry on specific studies in regard.

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Chapter 1: Introduction

1.1. Introduction

Over the last few decades, digital transformation has redefined the operational and strategic frameworks of enterprises across all sectors ([Vial, 2021](#)). The digital transformation, henceforth referred to as DT, is aged upon the world economy. As technology advances, companies are progressively incorporating digital tools, automation, and data-driven decision-making into their operations to improve effectiveness and competitiveness ([Rehan et al., 2023](#)). Digital transformation has altered how an organization functions, reflecting the shift from traditional organizational logic to a new digital organizing logic ([Yoo et al., 2010](#)). Global attention has been drawn to digital transformation's financial impact on businesses and the previously unheard-of prospects it offers. Digital transformation affects the entire organization, including internal and external users, particularly in relation to business models, operational procedures and user experiences which connect the entire supply chain for goods, services and consumption ([Tabrizi et al., 2019](#)). European companies, propelled by swift technical progress and legislative structures that promote digital integration, have experienced substantial transformations in their finance approaches ([Van Veldhoven & Vanthienen., 2022](#)).

Digital transformation is defined as continuous process of leverage emerging digital technologies, such as block-chain, social media and cloud computing, artificial intelligence, mobile technology the Internet of things (IOT) and big data analytics to accomplish business model innovation and facilitate value co-creation ([Wu et al., 2021](#)). It strengthens companies' access to diverse funding options, diminishes information asymmetry, and enhances operational efficiencies—elements that enable adjustments in capital structure ([Luo & Jiang, 2022](#)). In addition, it has generally motivated expanding information availability, boosting information

conversion rate, and decreasing information asymmetry, as well enhancing corporate governance capabilities and business performance ([Henriette et al., 2015](#)).

Industry integration and the emergence of new industry sector are fueled by digital transformation, which promotes the development of digital goods and services ([Almeida et al., 2020](#)), and helps non-financial firm to enhance their skills and processes while boosting value creation, distribution and capture ([Corsaro et al., 2022](#)). Digital transformation demonstrates how it affects their financial operational and innovation performance well as the examination of their mechanisms ([Qi et al., 2022](#)).

To achieve high quality, sustainable development and to improve non-financial performance, digital transformation is strategically crucial. Economic effects study on the integration of digital and real economics is supported both theoretically and empirically by the impact that digital transformation has on their non-financial performance ([Thi Viet Nguyen et al., 2021](#)). Non-financial performance can be greatly improved by raising the caliber of internal control through digital transformation, which strengthens companies' access to diverse funding options, diminishes information asymmetry, and enhances operational efficiencies—elements that enable adjustments in capital structure ([Luo et al., 2022](#)); so companies in Europe may enhance their leverage ratios to maintain competitiveness and ensure sustained long-term growth, especially in sectors undergoing a swift technological transition.

Finding the ways for firms to successfully manage the difficulties of incorporating digital technologies while preserving their conventional organizational structure is beneficial, and it is imperative to evaluate this landscape by better comprehending digital transformation ([Sarang et al.](#)) in non-financial enterprises.. Businesses can make sure to maintain the advantage of their current procedures while implementing the adjustments required for digital expansion by concentrating on striking a balance between the need.

1.2. **Background**

The background study helps in investigation how firms might modify their financial plans to meet the need of digital innovation while preserving their financial stability and competitiveness in a business climate that is changing quickly. This change has significantly impacted company models and productivity, and it is also pivotal in determining corporate financial decisions, especially regarding capital structure ([Nguyen-Thi-Huong et al., 2023](#)). The integration of digital technologies impacts risk management, investment plans, and financing requirements, ultimately affecting how companies reconcile debt and equity within their financial frameworks ([Zhao et al., 2024](#))

Non-financial organizations in a variety of industries are being reshaped by digital transformation, which has a significant impact on their capital structure, operating strategies and long-term viability. This transformation has an impact on several important areas for such organizations, as working capital management innovation performance and the adoption of sustainable practices. Equally important, corporate governance, organizational culture and risk management must be rethought in light of digital transformation, necessitating a flexible approach to strategic decision-making financial planning ([Siswanti et al., 2024](#)), stressing the fact that such transformation describes how traditional businesses strategically integrate many facets of digital technology to boost their profitability and competitiveness ([Tu et al., 2022](#)). Digital transformation refers to changes in society and industry in regards to the usage of digital technologies, where company's strategies are necessary for firms to embrace the impact of it and to drive better operational performance, thus improving the production techniques, optimizing work task operations and enterprise management effectiveness with lower cost, and increasing their capacity to handle financial difficulties ([Wang et al., 2022](#)).

For the non-financial firm's capital structure adjustment is a crucial component of financial strategy, especially when they adjust to shifting internal demands and market conditions. This

idea describes how businesses realign their debt and equity balance to achieve financial objectives, like maximizing profitability, preserving financial flexibility and lowering capital costs. According to research, a company's financial structure has significant impact on how well it overall performs, particularly when it comes to changes in the economy and new business model ([Kedzior et al., 2020](#)). Businesses constantly modify their capital structure in dynamic economic situation to maintain their competitiveness financial stability and ability to finance expansion or innovation plans ([Kristofik et al., 2022](#)), where numerous factors such as changes in the company model, market condition, and firm specific elements as liquidity and development potential, have an impact on this adjustment process ([Khan et al., 2024](#)). However, studies on rising economy show that businesses frequently have particular difficulties when adjusting their capital structure because they have to take into consideration both internal and external financial demand ([Črnigoj et al., 2009](#)).

To ensure that the result accurately reflects the connection among variables of interest, control variables are incorporated into the analysis to account for any influences on the dependent variable. For instance, three factors: firm characteristics (Firm size, tangibility, profitability, Non-debt tax shield), board characteristics (board size, board gender diversity and board meetings), and macro-economic characteristics (GDP and Inflation) may be taken when examining the capital structure adjustment in order to avoid confusing the connection among company and financial choices and its success ([Bilgin, 2023](#)).

Income, assets and workforce are main factors for any firm size describing an organization. Economics of scale, more market power, and improved financial flexibility are frequently advantages of larger businesses that affect their capital structure and profitability ([Udayasankar, 2008](#)). Tangible assets, that businesses own, are usually described by tangibility, as machinery real estate and equipment, so the company debt level and profitability may be impacted by the collateral that tangible assets offer for loans, leading to the fact that businesses with more

physical assets are more accessible to obtain finance ([Campello, 2007](#)). One important measure of a company's performance and financial health is profitability. It shows how businesses can turn a profit in relation to their income, equity or assets. Profitability businesses are more likely to reward shareholders, pay off debt and reinvest in their operations ([Akhmadi et al., 2020](#)). Corporate financial decisions are impacted by non-debt tax shield ([Sarang et al.](#)), since firms can take advantage of tax saving through NDTs instead of debt to acquire tax deductions, thus companies with higher depreciation charges typically utilize less debt ([Gabrielli, 2023](#)).

Board efficacy in governance and decision making are influenced by its size. Larger boards could result in inefficiencies or problems with coordination, even though they might bring a variety of viewpoints. On the other hand, smaller boards function more effectively but lack varied input ([Jenter et al., 2023](#)). However, a well-structured setting for strategic decision-making performance evaluation and compliance assurance are usually offered by regular board meetings. These are crucial for discussing corporate policies and handling any problem pertaining to governance ([Schwartz-Ziv et al., 2013](#)). More important, the diversity of board gender is improving organizational performance and becoming more widely acknowledged. Businesses with more female board members typically make well decisions, perform better financially and are more innovative ([Al-Shaer et al., 2016](#)).

One of the main macro-economic characteristics is GDP which is the total value of goods and services generated in a nation. It is frequently employed to determine whether an economy is expanding or contracting. Economic growth is typically indicated by a rise in GDP, whereas a recession is shown by a fall ([Shiferaw, 2023](#)). The rate at which prices for goods and services generally increase, reducing purchasing power, is referred to as inflation. Hyperinflation can cause economic instability, yet moderate inflation is a sign of developing economy. Inflation and GDP have complicated connection and if inflationary pressure is not well controlled, it may impede economic progress ([Xiong, 2023](#)).

1.3. Problem Statement

There are several important concerns highlighted through looking at difficulties encountered by non-financial firms undergoing digital transformation and capital structure adjustment. Non-financial companies frequently have trouble adjusting their financial plans and organizational structure to meet the need of digital innovation.

In past studies, firms faces problems undergoing the DT, which effects the business structure, as it clearly emphasizes and influences on business culture and leadership role in order to fill knowledge gap in miscellaneous areas ([Vial, 2021](#)). One of the major problems among financial and digital strategies is a significant obstacle that may result in inefficiencies and losing any chance to create value. Businesses may experience financial difficulties if the capital structure adjusted is not adaptable enough to meet demand of digital transformation ([Han, 2024](#)). Firming resistance to change, especially in traditional non-financial sectors that are used to legacy systems and practices, is another difficulty. Culture changes and leadership are often necessary for implementing digital transformation, which can cause conflict if the company's structure is inflexible or management and staff are not in agreement ([Westerman et al., 2011](#)). Furthermore, it could be challenging for non-financial businesses to obtain enough financing for digital projects without changing their capital structure adjustment that might have a serious effect on their long-term stability and financial health ([Fang et al., 2024](#)).

Focusing on such challenges and problems in non-financial organizations embracing digital transformation are the main objective of this thesis, especially those modifying their capital structure to satisfy the expectations of digital transformation in corporate environment, such as organizational resistance to change financial burden of investing in digital assets, the integration of financial and digital strategies, and the flexibility needed in capital structure adjustment to foster innovation. These issues are especially implanted in the European countries approaching digital transformation, and particularly shaped by a variety of economic

situations, regulatory framework and focus on sustainability. Consequently, it is important to address the intricacies of digital transformation and foundation for future research.

1.4. Research Question

- How does digital transformation influence capital structure adjustment in non-financial European companies?
- What role do control variables play in the relationship between the capital structure adjustment and digital transformation?

These inquiries clarify the intricacies of how organizational and financial dynamics are altered by digital transformation, giving investors and shareholders a greater understanding of how it affects traditional businesses' performance and decision-making procedures.

1.5. Research Aim and Objective

The main aim of this thesis is to fill the gap by examining how digital transformation impacts the capital structure adjustment, with a particular implementation on the control variable characteristics like firm characteristics (firm size, tangibility, profitability, non-debt tax shield) board characteristics (board size, board gender diversity and board meeting), macro-economic characteristics (GDP and inflation) that are influencing the process. The European countries are frequently used as the main point of research connected to the non-financial firms. The thesis looked at the effect of digital transformation on dynamic capital structure adjustment and located that it may improve a company transparency for the management team and investors, reduce information asymmetry and increase financial adaptability which hasten the pace of capital structure change ([Ye Chen et al., 2023](#)).

Non-financial firms partially adapt to their capital structure adjustment. According to the previous literature, non-financial firms and environmental elements both have substantial capacity to explain the best possible capital structure adjustment. The result shows that the shift

to an ideal capital structure is accelerated by digital transformation ([Frain et al., 1996](#)). It will be more definitive to show how digital transformation affects the rate of capital structure adjustment without focusing on non-financial enterprises from various countries. Examining how digital transformation effects on non-financial companies is equally significant for future research might be conducted in this area ([Aniūnas et al., 2009](#))

Moreover, only a few studies have explored the interplay among the digital transformation and control variables. They mainly focus on technology transformation to handle liability, equity allocation, risk management impacts, investment plan and financing decisions. The main objective of this thesis is to identify distinct and unexplored avenues by which digital transformation might increase capital structure adjustment, make simplified measures, and endorse the attitude of constant enhancement in European non-financial firms ([Zhao, et al., 2024](#)).

1.6. Contribution

This thesis enhances the current literature by providing a thorough examination of the relationship between digital transformation and capital structure adjustment, particularly in the European market. It fills the gap in several ways; firstly, it diverges from prior studies that concentrated exclusively on the financial determinants of capital structure by including the impact of technical improvements, thereby offering new perspectives on how digitalization affects corporate finance decisions ([Teo Piaw et al., 2024](#)). The results provide significant insights for policymakers, corporate executives, and investors, highlighting the critical role of digital transformation in financial decision-making. Secondly, this is the first empirical evidence that the relationship between digital transformation and the adjustment of capital structure is controlled by firm characteristics (firm size, tangibility, profitability, and non-debt tax shields), board characteristics (board size, board gender diversity, and board meetings) and macroeconomic variables (GDP and inflation). The existing literature has not fully studied how

these control variables interact with digital transformation and capital structure adjustment within non-financial firms. The lack of integration of these gaps creates a space for understanding the specific difficulties and opportunities for European non-financial organizations.

This thesis provides insight for the future managers and investors to offer practical insights into the way that structural changes and digital transformation affect European non-financial companies, especially when it comes to control factors. The findings provide management with recommendations on how to improve performance and efficiency by streamlining firm's structure and coordinating them with digital transformation projects. The thesis helps in highlighting the comprehension of how particular modification, impacted by digital transformation might enhance competitive advantage, resources allocation and decision making.

After the result analysis is clarified for future investors how these structural changes impact value creation and business performance, it will highlight how control variables affect and how well digital transformation initiatives work. Investors may choose which businesses are most suited to use digital transformation to achieve long-term growth and profitability by being aware of these characteristics. They can also evaluate possible returns and strategic alignment within the European market.

1.7. Research limitations

This thesis specially focuses on non-financial firms in European countries (Southern Europe, Western Europe and Eastern Europe), which are highly impacted by digital transformation and operate in sectors which constitute a significant portion of the European economy. As noted in the target section, there is a lack of comprehensive research on non-financial companies in European countries, especially about the function of control variables in digital transformation. This limitation enables a thorough analysis of how organizational and operational strategies in

sectors are impacted by digital transformation. Moreover, this delineation is helpful within distinct and technological advancements, and ability to generalize the findings in non-financial firms. By focusing on limitations, we emphasize future research to discover the cross-sectional analysis of digital transformation on different industries.

1.8. Thesis Structure

The structure of this thesis is designed to identify the efficient investigation on the effect of digital transformation on capital structure adjustment (CSA) performance in non-financial European firms. Each chapter builds the earlier one laying an inclusive base for considering the complicated connection among the digital transformation and capital structure adjustment (CSA).

Chapter 2 Literature Review: The implications of digitalization on non-financial firm structure are examined in the literature review along with the numerous theories and models that handle digital transformation. It also examines capital structure adjustment and how businesses reach to outside influences, especially through digital transformation. Control variables are also observed in this chapter. To offer contextual insights into difficulties and achievements of digital transformation in this region, research centered on European non-financial firms are reviewed as well. The chapter ends with a list of gaps and aims in the literature that this thesis seeks to address.

Chapter 3 Methodology: It starts with an explanation of why the selected research design is the best method for addressing research issues. The sample strategy is covered in full, along with the inclusion criteria and the method used to choose the firms for the thesis. Methods for gathering secondary data are explained as the reason behind their choice. Data analysing methods will be used, including Correlation Matrix, the Panel GMM regression analysis, Descriptive statistics and Robustness of Results. The function of control variables in the thesis

is specifically discussed along with how they will include guaranteeing a sophisticated comprehension of the connection among capital structure adjustment and digital transformation.

Chapter 4 Results and analysis discussion: Evaluate the findings considering the body of exiting literature. This chapter discusses the results or contradicts accepted theories and models by contrasting the findings with those of earlier studies, with emphasis on how research advances the knowledge of digital transformation on non-financial firms. It also explains the findings considering the literature that was examined in chapter 2, examines the results as confirming or refuting earlier research, and discusses the findings of theoretical ramifications for comprehending digital transformation on non-financial firms. Finally, the chapter describes useful suggestions for managers and investors.

Chapter 5 Conclusion: In this chapter, the thesis provides an overview of the secondary research findings. It summarizes the research with contribution to the areas and highlights how advances knowledge of European non-financial firm digital transformation and how the structure changes. The chapter defines how these findings can be applied to actual situations. It also implements the consequences through a grasp of the effects of digital transformation on capital structure adjustment and control variables in European non-financial enterprises.

1.9. Conclusion

Chapter 1 established the fundamental knowledge of how digital transformation is gradually integrated into the organizational strategies performance across the European non-financial firm and moved to shareholder anticipations. This chapter also highlights the problems that most businesses encounter like coordinating financial plans with digital objectives, getting past firm opposition, and adjusting technologies need without compromising financial security. The importance of control variables in influencing these dynamics is also covered in this chapter by laying the groundwork for this research. This chapter also investigates these connections

and offers insightful information that may help in the next chapters. Finally, it navigates the challenges of digital transformation, laying the goal of investigation of this relationship with businesses, and offers insightful information for future implementation.

Chapter 2: Literature Review

2.1 Introduction

To provide an insightful knowledge of digital transformation and its impact on the capital structure adjustment of non-financial firms in European countries, Chapter 2 provides a thorough assessment of previous studies. This literature study, which examines important hypotheses and relevant control variables, provides the basis for the thesis. The hypotheses describe expected relationships between capital structure adjustment and digital transformation to guide the experimental investigation.

2.2 Theoretical Background

2.2.1 Trade-off Theory

According to the trade-off theory hypothesis, businesses try to weigh the advantage of debt against the disadvantages of possible non-financial hardship. By potentially lowering operational risks and increasing non-financial sustainability, digital transformation can have impact on this balance and enable businesses to more dynamically modify their capital structure (Duwe & Duwe, 2022). This theory considers a big public company allowed to use outside equity to fund projects, proving that easing a funding constraint is not the reason for making bank lenders more stringent. Instead, the company aims to expand bank debt capacity because the primary source of external funding market debt results in bankruptcy expenses, keeping outside equity in tax disadvantage (Hackbarth et al., 2007).

According to the trade-off theory, businesses may modify their capital structure to fund digital expenditures in relation to digital transformation, balancing the possible advantages of better operating efficiency against the risk of higher debt (Serrasqueiro & Caetano, 2015). The trade-off argument states that business weighs the advantages of the debt like tax benefits may

increase the disadvantage of non-financial hardships. This maintenance can be affected by digital transformation which may lower operation risks and expenses and increase the appeal of debt ([Sdiq & Abdullah, 2022](#)). In capital structure higher leveraged companies may be able to reduce their overall cost of capital and take use of tax shield, both of which have a beneficial effect on the trade-off theory ([Cekrezi, 2013](#)). By assuming leverage benefits, trade-off favors the use of leverage to build capital structure, and by weighing the advantage of interest payments against the expenses of issuing debt, the ideal degree of leverage is reached; for debt-tax shield reduce anticipated tax liabilities and increase after tax cash flows debt is seen favorability in the financial world ([Jahanzeb et al., 2013](#)).

Larger firm sizes typically have reduced risk, which makes them more willing to take on debt, so that the boards size may directly benefit company stability through improving the board of directors. Inflation has a direct impact on capital structure because debt rises with inflation. Businesses are less likely to experience non-financial hardships; so, they can afford to take more debt. The tax advantage is diminished by NDTs like depreciation, and increasing GDP can have a favorable effect on capital by lowering the Cost of Debt and assessing to better non-financial market.

The physical assets can improve a company capacity to take on loan by reducing the likelihood of bankruptcies which benefits capital structure ([Ahmadimousaabad et al., 2013](#)). The tradeoff theory grown more intricate over the last 50 years, particularly in capital structure model of the company that aim to depict genuine aspects of a firm surroundings ([Fama et al., 2002](#)). Companies with a healthy capital structure are not always stressed by profit, so they may focus on broader governance goals, such as diversity. Supported by financial stability, more frequent and focused board meetings also improve the quality of decision making. ([Sarang et al., 2021](#)). Trade-off theory states that businesses should take on as much debt as possible to optimize the benefits of debt tax shielding and reduce the risk of bankruptcy ([Kraus et al., 1973](#)).

2.2.2 Pecking-Order Theory

According to this theory, businesses prioritize their funding sources based on the least amount of work, favoring internal funding initially debt second and equity issuance as a last resort. By improving an organization capacity internal money through higher efficiency and advancement, digital transformation can have an effect on the pecking order by reducing its dependence on external funding ([Kiliç & Sakalsiz, 2023](#)).

Moreover, theoretically, businesses favor internal funding over external financing, as well as debt over equity when external non-financial is required. Through its effects on non-financial decisions made by firms, digital transformation affects this indication. Due to increased operational effectiveness, firms undergoing the digital transformation may create more internal money and become less dependent on outside finance ([Adair & Adaskou, 2015](#)).

This thesis demonstrates the relationship among the pecking order theory in firms with different attributes in the context of digital transformation. The impact shows that larger businesses might still favor internal finances, and technological developments that provide more flexibility and effectively which seeking outside capital ([Castro et al., 2015](#)). According to this theory, businesses prefer inside finance due to irregularity and steer clear of outside of finance. This may result is less expensive finance and more stable capital structure adjustment ([Frank et al., 2020](#)). Equally important, this theory states that businesses lack a clear capital structure and the capital structure of it is outcome of long-term, hierarchical funding choices ([Myers, 1984](#)).

The size of the firm can influence non-financial decisions, where larger companies can obtain external money more easily that has a positive effect on non-financial performance. The expenditure outside of finance is simply seen as an impacted inflation which could make inside finance more appealing. Increasing profitability typically results in a decrease in requirements for outside funding, which may neutrally affect. The expenses of outside finance can impact

on economic growth which could favorable effect of non-financial performance ([Nuñez Huerta, 2021](#)).

The board size may not have a major influence on non-financial performance, thus indicating a neutral impact. The NDTs have a largely neutral impact because of their limited direct influence on non-financial performance. The tangibility have beneficial influence on capital structure performance because they can lessen information and offer additional non-financial possibilities ([Dissanayake et al.](#)). One of the most features of corporate finance is the pecking order theory of capital structure ([Li-Ju Chen et al., 2011](#)). However, there is no desired capital structure, according to the theory itself, and companies usually prioritize internal finance, debt and equity when selecting capital.

Mainly, companies that prioritize inside finance may have a smaller amount of cash available for diversity programs, according to this theory. The results shows that the effect of board meeting and gender diversity maybe neural since the businesses may put non-financial security ahead of diversity initiatives ([Elmoursy, 2020](#)). The current studies specifically aim to examine if financing decisions are impacted by a financing approach that results in either from a hierarchical order of funding sources section, which can be explained by the existence of information asymmetry and the costs of various financing sources, or from the balance between debt shield and bankruptcy costs related to debt. In this regards, this thesis aim to determine if the financing behavior of SME aligns with the predication of the pecking order theory and the positive correlation among debt and firm size was found, which is also consistent with the tenets of pecking order theory ([Serrasqueiro et al., 2015](#)).

2.2.3 Agency Theory

One of the first theories in management and economics literature is the agency theory ([Daily et al., 2003](#)). This theory investigates the disputes among competing interests that exist between

both the shareholder and the leadership of any corporation. Enhancing openness and knowledge flow through digital transformation can help reduce agency difficulties and influence capital structure choice to better line with the need of shareholder ([Chen & Yu, 2011](#)), that the differences that arise between the managers and shareholders are examined by this theory. It implies that businesses may experience a decrease in information asymmetries and agency costs if they implement digital innovation in the context of digital transformation. Because of the increased governance and openness, this may result in more effective decision-making and possible decrease in the cost of capital ([Fang et al., 2023](#)). According to this theory, hoe disputes are demonstrated among owners and managers, as well as CEO and creditors, and this can influence how businesses finance their operations ([Jensen et al., 2019](#)).

The premise that the debt will help reduce the agency costs among both the managers and shareholders, aligning interest and improving the business performance, is supported by the proof and agency theories. This is especially important since businesses are using debt to fund their digital transformation which can lower the operation effectiveness and increase value overall ([Hoang et al., 2021](#)). In capital structure, debt can lower agency theory by putting manager's interests in line and lowering their diplomacy. This raises the company worth and lessens the possibility of unnecessary administrative expenditure ([Ahmed et al., 2023](#)).

A better monitoring and control system can lower agency costs and as a result a larger firm size, which will positively influence the decision of the company size. The bigger board may lower the agency expenses and enhance the supervision, and the increases in inflation may boost the agency expenses and possibly affect business decisions. In addition, enhancing profitability has a favorable effect by balancing management which lowers the agency expenses. Higher GDP is associated with better economic performance, collaterals may be provided by tangible assets which lower the agency expenses, and NDTs are present which may have a determinable effect on the use of debt ([Khandelwal et al., 2023](#)).

According to this theory, a diverse viewpoint through gender diversity can have a positive impact on this agency by enhancing oversight the board meeting. More gender diversity in boardrooms can improve dialogues and decision making procedures in meetings since different perspectives lessen prejudices and widen the range of decisions that can be made ([João et al., 2023](#)). Idea of agency and developed two strategies in their individuals publications believed that the institutional framework is the cause of the agency problem, related to incentives; yet, the main notion underlying both views is comparable, principle-agent problem as a result of the compensation decision and believed that the issue is not limited to the company but also affect society as a whole ([Ross, 1973](#)).

When the future is uncertain, the theory assumes a contractual arrangement among the principle and the agent, which can be covered either for finite or infinite periods. Contracting is supposed to solve the agency problem in practice, where there are several obstacles, including knowledge asymmetry, rationality, fraud and transaction costs. Although they have limited involvement in the company, shareholders are mainly interested in maximizing their return. Director's responsibilities are restricted to overseeing managers; their future roles are often uncertain. Finally, this theory disregards the managers skills and views them as opportunistic actors. ([Panda et al., 2017](#)).

<i>Table 1: Summary of Expected impacted based on the previously mentioned theories</i>			
Variables	Trade-off theory	Pecking-order theory	Agency Theory
Digital transformation	+	+	+/-

The idea is to assess the impact of the variables using data from earlier research. Table 1 summarizes the favorable, positive, negative or neutral effect of these variables on the pecking order theory, agency theory and trade-off theory. These assessments are compiled from

previous studies that examine how businesses optimize their capital structure decisions within the context of these theoretical frameworks.

2.3 Previous studies and Hypothesis Development

Digital transformation significantly influences a firm's capital structure adjustment, as the transition from equity to debt is driven by enhanced operational performance and reduces the risk of bankruptcy. Research has indicated that digital transformation expedites the alteration of capital structure adjustment, enabling organizations to respond more swiftly to both favorable and unfavorable changes ([Olaniyi et al., 2024](#)).

Equally important, digital transformation may accelerate capital structure adjustments by enhancing the stock market or modernizing the bond market. The idea here is that information asymmetry can be mitigated through such transformation ([Liu & Liu, 2023](#)), resulting in a dynamic capital structure adjustment and emphasizing the shift from equity to debt as enterprises enhance operational efficiency and reduce expenditures ([Xue et al., 2024](#)).

To establish the theoretical framework and create hypotheses, this section looks at how variables interrelated. It will investigate how digital transformation affects capital structure adjustment by using the control variables and decisions, then it can be put forth by evaluating previous research. Table 2 outlines the sample size and the use of secondary data gathering, where a representative sample of businesses going through digital transformation is chosen. Regression analysis and structural equation modeling of statistical tests are used to evaluate the relationships between variables from earlier studies; as these approaches guarantee validity and reliability.

Table 2 Selected literature review

Authors	Countries	Year	Sample Size	Methodology	Results
(Aly, 2020)	South Africa, India Brazil	(9-year 2013-2021)	950	The impact of digital transformation on Productivity Simple Regression	Shows positive connection between Productivity and digital transformation. It shows that countries focus on digital technology for enhancing the organization performance
(Małkowska et al., 2021)	European countries (EU members)	Year (2019-2022)	Sample size 500+firms	Regression analysis is not specifically mentioned in this paper. Rather, it employs the TOPSIS approach and cluster analysis to assess and rank the degree of digital transformation in EU countries.	Results disparity in digitization among EU member' states, highlighting the necessity of focused strategies to encourage regional technology development coherence.
(Teng et al., 2022)	China	Year (2018-2020)	500 plus non-financial firms	Regression of structure equation modeling	In firms, digital transformation promotes sustainable development.
(Haryanti et al., 2023)	Brazil	Year (2020-2023)	80+ firms	Logistics and multi liner regression analysis. Measurement the probability of enterprises going through digital depending on infrastructure and market factor	The results shows that there is the positive connection among the digital analysing and market factors infrastructure

(Masoud et al., 2023)	US, Germany, France, UK, Canada, India, China, Japan (8 countries)	Year 3 (2019-2023)	246 firms	Multiple Regression analysis Impact of digital transformation in customer experiences in IT sector	The results show that their digital transformation in customer experiences in IT sector with implementing IT innovations and increasing the organizational performances.
(Ye Chen et al., 2023)	China	11 Year (2011-2021)	3,855 firms	Dynamic panel regression analysis of digital transformation	The pace of capital structure adjustment is greatly accelerated by digital transformation.
(Egala et al., 2024)	Emerging Economy Countries (not specified)	years 2020-2023)	472 Employees Small-Medium size organizations	Structural equation modeling connection among the organization performance and digital transformation (Linear Regression Analysis)	Results show that there is a positive impact of digital transformation on organization performance.
(Liu et al., 2024)	Singapore and China	Year (2019-2020)	Sample size 100	Aggregate Regression analysis impact of digital transformation on the Firm performance.	Results shows that digital transformation effects on various aspect of firm performance

Collectively, prior research highlights that digital transformation improves many facets of organizational performance and contributes to economic growth in diverse industries and geographical areas. The impact, however, varies based on operational demands and sector-specific conditions. For instance, non-financial organizations often exhibit higher debt ratios, which operate under different structural and regulatory requirements ([Kuč et al., 2021](#)).

In the context of non-financial institutions, digital transformation refers integrated digital technologies into every aspect of corporate activities, radically altering the way these companies run and provide value to their clients. It entails utilizing big data analysis, blockchain, IOT, AI and other innovation ([Wang et al., 2024](#)). Digital transformation affected the non-financial institutions in terms of risk reduction, client interaction, operational procedures and organizational non-financial performances ([Fang et al., 2024](#)). By removing boundaries between people, firms and objects, digital transformation is upending companies across all industries, developing new goods and services as well as effective business practices. These developments are taking place in every industry and among all kinds of organizations. But they all have three things in common: the capacity to change non-financial firm models and procedures, the empowerment of employees' creativity and efficacy, and the customization of consumer experience. Businesses require an outcome-driven technologically enabled digital business platform in order to do this ([Schwertner, 2017](#)).

Given the profound implications of digital technology on nearly every field of a firm's internal and external environment, the development and execution of digital transformation has become critical for many pre-digital enterprises. These enterprises are well-established businesses in conventional sectors like retails, auto and non-financial services, facing an existential danger from the internal economy despite being profitable in the per digital era ([Ross et al., 2016](#)). The digital transformation strategy has no end in sight, and its focus is continuously shifting. It must be updated and rewritten on a regular basis to enhance fresh insights and lessons from ongoing execution projects, in order for it to develop new method and techniques ([Chanias et al., 2019](#)). In non-financial organizations, digital transformation can be only accomplished by integrating technological resources to improve company procedures and consumer interactions. This transition can also be terminated by a rise in underground finance activities as corporations leverage technological advances to deliver indirect non-financial product and services ([Zhang,](#)

[2023](#)). Driven by developments in digital advancement, the transformation in non-financial firms entails a deep and rapid shift in company and commercial operations, procedures and skills. Usually there are several factors contributing to this transition – digitalization, digital optimization, and digital transformation – where new companies and value offerings are created to satisfy customer needs ([Papathomas et al., 2023](#)). Depending on how digital transformation is used to improve and circumvent established non-financial institutions, it may result in either an increase or decrease in shadow banking activity. The process frequently involves integrating digital solutions to enhance consumer interaction, operational efficiency and overall firm performance ([Carroll et al., 2023](#)).

Capital structure of a company, both internal and external, along with non-financial ratios, plays a key role in supporting the company's growth and operational expansion. The debt-to-equity ratio, or capital structure, contributes significantly to this development ([Khandelwal et al., 2023](#)). The revenue and sustainability of the company are positively impacted when the cost of the capital is lower than the average rate of return ([Ali et al., 2020](#)). Due to their more recognized market position and perceived reliability, larger companies are typically offered more options when seeking capital. In contrast, smaller enterprises tend to have greater access to finance institutions. Non-financial versatility is often supported by an equitable capital structure that combines debt and equity, allowing businesses to adapt to ever-changing demands without relying heavily on leverage ([Teseema, 2024](#)). Shareholders wishing to maintain control over the business may resist issuing new equity, as it could dilute their ownership shares. As a result, they often prefer debt funding ([Luo et al., 2022](#)). To meet regulatory compliance, non-financial institutions frequently restructure debt while issuing equity. These adjustments can influence overall business performance, and companies may modify their debt ratios based on the performance data from previous quarters ([Tian et al., 2024](#)). Using non-financial leverage to balance debt and equity is an integral part of this

procedure, which also push the organizational non-financial structure to satisfy operational and market demands ([Thi Viet Nguyen et al., 2021](#)). Both type of firms consistently work to improve their capital structure in order to adapt to shifting market circumstances ([Mansour et al., 2023](#)). Selecting the appropriate capital structure is vital to a company's success, as one of its main goals is to increase the wealth of its shareholders. In other words, maximizing net income or earnings per share requires careful capital structure planning ([Jensen et al., 1979](#)). The company's capital structure adjustment impacts its performance, often measured by comparing total debt to return on assets. When evaluating agency theory, emphasis is placed on how debt influences profitability ([Kebewar, 2013](#)).

Several factors influence capital structure decisions in non-financial firms, including market performance, asset composition, company size, and profitability. These firms typically establish a debt-to-equity ratio to manage capital expenses while maintain non-financial mobility ([Dabi et al., 2023](#)). Ensuring balance and stability in the capital structure requires routinely evaluating the debt-to-equity ratios and adjusting the mix of debt and equity in line with market trends, operational conditions, and capital requirements ([Corsaro et al., 2022](#)). Both debt and equity are included in the capital structure; thus, depending on a firm's non-financial objective, the percentage of market dynamics and strategy might change, since each company balances its loans and bonds in different methods.

2.3.1 Digital transformation and capital structure adjustment (CSA)

Digital transformation profoundly impacts the capital structure adjustment of non-financial enterprises. Empirical research has shown that digital transformation expedites the rate of modification in capital structures achieving optimal levels. The acceleration is mostly accomplished through improved financial flexibility, thus allowing companies to react more rapidly to market fluctuations and funding requirements ([Chen et al., 2023](#)). The influence of digital transformation and capital structure adjustment varies depending on several factors such

as ownership type, asset's size and credit cycles. Non-state owned firms and established organizations exhibit more significant impact, particularly in areas characterized by substantial sophisticated financial technology infrastructures ([Yang et al., 2025](#)). Nonetheless, it is important to acknowledge that no studies have been conducted on this subject matter. Research suggests that variables such as company's size and its capital structure do not substantially affect its inclination towards digital transformation ([Bela et al., 2024](#)). Digital transformation may expedite changes in capital structure adjustment by enhancing stock liquidity or advancing the bond market, but its imbalance may be improved through such transformation ([Jiang et al., 2021](#)). These adjustments are essential for utilizing technology breakthrough for strategic non-financial planning and adjusting competition demands ([Han, 2024](#)). Increased operational expenses, such as system maintenance and training, are also affected by digital transformation. Consequently, businesses must promptly modify their capital structure to meet the requirements of digital transformation. They can raise funds through debt and equity financing, as well as other means to upgrade their assets and technological advancement ([Han, 2024](#)). Over time, digital transformation has emerged as a key driver of corporate development, encouraging innovation in operational models and significantly increasing investment in research and development (R and D) and technology. To maintain competitive advantage in the digital era, businesses are increasingly investing in R and D, including the creation of new products, the enhancement and optimization of existing products, and the efficient transformation of production processes. These initiatives require substantial financial support and play a significant role in shaping organizational capital structure adjustments ([Iansiti et al., 2014](#)).

The competitive landscape and market environment have been significantly reshaped by digital transformation, which also indirectly influences the dynamic adjustment of capital structure. Market rivalry increases due to the influence of digital technology requiring prompt market

adaptation, modification, and ongoing tweak of corporate structure and tactics. These shifts in the market environment have a direct impact on businesses' ability to withstand risk and to remain profitable. Businesses that successfully use digital transformation increase operational effectiveness and lower their expenses, thus greatly increasing profitability ([Almeida et al., 2020](#)). As discussed previously, digital transformation has a profound effect on capital structure organizing the businesses, allowing the shift from equity to debt, which is simply motivated by improved operational performance and lower threat bankruptcy. However, it is still unclear how such transformation influences the adjustment of the capital structure. Enterprises adopting digital technologies may quicken the transition process; as for start-up businesses, digital transformation might encourage the firms to spend in research and development to pursue company's structure transformation. And this is shown experimentally through digital transformation effecting the organizational risk taking ([Tian et al., 2022](#)). It is discussed that the early phase of a good investment in research and development for digital transformation may not be particularly successful because it may lead to cost loss of the capital ([Zhai et al., 2022](#)). Firms may engage in digital transformation methods, but they might infrequently see a matching increase in their profit, resulting in a negative non-financial impact. The term digital transformation strategy, a key component of business model formula, refers to new managerial logic of introducing digital technology into the businesses' whole structure, entailing additional value and utilizing new innovations ([Jiang et al., 2021](#)).

Businesses typically need to modify their capital structure to facilitate digital change. This involves reevaluating and reorganizing their non-financial resources and investments. Effective capital structure modifications enable the efficient allocations of resources, investment in technology and mitigation of non-financial risks associated with digital transformation ([Warner & Wäger, 2019](#)). As firms undergo digital transitions, their operational models evolve, significantly influencing capital structure adjustments. This transformation also prompts

companies to revise their border model ([Libert et al., 2016](#)). Businesses now investing more in research and development, technological upgrades, and workforce training due to the rise of technologies such as big data, cloud computing, and the internet of Things (IOT). These initiatives, while non-financial in nature, involve flexibility and foresight in capital structure planning. A lack of adaptability in capital structuring is a main obstacle to successful digital transformation ([Warner & Wäger, 2019](#)).

Digital transformation also enhances the disclosure of both stocks and equity information. By reducing information asymmetry, it builds shareholders trust and decreases the cost of equity financing for businesses. Organizations that deliver accurate and timely non-financial information allows shareholders to make more informed decisions, increasing transparency and lowering perceived investment risks ([Ren et al., 2023](#)). By enhancing the bond market or stock liquidity, digital transformation may also accelerate changes in the capital structure. The main idea is that digital transformation helps reduce information imbalances ([Jiang et al., 2021](#)). This enhances the flow of capital structure adjustment data, lowers perceived risk for investors, and reduces funding costs for non-financial firms ([João et al., 2023](#)). Furthermore, digital transformation allows enterprises to deliver more reliable and promptly available non-financial information, improving transparency and supporting more informed shareholder plans ([Ren et al., 2023](#)). Prior studies show that digitization improves the speed and efficacy of decision-making processes for capital allocation ([Nuñez Huerta, 2021](#)). Through new technologies, non-financial firms can reduce asymmetries, enhance transparency, and increase access to financial data ([Culata & Gunarsih, 2012](#)). These improvements lower equity borrowing costs and increase a firm's responsiveness to external economic pressures and competition ([Elmoursy, 2020](#)). Consequently, digital transformation enhances financial resilience and enables more agile capital structure adjustments. Based on this discussion and a review of relevant literature, the hypothesis of this thesis is proposed as follows:

H1: There is a positive connection between digital transformation and capital structure adjustment

Capital structure adjustment benefits significantly from digital transformation, as it radically changes how firms operate and engage with their stakeholders. Companies can increase production and efficiency by automating procedures and integrating advanced technologies, which streamline workflows and reduce costs. Data analytics support decision-making related to non-financial conditions of capital structure. Moreover, digital transformation increases organizational agility, enabling firms to promptly adjust to market developments and grasp fresh prospects.

Finally, through these adjustments, businesses can better manage their non-financial and investment portfolios. By increasing non-financial performance and decreasing financial costs through improved transparency, digital transformation supports more effective capital structure optimization. Integrating digital transformation into financial strategies is expected to remain critical for maintaining competitive advantage and attaining optimal capital structure adjustment as the digital economy develops.

2.4 Conclusion

An examination of previous studies and hypothesis confirms that digital transformation has a profound effect on non-financial firms, particularly in enabling capital structure adjustment ([Sarang et al.](#)). Previous research has demonstrated how digital transformation improves decision-making, operational efficiency and resource allocation—allowing businesses to modify capital structure in response to changing market conditions. Nonetheless, there is a substantial knowledge vacuum about the precise processes by which digital transformation influences the structure modifications of non-financial enterprises within European context. This chapter also examined the theoretical studies surrounding control variables, CSA and DT, forming a strong

foundation for comprehending the connection between these components and their effects on non-financial firms by putting pertinent theories into practice.

By evaluating how digital transformation can handle non-financial issues and offering a tactical framework for CSA, this thesis aims to fill that gap. This not only improves the understanding of DT in European settings but also offers practical advice to businesses aiming to achieve long-term growth through digital innovation. Emphasizing earlier research, digital transformation reaffirms its vital role in promoting firm transformation and emerges as a crucial facilitator of constructive and adoptable changes in CSA of non-financial organizations.

Chapter 3: Methodology

3.1. Introduction

This chapter analyzes the correlation between digital transformation and capital structure adjustment, incorporating control variables such as firm characteristics (e.g., firm size, tangibility, profitability, non-debt tax shield), board characteristics (e.g., board size, gender diversity, board meetings), and macro-economic characteristics (e.g., GDP and Inflation). Among European countries (Southern Europe, Western Europe, and Eastern Europe), non-financial firms are frequently used as the focus of research related to capital structure. The thesis utilizes data from the Refinitiv Eikon database, covering the years 2010 to 2023. The research examines a meticulously selected sample of 514 firm drawn from an original pool of 8,149 to ensure data integrity. This chapter outlines the analytical methodologies and structured research strategy used to evaluate the sustainability and non-financial performance of European enterprises.

3.2. Sample Used

This methodology uses data from the Refinitiv Eikon (LSEG) database to examine the relationship between digital transformation and capital structure adjustment, while integrating control variables in the European non-financial organizations from 2010 to 2023. The research examines a total of 51 companies. [Table 3](#) provides the details of sampling procedures, covering a variety of methods used by European businesses.

The regional breakdown is as follows:

- Western Europe: population of 1925, sample size of 205
 - Eastern Europe: population of 1903, sample size of 37
 - Northern Europe: population of 2738, sample size of 250
 - Southern Europe: population of 2379, sample size of 22
- The total population is 8945, with a final sample size of 514 firms.

<i>Table 3: Sampling Procedure</i>			
Sampling Procedure	Number of Countries	Total Population	Sample size
1: Western Europe	9	1925	205
2: Eastern Europe	10	1903	37
3: North Europe	15	2738	250
4: Southern Europe	17	2379	22
Total	51	8945	514

This dataset facilitates comparative study among the European regions due to variation in enterprise population and sample size, allowing for the analysis of variations in digital transformation and capital structure adjustments across diverse non-financial markets. Although the dataset is structured for geographic coverage, it is crucial to ensure that the sample size adequately represents firm diversity to yield strong, generalizable findings.

3.3. Research Model

Panel GMM regression is applied to investigate the impact of digital transformation on the adjustment of capital structures and address the issue of endogeneity ([Bajaj et al., 2020](#); [Zhang et al., 2022](#); [Zhu et al., 2024](#)). Endogeneity may result from measurement errors, omitted variable bias, or simultaneity, leading to biased and inconsistent estimates if inadequately addressed. The Generalized Method of Moments (GMM) is a statistical technique that yields efficient and unbiased parameter estimations in situations where conventional assumptions may be invalid. In the context of capital structure adjustment, GMM helps to address any endogeneity between explanatory variables and error terms, hence providing more dependable outcomes. This method has been used to assess endogeneity issues examining dynamic capital structure adjustment, resulting in robust conclusion ([Thanh Nguyen et al., 2024](#)).

Recent research employing dynamic panel data models and GMM estimation techniques has found that capital structure adjustment has a lagged influence on non-financial firm

performance, with business model innovation serving as mediator in this relationship (Tian et al., 2024).

To assist non-financial executives in understanding the variables influencing capital structure adjustment decisions, this thesis lags all control variables by one year. This research evaluates the impact of Digital transformation on capital structure adjustment.

The economic model is given below in equation 1

$$CapStAd(i, t) = \alpha + \beta_1 CapStAd(i, t - 1) + \beta_2 DT(i, t) + \beta_3 FSize(i, t) + \beta_4 Tang(i, t) + \beta_5 NTShield(i, t) + \beta_6 Prof(i, t) + \beta_7 BSize(i, t) + \beta_8 BGD(i, t) + \beta_9 BMeet(i, t) + \beta_{10} GDP(t) + \beta_{11} Inf(t) + \varepsilon \dots\dots\dots (1)$$

Where;

- CapStAd: Capital Structure Adjustment toward the optimal capital structure.
- DT: digital transformation measured through data text mining via the ratio of keyword occurrences to the total word count in the annual report.
- Fsize: Firm Size which is measured by the natural logarithm of total assets.
- Tang: Tangibility which is measured by fixed assets divided by total assets.
- NTShield: non-debt-tax shield which is measured by accumulated depreciation divided by total assets.
- Prof: Profitability measured through return on assets
- BSize: Board Size and measured by the number of members on board.
- BGD: is board gender diversity and measured by the percentage of females on board.
- BMeet: is a board meeting and measured by the number of board meetings in a year.
- GDP: is the growth in the Gross Domestic Product.
- Inf: is inflation and measured by the percentage of consumer price index.
- i,t: i denotes entities, and t indicates the time.
- a: It's constant.
- β_1 - β_{10} : are coefficient of selective variables in the model

This equation model offers a thorough framework for examining the impact of internal and external factors on a firm's capital structure adjustment. Incorporating variables associated with digital transformation, organizations featuring firm characteristics, board characteristics and macro-economic, enables practitioners to gain a deeper understanding of the determines of capital structure adjustment in non-financial firms. Such insights are essential for making educated financial decisions and formulating successful corporate governance practices

3.4. Measurement of Variables

Accurate measurement of digital transformation allows firms to make better strategic decisions, aligning digital projects with business objectives and industry characteristics ([Zhao, et al., 2024](#)). [Table 4](#) outlines the measurement of the variables, using the extant literature to ascertain the sources employed in previous research quantifying these variables.

Table 4: Means of Measuring Variables

Variable	Measurement	Reference	Source
Dependent Variable			
Capital structure adjustment	Net change in leverage ($\text{Act Lev}_{i,t} - \text{Act Lev}_{i,t-1}$)	(Khalaf, 2017)	Refinitiv Eikon
Independent Variable			
Digital Transformation	Content Analysis (Data Text mining of annual reports), using the ratio of keyword occurrences to the total word count in the annual report	(Teo Piaw et al., 2024)	Annual Report
Control Variable (Firm Characteristics)			
Firm Size	The natural logarithm of total Assets	(Saldi et al., 2023)	Refinitiv Eikon
Tangibility	(Total Assets – Current Assets) / Total Assets	(Jain et al., 2024)	Refinitiv Eikon
Non-Debt – Tax Shield	Accumulated depreciation to total asset	(Lebow & Rudd, 2006)	Refinitiv Eikon
Profitability	Return on Assets	(Rachmawati, 2021)	Refinitiv Eikon
Control Variable (Board Characteristics)			
Board Size	Number of directors on board	(Joseph et al., 2023)	Refinitiv Eikon
Board gender diversity	Female percentage on board	(Martinez-Jimenez et al., 2020)	Refinitiv Eikon
Board Meeting	Total number of board meetings	(López-Cabarcos et al., 2023)	Refinitiv Eikon
Control Variable (Macro-Economic Characteristics)			
Inflation	Consumer price Index (CPI)	(Marcoulides & Raykov, 2018)	World Bank
GDP	Growth in Gross Domestic Product	(Öztekin, 2015)	World Bank
Authors Analysis			

The measurement of the variables in [Table 4](#) guarantees the model reliability for each variable. Each indicator is derived from pertinent sources, illustrating the robust correlation between digital transformation and capital structure adjustment in non-financial firms. The table emphasizes the strength of the correlation between digital transformation and capital structure adjustment by concentrating on these variables' measurements.

3.5. Model Development

3.5.1. Dependent Variables: Capital Structure Adjustment

The variable $Ldev_{i,t}$ measures the deviation of the actual leverage from the previous leverage ratio. It is calculated by deducting the lagged actual leverage ratio from the current leverage ratio for the current year ([Hovakimian et al., 2011](#)). This metric is vital for creating a comprehensive non-financial organizational strategy and influences organizational value and success ([Meshack et al., 2022](#)). In financial research, specifically concerning capital analysis, the term “net change in leverage” denotes the fluctuation in a firm leverage ratio over a designated time frame. In this context, leverage is generally described as the ratio of debt inside a company capital structure adjustment, commonly assessed by metrics such as debt to equity or debt to assets ratio. The formula $Act Lev_{i,t} - Act Lev_{i,t-1}$ estimates the net change by deducting the leverage ratio at the beginning of the period (time t-1) from the leverage ratio at the end of the period time ([Iqbal-Hussain et al., 2015](#)). This method determines the variations in leverage between two successive time points, offering insight into the evolution of a firm debt level in relation to its equity or asset over time ([Khalaf, 2017](#)).

3.5.2. Independent variable: Digital Transformation

The magnitude of a firm's digital transformation can be calculated by taking the cumulative frequencies of digital revolution terms in its annual report. Natural language processing (NLP) was employed to identify and extract key terms related to digital transformation, include: “big

data”, “artificial intelligence”, “online finance”, “digital economy”, “mobile internet”, “IOT”, “cloud computing”, “multi-purpose security computing”, “business intelligence”, and “virtual reality”. The presence of such terms is taken to reflect a firm’s commitment to digital transformation ([Bharadwaj et al., 2013](#)). The digital transformation variable in this thesis was created using a data mining methodology, namely by looking at how frequently relevant term appears in the annual reports. This was done by measuring the ratio of keyword occurrences to the total number of words in the annual report ([Gurumurthy et al., 2020](#)).

Analysis of the non-financial firm business annual reports with text mining tools has become a promising method for assessing digital transformation. indicators are frequently created based on the meaning of digital related phrases. For example, a study reviewing an annual report of Chinese ‘A-listed’ non-financial firms from 2009 to 2017 used this method to examine the influence of digital transformation on innovation quality ([Lilst et al., 2023](#)). This method provides an objective and quantitative assessment of a firm’s digital transformation initiatives, serving as a data-driven indicator revealing how organizations prioritize and incorporate digital strategies into their operations ([Chen et al., 2023](#)). The resultant variable functions as a significant input for evaluating the effects of digital transformation on the adjustment of the capital structures of non-financial companies in Europe.

3.5.3. Control Variables

In non-financial firms, control variables are crucial for evaluating performance indicators that are not solely financial. A study investigating the influence of management control variables on non-financial performance indicators, such as employment satisfaction and performance efficiency, must consider variables such as firm size, industry type and market conditions. Controlling these variables guarantees that the observed impact are authentically attributable to the management control systems instead of external sources ([Ismail et al., 2023](#)). There are

three characteristics of control variables spotted: firm characteristics, board characteristics and macro-economic variables.

3.5.3.1 Firms Characteristics

Firm Size

The capital structure adjustment process is significantly influenced by the size of the business itself, as larger organizations are often met with cheaper financing costs, enhanced access to capital markets, and less information asymmetry relative to smaller enterprises ([Rasiah & Kim., 2011](#)). Large corporations often possess more varied income sources, superior credit ratings, and robust affiliations with financial entities, enabling them to modify their capital structures more effectively in reaction to market dynamics ([Wahhab et al., 2021](#)). Equally, smaller enterprises face elevated borrowing expenses, financial limitations, and reduced adaptability in modifying their debt-to-equity ratios. Considering these dynamics, firm size is typically represented by total assets since this value offers a distinct and measurable indication of a company's entire scale and resource capacity. The total assets value reflects a firm's ability to generate capital and withstand financial disruptions, serving as a dependable metric for assessing capital structure modifications for enterprises of varying sizes ([Nuñez Huerta, 2021](#)). This research has employed total assets to analyze the influence on financial leverage, capital expenditure and diversification strategies. The selection of a proxy can profoundly affects the results of empirical analysis, highlighting the necessity of choosing measures that closely correspond with the research objectives presented ([Dang et al., 2018](#)). Firm size refers to the magnitude of the organization, quantified in previous research study using formula "total assets carried by the firm" ([Saldi et al., 2023](#)).

Tangibility

Tangibility significantly influences the capital structure adjustment process since enterprises with a greater ratio of tangible assets generally have improved access to secured loan funding (İltaş, & Demirgünes, 2020). Tangible assets, including property, plant, and equipment (Adair et al.), function as collateral, explanatory risk for lenders and decrease borrowing expenses. Consequently, companies with significant asset tangibility are more inclined to modify their capital structures by augmenting leverage as necessary as they may obtain loans with greater ease (Camisón et al., 2022). A larger tangibility ratio may signify an enhanced ability to obtain debt financing, as tangible assets are considered collateral (Yallwe et al., 2014). In non-financial entities, especially within asset-intensive sectors such as manufacturing and logistics, the tangibility ratio is an essential measurement. An increased ratio of tangible assets can improve a firm's borrowing potential, as these assets may serve as collateral for loans. A diminished tangibility ratio indicates a requirement on intangible assets, potentially affecting investing strategies and risk management approach (Camisón et al.). In contrast, companies with reduced tangibility—such as those in the technology or service industry, may be subject to elevated borrowing costs due to insufficient collateral, complicating their ability to change debt levels effectively (Vengesai, 2023). Tangible assets affect the pace of capital structure adjustment since businesses with substantial collateral can more rapidly realign their leverage in reaction to market changes or desired capital structures (Alves & Lourenço, 2022).

Profitability

Profitability considerably impacts a firm's capital structure adjustment since more profitable enterprises often depend less on external loans and modify their capital structures at a slower rate than less profitable firms. The pecking-order hypothesis suggests that enterprises with greater profits choose to finance their operations through internal funds (retained earnings) instead of incurring more debt, hence minimizing the necessity for frequent capital structure

modifications ([Jayathilaka, 2020](#)). In contrast, less profitable enterprises, which may have greater financing limitations, are more inclined to modify their capital structures by augmenting leverage to satisfy funding requirements ([Zambrano Farías et al., 2022](#)). Likewise, profitability influences the rate of adjustment, as organizations with robust revenues may swiftly diminish excessive debt levels while aiming for an optimal capital structure, whereas financially weaker enterprises may encounter difficulties in making prompt modifications due to liquidity limits. Consequently, profitability serves as a dual function in capital structure modification, affecting both the trajectory and pace of financial decision-making ([Puspitaningtyas et al., 2018](#)).

In studies concerning non-financial organization, the measurement return on assets (ROA) is often utilized as control variables. This practice accounts for the intrinsic profitability of enterprises while analysing the impact of other variables. By controlling ROA, previous research can well isolate and comprehend the influence of characteristics, such as leverage and liquidity on non-financial firm performance. It also examines that the impact of leverage on non-financial firm valuation that may incorporate ROA as a control variables to ascertain that the observed associations are not only attributable to fluctuations in profitability ([Tailab, 2014](#)).

Non-Debt Tax Shield

Non-debt tax shields (NDTSs), such as depreciation, diminish a firm's taxable revenue without reliance on debt funding. Dividing depreciation charges by total assets, offering a uniform metrics across non-financial firms ([Deitiana et al., 2016](#)), and examining factors influencing capital structure adjustment, NDTS is frequently utilized as control variables to discern its impact on leverage decisions. Researchers might enhance their comprehension of correlation between the tax shield and debt utilization through NDTS ([Teja, 2019](#)). Previous research indicates that increased depreciation as part of NDTS may drive enterprises to choose reduced debt level due to tax advantages related with depreciation ([DeAngelo et al., 1980](#)). Companies with elevated NDTSs are less motivated to depend on interest tax deductions from debt,

potentially hindering capital structure modifications towards more leverage ([Nasution et al., 2017](#)). In contrast, enterprises with lower NDTs may more actively modify their capital structures by raising debt to capitalize on interest tax shielding, hence expediting the adjustment process towards their target leverage ratio ([Hristov et al., 2023](#)).

3.5.3.2 Board Characteristics

Board Size

The size of the board is typically measured by the total number of directors serving a non-financial firm. This clear numerical metric provides a basis for analyzing the relationship between board size fluctuations and diverse performance indicators. Board size can impact the adjustment of capital structure by influencing the speed and efficacy of financial decision-making ([Kalsie & Shrivastav, 2016](#)). In empirical studies, data on board size is frequently collected from Refinitiv Eikon, corporate governance disclosures, or esteemed financial databases. A study on non-financial enterprises registered on the Kuwait stock Exchange ([Iltas, & Demirgünes, 2020](#)) defined board size as the total number of directors and used this metric to investigate its influence on non-financial firm performance ([Al-Saidi, 2021](#)). Research indicates that larger boards offer a boarded range of expertise and perspectives, which can improve decision-making and organizational success. For example, a research of French non-financial enterprises found a positive correlation between board size and non-financial performance, indicating that larger boards may contribute to improved outcomes ([Belkhir, 2009](#)). Conversely, smaller boards are often agiler and resistant to change, allowing such firms to modify their leverage more effectively in response to market dynamics and financial objectives ([Elmoursy, 2020](#)).

Board Gender Diversity

According to Reddy and Jadhav (2019), gender-diverse boards can enrich financial governance and oversight, enabling more effective capital structure adjustments and promoting long-term financial stability. The total count of female directors functions as a direct indicator of board gender diversity among the non-financial firms, that this method entails quantifying the number of women occupying board members positions at a specific moment. Researchers choose this measurement for its straightforwardness and lucidity, as it provides a clear depiction of female representation in board governance ([Marashdeh et al., 2021](#)).

Board Meetings

The frequent board meetings play a vital role as a control variable in research measured board dynamics. It indicates board engagement and dedication to governance duties. Researchers typically quantify this by documenting the total number of board meetings conducted within a designed timeframe, generally on an annual basis ([Yilmaz et al., 2023](#)). This information is frequently derived from corporate reports or formal filings. Board meetings are frequently included as a control variables enabling researchers to consider the possible impact of board activity on company outcomes, thus ensuring that the effects ascribed to board diversity are not obscured by fluctuations in meeting frequently ([Vafeas et al., 2024](#)).

3.5.3.3 Macro-Economic variables

Inflation

Inflation, characterized by the overall rise in the price of goods and services over time, impacts all sectors of the economy, including non-financial entities. It can profoundly affect capital structure modification by altering financing expenses and debt management tactics ([Živkov et al., 2020](#)). In periods of high inflation, companies may modify their capital structures by augmenting leverage since the actual value of debt declines, formulating the act of borrowing

more appealing [Ali et al., 2023](#)). However, inflation may result in elevated interest rates and economic instability, thereby hindering modifications as companies exercise greater caution around incurring extra debt ([Fitzgerald et al., 2020](#)). Precise monitoring of inflation is essential for these organizations to sustain financial stability and make informed operational decisions. The consumer price index (CPI) is a fundamental instrument for measuring inflation, indicating the average variation over time in the prices consumer pay for a representative assortment of good and services ([Okof-Dartey, 2024](#)).

GDP

The performance and strategic choices of non-financial organizations are intrinsically connected to the macroeconomic environment in which they function. Variations in GDP can affect consumer demand, investment prospects and general market conditions. GDP growth impacts capital structure modification by influencing economic stability, loan accessibility, and corporate profitability ([Cracolici et al., 2010](#)). In times of robust GDP development, companies may modify their capital structures by augmenting leverage, as elevated economic activities enhance profitability and diminished default risk ([Cohen Kaminitz, 2023](#)).

Conversely during economic recessions, firms may have diminished demand, promoting cost-reduction tactics and reassessment of business plans. In empirical researches, especially those related to non-financial organizations, GDP is often utilized as control variables. This practice seeks to consider the impact of the overall economic environment on the variables being studied, ensuring that the reported impacts are not simply artifacts of wider economic volatility ([Akkemik et al., 2014](#)).

3.6 Conclusion

This chapter examines the impact of digital transformation on capital structure adjustment in European non-financial enterprises employing the GMM data analysis, utilizing a sample of

firms from the various industries across a defined time frame (2010 to 2023). The dataset is often derived from financial records, corporate reports and digital transformation indexes, encompassing variables such as leverage, firm size, profitability, tangibility, and growth prospects. Digital transformation is assessed using metrics such as digital investment ratios, technology adoption rates and research and development expenditures. Firm characteristics (Firm size, tangibility, profitability, non-debt tax shield), board characteristics (board size, board gender diversity and board meeting), and macro-economic characteristics (GDP and Inflation) specific trends are included as control variables to ensure robustness. This chapter indicates that digital transformation expedites modifications in capital structure adjustment by improving financial flexibility. It also emphasizes that digital transformation is essential for optimizing financial structures, allowing organizations to respond more effectively to evolving market conditions.

Chapter 4: Results and Analysis

4.1 Introduction

The empirical results using panel GMM regression analysis, descriptive analysis, and correlation analysis examining the connection between capital structure adjustment and digital transformation are presented in this chapter. This section's main objective is to assess how digital adoption affects European non-financial firms' capacity to make dynamic adjustment to their capital structure. These findings have important results for corporate finance strategies since they imply companies using digitization can modify their capital structure adjustment more effectively, lowering adjustment costs and increasing financial flexibility. In depth statistical results, interpretations of the results and discussion of their significance for the larger corporate finance and digital transformation landscape are covered in the chapter.

4.2 Results

4.2.1 Descriptive statistics

With the inclusion of control variables, this section descriptive analysis offers a qualitative evaluation of 8,945 non-financial European companies to investigate the relationship between digital transformation and capital structure adjustment. In table 5, sample enterprises often modify their capital structure adjustment in a moderate manner over time, according to the mean CSA value of 0.199. These companions have a comparatively high degree of investment in digital transformation, as indicated by the mean DT 0.015. This implies that most firms in the sample have made a substantial commitment to digital transformation. With a standard deviation of 0.058 for CSA, firms' capital structure adjustments exhibit low dispersion and do not deviate much from the mean. Previous studies firms demonstrate that digital transformation markedly enhances non-financial performance indicators, including innovation performance, ESG performance and working capital management. The analysis indicates a mean digital

changes degree of underscoring significant diversity in digital transformation levels among organizations ([Dai et al., 2024](#)). This disparity highlights the differing level of commitment to capital structure standards among the non-financial firm evidence by significant standard deviation (Öztekin, 2015), highlighting the outcomes of the impact of capital structure as a crucial element of the performance of non-financial firms ([Alkhatib, 2012](#)).

More variation in digital transformation level among non-financial firms is suggested by SD of DT of 0.001, which shows that some non-financial firms have made significant investments in digitization, while others have adopted digital technology at lower rates. Some non-financial firms in the sample have significantly reduced their leverage or capital restructuring initiatives, maybe due to financial difficulties or strategic adjustments as shown by the minimum CSA value of -0.285. The datasets of the least digitally transformed non-financial firms, however, exhibit some degree of digital adoption as indicated by the lowest DT value 10. This suggests that digitization is present in all non-financial firms, albeit to differing degrees.

Table 5: Descriptive Statistics

	<i>CapStAd</i>	<i>DT</i>	<i>FSize</i>	<i>Tang</i>	<i>Prof</i>	<i>NTSheild</i>	<i>BSize</i>	<i>BGD</i>	<i>BMeet</i>	<i>GDP</i>	<i>Inf</i>
Mean	0.199	0.015	22.583	0.633	0.069	0.184	10.492	0.259	8.044	0.014	0.022
St Dev	0.058	0.001	1.671	0.203	0.116	0.030	3.765	0.143	2.347	0.025	0.024
Min	-0.285	0.009	15.008	0.111	-0.140	0	3	0	2	-0.057	-0.062
Max	0.578	0.032	27.211	1.000	1.493	0.318	26	0.75	12	0.060	0.083

Generally, findings imply that although non-financial firm degrees of digital transformation vary greatly, their capital structure adjustment stay largely consistent. This may suggest that non-financial flexibility is enhanced by digital transformation, enabling firms to modify their capital structures gradually as opposed to drastically.

4.2.2 Correlation Matrices

Table 6 displays the correlation matrix, clarifying the relationship between the variables. The correlation coefficient of 0.007 indicates a very weak positive associated between capital structure adjustment and digital transformation. This suggests that although capital structure adjustment decisions may be impacted by digital initiatives to some extent, the impact is negligible or statistically insignificant. Organizations experiencing digital transformation frequently require significant financial resources to invest in digitalization, prompting them to modify their capital structures by optimizing their debt/equity ratios. The influence of digital transformation on corporate social accountability has been determined to be asymmetric, with a greater effect observed in over leveraged companies. This indicates that companies with elevated debt levels derive greater advantages from digital transformation with regards to the modification of their capital structure adjustments due to heightened financial risk and larger impetus to alter capital configuration ([Li et al., 2025](#)). Tangibility shows (0.213), a positive correlation implies that companies with larger physical assets typically make better capital structure adjustments, because of their capacity to secure get debt financing and a substantial link among capital structure ([Muigai, 2016](#)). Board meeting (0.076) shows a positive correlation, that it became stronger and more stable in the market. NDTS (0.008) demonstrates a very slight positive correlation. This is essentially insignificant, indicating that NDTS has little effect on capital structure modification. Profitability exhibits a negative correlation of (-0.101), indicating that more profit firm reply more of internal funds. The results also insight the impact of the market condition, including inflation which is show a negative correlation of (-0.014) and GDP growth presents a weak negative correlation of (-0.017), as greatly affect the non-financial firm's capital structure performance, highlighting the importance of including these control factors in any thorough examination of capital structure ([Abdullah et al., 2021](#)). Firm size and capital structure adjustment have somewhat negative associated, as indicated by

a correlation value of (-0.004). This implies that, in comparison to smaller enterprises, larger firms modify their capital structure adjustment more slowly. Larger companies might not feel pressured to regularly adjust their capital mix because their financial resources are more reliable. These findings highlight the intricacy of capital structure adjustment dynamics, where diverse firms adopt various financial strategies. Non-financial firms must comprehend this connection to refine their capital structure adjustment approaches to improve performance and sustainability.

Table 6 Correlation analysis

	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>
1.CapStAd	1										
2.DT	0.007	1									
3.FSize	-0.004	-0.033	1								
4.Tang	0.213	-0.038	0.248	1							
5.Prof	-0.101	0.053	-0.186	-0.171	1						
6.NTSheild	0.008	-0.020	-0.050	-0.007	-0.048	1					
7.BSize	-0.036	-0.005	0.437	0.057	-0.088	0.042	1				
8.BGD	-0.003	-0.008	0.125	0.008	-0.022	0.014	0.045	1			
9.BMeet	0.076	-0.006	-0.014	0.034	-0.052	0.058	-0.055	0.098	1		
10.GDP	-0.017	-0.002	0.003	-0.015	0.036	-0.007	0.006	0.028	0.014	1	
11.Inf	-0.014	-0.114	0.061	-0.002	-0.009	0.007	0.012	0.230	0.053	0.224	1
12.VIF	1.562	1.251	1.952	1.756	1.625	2.152	1.960	1.484	1.263	1.185	1
Authors Analysis											

4.2.3 The Panel GMM Regression Analysis

The Panel Generalized Method of Moments (GMM) Regression is employed to examine the factors influencing capital structure adjustment in non-financial firms. The regression coefficients and their associated p-value explain the relationship between many independent variables and dependent variable capital structure adjustment. The results explain that DT exerts a substantial beneficial influence on capital structure adjustment, as the coefficient of 0.068 and highly significant p-value of 0.000 indicated statistical significance at 1% level, implying that enterprises engaged in digital transformation are more inclined to optimize their

capital structure effectively. According to the results of the panel GMM regression analysis shown in Table 7, digital transformation positively and significantly impacts the capital structure adjustments of non-financial firms. The capital structure adjustments of these companies become more stable and appealing to investors as digital transformation activities expand, according to the highly significant coefficient, in accordance with the results reported by Santos (2023). More specifically, these results suggest that digitally advanced enterprises may have greater development potential, enhanced operational efficiency, and increased profitability, as well as a better capacity to manage their leverage efficiently and adapt their capital structures in response to financial and market conditions (Tsou & Chen, 2023). This suggestion indicates that companies engaged in digital transformation exhibit greater dynamism in financial decision-making, while also maintaining a capital structure that aligns with their changing strategic goals (Rothstein, 2024). According to these findings, non-financial companies that embrace digital transformation have superior operational savings, innovative potential, and overall market competitiveness. The findings suggest that these firms are better positioned to encourage investment (Bruszt & Langbein, 2020). The dynamic trade-off theory posits that enterprises modify their capital structures over time to maximize the tax advantages of debt while mitigating bankruptcy risks. Digital transformation reduces adjustment costs, increases capital accessibility, and promotes financial decision-making, resulting in expedited and less expensive adjustments to capital structures (Ahmed et al., 2023). Furthermore, the pecking-order theory suggests that firms favor internal finance over external financing because of asymmetric information. Digital transformation enhances financial openness and credibility, diminishes information asymmetry, and enables enterprises to acquire external finances on more advantageous terms (Bela et al., 2024).

The positive coefficient of 0.096 indicates that larger firms are more inclined to modify their capital structure adjustment, and the p-value of 0.000 signifies strong statistical significance.

The significant positive impact of firm size on the adjustment of capital structures corresponds to trade-off theory, which posits that companies modify their capital structures to achieve an optimal debt ratio by weighing the tax benefits of debt against bankruptcy expenses ([Ahmed & Abu Khalaf, 2025](#)). Large corporations, owing to their financial robustness, adapt more effectively than smaller enterprises, which may encounter limitations. Moreover, dynamic trade-off models suggest that large enterprises have greater adjustment speed due to lower adjustment costs, including fewer constraints from lenders and decreased market friction in capital acquisition ([Chen & Xu, 2023](#)). Similarly, tangible assets show a positive relationship with CSA inclusive of a coefficient of 0.062 and a p-value of 0.000, indicates that enterprises with greater tangible assets are more likely to modify their capital structure adjustment, and thus indicating that larger companies and those with more tangible assets are better able to manage their resources, maintain financial stability, and move toward their optimal capital structures ([Chen et al., 2023](#)). The size of a board is positive and significant with a capital structure adjustment coefficient value of 0.078 and p-value 0.028. So, a larger board typically provides varied experience, improved governance, and enhanced oversight, hence augmenting the corresponding firm's capacity to effectively modify its leverage ratio ([Abu Khalaf, 2024](#)). Moreover, the frequency of its meetings has an important role in corporate financial decision-making, especially with respect to capital structure modifications, coefficient value of 0.044 and p-value 0.010. Frequent meetings enable facilitate ongoing oversight, prompt decision-making, and proactive reactions to financial discrepancies, guaranteeing that companies can modify their capital structures in accordance with strategic objectives ([Elmoursy, 2020](#)). An increased board size correlates positively with enhanced decision-making, as it encompasses directors possessing diverse forms of financial acumen, industry insights, and risk management competencies ([Epong & Anom, 2019](#)). This diversity allows companies to assess various financing alternatives, enhance debt/equity ratios, and promptly adjust their capital structures

in response to market fluctuations. Moreover, an effectively organized board helps alleviate agency issues, guaranteeing that managers prioritize their firm's best interests above inefficient financial approaches (João et al., 2023). Regular board meetings improve the speed and effectiveness of capital structure modifications by promoting active discourse on financial policies, debt management, and equity-financing methods (Alshaiba & Abu Khalaf, 2024). Holding more meetings enables boards to promptly address economic swings, interest rate variations, and investment prospects, thereby averting extended divergences from the ideal capital structure. Besides, regular meetings foster robust corporate governance, mitigating information asymmetry and improving access to capital markets (Joseph et al., 2023).

Profitability imposes a negative and significant influence on capital structure adjustment which is coefficient: -0.147 and p-value: 0.000, as posited by the pecking-order hypothesis that indicates firms favor internal financing over external financing (Hristov et al., 2023). More profitable companies accumulate greater retained earnings, hence diminishing their need for debt or equity financing (Al-Kubaisi & Khalaf, 2023). Consequently, these organizations have less of an incentive to modify their capital structures, resulting in slower or less frequent adjustments in their leverage ratios (Jayathilaka, 2020). Moreover, highly profitable companies typically avoid unnecessary financial risk and prefer sustaining lower debt levels, further constraining the necessity for frequent capital structure modifications (Kim et al., 2023).

Likewise, gender diversity on boards may adversely affect capital structure adjustment, coefficient is -0.051 and p-value 0.000, due to variations in risk perception and decision-making approaches. Studies indicate that female board members are generally more risk-averse, favoring financial stability over bold financing modifications (Khalaf, 2017). This prudent strategy may result in postponed or conservative modifications to capital structures, as diverse boards prioritize long-term sustainability over swift reconfiguration of debt and equity (Reddy & Jadhav, 2019). Furthermore, heightened variety may prolong decision-making procedures

since several perspectives must be evaluated prior to implementing substantial finance alterations. Thus, while gender diversity improves governance and ethical decision-making, it may impede a firm's capacity to optimize its capital structure effectively ([Sarang et al., 2021](#)).

Inflation by the coefficient of -0.054 and p-value of 0.062 adversely and substantially affected the modification of capital structure, because of its influence on borrowing expenses, investment unpredictability, and corporate valuation. Elevated inflation results in increased interest rates, rendering debt financing more costly and deterring companies from modifying their capital structures via further borrowing ([Zhang et al., 2022](#)). Moreover, inflation heightens economic uncertainty, prompting companies to choose a more conservative strategy for financial restructuring, as variable prices and expenses complicate the forecasting of future cash flows and repayment abilities ([Ali & Asfaw, 2023](#)). In addition, inflation can diminish the actual value of liabilities, prompting enterprises to postpone capital structure modifications in expectation of additional inflationary effects ([Ktit & Abu Khalaf, 2024](#)). Consequently, companies in high-inflation contexts may find it challenging to optimize their capital structures, thus reducing financial risk and preserving liquidity, thereby impeding the adjustment process ([Zou et al., 2024](#)).

Table 7: Panel GMM regression Results		
Dependent Variable: Capital Structure Adjustment		
Variables	Coefficient	p value
CapStAd _(t-1)	0.035	0.000
DT	0.068	0.000
FSize	0.096	0.000
Tang	0.062	0.000
NTSheild	0.021	0.218
Prof	-0.147	0.000
BSize	0.078	0.028
BGD	-0.051	0.000
BMeet	0.044	0.010
Inf	-0.054	0.062
GDP	0.030	0.255
Intercept	0.235	0.000
Country Dummies	Yes	
AR1	0.135	
AR2	0.172	
Hansen Test	0.404	
Wald Chi ²	1952.23 (0.000)	

4.2.4 Robustness of results

In the following table 8, the Panel Generalized Method of Moments (GMM) estimation model is used to validate the robustness of the results by integrating various proxies for the chosen variables. Alternative measures are employed to guarantee that the conclusions would not be influenced by a particular variable's definition and maintain consistency across many specifications. The GMM methodology adeptly mitigates any endogeneity issues while enhancing the dependability of estimations. The outcomes derived from these robust assessments confirm the credibility of the principal's findings, illustrating that the associations recognized by the basic model persist even when other proxies are employed. The results provided by the panel GMM regression hold, as evident in Table 8 below, suggest that digital activities have a favorable impact on capital structure adjustment, so the positive coefficient 0.059 and very significant p-value 0.000 imply that digital transformation favorably affects capital structure adjustment in non-financial enterprises. Firm size exerts a substantial positive

influence on CSA evidenced by a positive coefficient of 0.088 and a significant p-value 0.000, showing the effect of firm size on the adoption of digital transformation on anticipated environmental sustainability. As anticipated, the slope is positive for data analysis and sharing technologies and negative for data collection technology ([Hernández et al., 2024](#)). Tangibility has positive effect, with coefficient 0.057 and substantial p-value indicate the increased asset tangibility positively affects capital structure adjustment. As firms become more innovative, DT rises prominently. This suggests that firms with a high capacity for innovation ought to make investments in digital transformation and settle in more advanced digital sectors ([Li et al., 2023](#)). Regression study validates preliminary findings that businesses in the consumer discretionary and telecoms sectors have substantially higher digitalization indices. Businesses that are listed on advanced EU market are also far ahead in digitizing their operations ([Ionașcu et al., 2022](#)). According to the findings of the study data testing, the only variables that significantly affect the degree of digital transformation are size and capital structure adjustment. The degree of digital transformation is influenced by the profitability, firm size etc. ([Bela et al., 2024](#)). The way the explanatory variables are measured may have an impact on the relation between both the non-financial firm's performance and digital transformation. Therefore, profitability, firm size, and capital structure adjustment have an impact on the degree of digital transformation, preventing measurement errors that could result in erroneous regression result ([Dai et al., 2024](#)). The findings show that increased oversight and financial decision-making are positively and significantly correlated with board size (0.085, p-value 0.032). Additionally, the frequency of board meetings has a positive and significant effect (0.049, p-value 0.025), indicating that regular meetings enhance the board's ability to respond to financial and market developments. The Hansen result of 0.452 indicates that variation in CSA is elucidated by the independent variables. Although this demonstrator's moderate explanatory power, additional observed factors may potentially affect capital structure adjustment decisions. The Wald Chi²

score 1845.25 indicates that the whole model is statistically significant, implying that the independent factors jointly affect CSA. The outcomes derived from these robust assessments substantiate the credibility of the principal's findings, illustrating that the associations recognized by the basic model persist even when other proxies are employed. The results provided by the panel GMM regression hold, as evident in Table 8 below, suggest that digital activities have a favorable impact on capital structure adjustment

Table 8: Robustness of results		
Dependent Variable: Capital Structure Adjustment		
Variables	Coefficient	<i>p</i> value
CapStAd _(t-1)	0.022	0.000
DT	0.059	0.000
FSize	0.088	0.000
Tang	0.057	0.000
NTSheild	0.020	0.352
Prof	-0.177	0.000
BSize	0.085	0.032
BGD	-0.047	0.000
BMeet	0.049	0.025
Inf	-0.053	0.081
GDP	0.035	0.284
Intercept	0.288	0.000
Country Dummies	Yes	
AR1	0.121	
AR2	0.198	
Hansen Test	0.452	
Wald Chi ²	1845.25 (0.000)	

4.3 Discussion and Analysis

The results and analysis examine the influence of digital transformation on capital structure adjustment in European non-financial firms, employing several statistical techniques such as descriptive statistics, correlation analysis, panel GMM regression analysis, and Robustness of results. The findings offer significant understanding of the impact of firm specific variables on capital structure adjustment choices. Descriptive statistics indicate that larger enterprises with greater tangibility typically modify their capital structure more effectively. Profitability is negatively correlated with CSA, corroborating the pecking order theory, which suggests that more profitable enterprises favor internal financing over external debt. The CSA of non-financial firms in the EU from 2010 to 2023. Their results show that these nations, CSA, diverge significantly from one another, with only modest medium-term convergence. That simply implies that past capital structure adjustments still have an impact on present financial choices, which may have an impact on the uptake and results of digital transformation researches ([Kristofik et al., 2022](#)), demonstrating the transnational management of digital transformation, with emphasis on funding innovation in peripheral Europe. According to the pervious analysing, authorities must impose requirements on non-financial companies in digital transformation. However, governance centers on transitional players excluding the state from the capital allocation process, may have an effect on capital structure adjustment of business ([Rothstein, 2024](#)). Further demonstrating the beneficial impact of digital initiatives on financial stability, digital transformation increases a company resilience to threats, lower default risk and lower debt financing cost ([Meiyu Liu et al., 2023](#)). By strengthening a company resilience to risk, digital transformation can minimize default risk and debt financing expenses ([Wang et al., 2023](#)). The correlation analysis reveals substantial positive associations between firm size, tangibility, and CSA, whereas profitability demonstrates a negative link, underscoring that firms with robust financial performance depend less on external financing. NDTs exhibits a

weak association, indicating that tax advantages are more a significant factor influencing CSA for non-financial corporations. The panel GMM regression analysis offers a more reliable estimation by addressing variability and verifies that digital transformation significantly enhances CSA, suggesting that companies implementing digital changes can more efficiently modify their financial structures, relating to non-financial enterprises. Statistical investigations validate these associations, with regression models indicating that digital transformation improves financial adaptability. The results indicate that companies with advanced digital capabilities can enhance their finance strategies more efficiently. Several control variables have been found to be important factors in determining CSA decisions in the context of digital transformation. Factors including firm size, NDTs, profitability are important to determine leverage decisions, according to the previous analysis that used capital structure adjustment with a significant impact on firms judgment's about leverage ([Bilgin, 2023](#)).

The results indicate that tax related factors are not significant in capital structure adjustment decisions for non-financial firms, suggesting that other concerns, such as growth possibilities and market conditions, may exert a great influence. The overall results and analysis underscore the significance of digital transformation in non-financial decision-making. Companies that implement digital strategies can optimize their financial frameworks more effectively, enhancing their financial agility. The findings correspond with financial theories that elucidate how companies balance debt and equity financing in relation to their profitability, asset composition, and strategic orientation. The results also underscore the necessity for non-financial firms to include digital initiatives into their financial planning procedures to improve their responsiveness to fluctuating market conditions and sustain financial stability.

4.4 Conclusion

In this section the results and analysis offer significant insights into the correlation between digital transformation and CSA in European non-financial firms. The results affirm that digital transformation positively impacts corporate social accountability, enabling companies to enhance financial decision-making optimize debt equity ratios. Moreover, firm size and asset tangibility substantially improve CSA, indicating that larger enterprises and those possessing tangible assets enjoy superior access to funding alternatives.

These financial results correspond with financial theories, including trade-off theory and pecking order theory, highlighting the significance of digital transformation in financial decision-making. This chapter enhances the existing literature by elucidating the influence of technical improvements on business finance methods. Subsequent results may investigate additional macro-economic and industry specific determinations affecting capital structure adjustment.

Chapter 5: Conclusion

5.1 Introduction

The growing incorporation of digital technologies into corporate operations has fundamentally reshaped financial decision-making processes. Digital transformation has become a vital factor influencing firms' ability to efficiently adjust their capital structure. This study investigates the influence of digital transformation on capital structure adjustment in European non-financial companies. To provide a comprehensive analysis, it includes essential control variables like firm characteristics (firm size, tangibility, profitability, non-debt tax shield), board characteristics (board size, board gender diversity and board meeting), and macro-economic characteristics (GDP and Inflation). This study examines whether technology improvements facilitate or hinder the effective adjustment of financing strategies and how digital transformation enhances financial flexibility.

This research employs a dataset of 8,945 European non-financial enterprises, with data sourced from Refinitiv Eikon. Empirical analysis includes Generalized Method of Moments (GMM) regression, descriptive statistics, correlation analysis, and robustness checks to evaluate the relationship between digital transformation and capital structure adjustment. The inclusion of integrate control variables further strengthens the understanding of how firm-level, governance, and macroeconomic factors collectively influence capital structure adjustment options.

The relevance of this study is heightened by the increasing dependence on digital solutions in corporate financial management. The findings contribute to the literature by offering empirical evidence on how digital transformation optimizes financing decisions. The results provide significant insights for corporate executives, financial analysts, and regulators, aiding informed decision-making regarding digital transformation and capital structure adjustment.

5.2 Conclusion

This research underscores the significant impact of digital transformation on capital structure adjustment in European non-financial enterprises. The results indicate that companies with advanced digital transformation demonstrate enhanced financial flexibility, allowing for more effective capital structures modifications. The incorporation of control variables enhances the intricacy of the analysis firm size and tangibility are found to have positive affect on capital structure adjustment, whereas profitability exhibits a negative correlation, suggesting that more profitable firms rely more heavily on internal financing. Digital transformation improves enterprise performance by alleviating financial constraints, improving transparency, and streamlining operations, which leads to improved non-financial results. ([Meiyu Liu et al., 2023](#)). Companies undertaking digital initiatives often report benefits such as higher profitability, reduced operating expenses, and lower financial risks. These advantages materialize over time and become more noticeable after about a year ([Chen et al., 2024](#)). According to the previous research conclusion, digital transformation accelerates the CSA by increasing information transparency and reducing knowledge asymmetry ([Demiraj et al., 2024](#)). Larger firms tend to derive greater benefits from digital transformation due to their ability to allocate superior resources and capacity to deploy sophisticated digital technologies, which results in more efficient CSA. Profitability further confirms that more successful businesses favor internal funding over external debt, which is consistent with pecking order theory ([Saif-Alyousfi et al., 2020](#)).

The research findings possess multiple ramifications for forthcoming studies and for non-financial enterprises operating within the same target domain. They highlight the necessity for non-financial enterprises to incorporate digital transformation into their strategy planning to strengthen financial stability and attract long-term investments. Digital tools and technologies not only enhance operational efficiency but also reduce perceived risks and financing expenses,

facilitating easier access to capital markets. Companies can utilize these insights to synchronize their financial strategy with technical improvements, thereby ensuring sustained growth and competitiveness in the European market. This research challenges the traditional static perspective of capital structure theories, exposing its varied effects on high and low leverage enterprises, and how digital transformation continuously supports optimal financial decisions ([Puni et al., 2020](#)). By highlighting the long-term dynamic support of technology in financial strategy, the findings provides new insights for policymakers and corporate managers. The results validate the important role of digital transformation in improving capital market access and lowering barriers to external financing ([Izhakian et al., 2022](#)).

Overall, this thesis contributes significantly to the growing discourse on the intersection of digital transformation and financial management. By acknowledging the significance of digital adoption, companies can refine their finance framework to improve their competitiveness in a swiftly changing economic environment.

5.3 Research Limitations

While this research paper provides valuable insights, certain limitations must be acknowledged when evaluating the findings. The research is confined to European non-financial enterprises, which may restrict the generalizability of the findings to firms in other countries or within financial sectors. Future studies should expand the geographical scope to understand how digital transformation influences capital structure adjustment across various economic contexts.

This research utilizes the secondary data from Refinitiv Eikon. Although the database is reputable, it may bring significant biases about data accuracy and completeness. Additionally, the dataset may not fully capture qualitative dimensions of digital transformation, such as internal digital culture, firm specific innovation strategies, or organizational readiness. Another limitation is the absence of industry specific digital maturity analysis. Different sectors may

demonstrate varying levels of digital adoption, significantly influencing the relationship digital transformation and CSA. Future research should incorporate industry classifications and digital maturity to improve the robustness and relevance of the analysis ([Ciampi et al., 2022](#)).

Moreover, this research also fails to consider industry specific digital maturity levels, which may substantially affect the influence of digital transformation on capital structure adjustment. Certain industries may exhibit greater proficiency in digital adoption, whereas others may fall behind, thus influencing the outcomes. Subsequent study ought to integrate industry classifications and digital maturity metrics to enhance the analysis.

Lastly, this thesis primarily focuses on short-term capital structure adjustments and does not evaluate the long-term Implications of digital transformation. Future studies should adopt a longitudinal design to assess how digital initiatives affect financial stability and firm performance over extended timeframes.

5.4 Recommendation for Future research

Future research should broaden its scope to include enterprises from a variety of regions and economic contexts, enhancing the global relevance of the findings. An analysis of digital transformation effects in established versus emerging economies can offer a comprehensive understanding of its significance in financial management.

Additionally, qualitative research methodologies – such as case studies, interviews with financial executives, and expert panels – can yield profound insights into how companies strategically execute digital transformation to enhance their financial framework. These methods would augment the quantitative results and provide actionable recommendations for companies aiming to improve their digital competencies. Many non-financial have already implemented digital transformation initiatives to improve their operations. For instance, South Africa adoption of regulatory sandbox has asseverated innovation in industries like finance and

e-commerce by offering controlled testing grounds for new digital services ([Friederici et al., 2020](#)). Future research should investigate the influence of external circumstances, such as technology disruptions, regulatory modifications, and financial crises on the relationship between digital transformation and capital structure adjustment. Considering these external factors, researchers may create more robust models that encapsulate the intricacies of financial decisions making in a digital market.

Ultimately, enterprises and policymakers should leverage these insights to formulate regulatory frameworks that facilitate digital adoption in corporate financial management. Promoting digital innovation and offering financial incentives can improve firms' financial adaptability, enhance access to external capital, and foster long-term financial resilience in a digital-first landscape.

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Article

Does Digital Transformation Reflect the Adjustment of Capital Structure?

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Abstract: This study investigates the effect of digital transformation on non-financial firms' adjustment of the capital structure in European countries while controlling for firm characteristics (firm size, tangibility, profitability, and non-debt tax shields), board characteristics (board size, board gender diversity, and board meetings), and macroeconomic variables (GDP and inflation). Data were collated from the platform Refinitiv Eikon (LSEG). The final sample size was 514 companies during the 2010–2023 period. Panel GMM regression was used to thoroughly investigate the impact of digital transformation on the adjustment of capital structure. The results show that digital transformation improves capital structure adjustments. Based on the results of panel GMM regression, our results hold and confirm that there is a positive significant impact of digital transformation on the adjustment of capital structure. The main recommendation for businesses and policy makers is to successfully enter the digital age.

Keywords: digital transformation; capital structure adjustment; non-financial firms; European countries; panel GMM regression

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1. Introduction

Over the last few decades, digital transformation has redefined the operational and strategic frameworks of enterprises across all sectors (Vial, 2021). As technology advances, companies are progressively incorporating digital tools, automation, and data-driven decision-making into their operations to improve effectiveness and competitiveness (Rehan et al., 2023). This change has significantly impacted company models and productivity, and it is also pivotal in determining corporate financial decisions, especially regarding capital structure (Nguyen-Thi-Huong et al., 2023). The integration of digital technologies impacts risk management, investment plans, and financing requirements, ultimately affecting how companies reconcile debt and equity within their financial frameworks (Zhao et al., 2024).

The connection between digital transformation and capital structure modification has become notably significant in the European setting. European companies, propelled by swift technical progress and legislative structures that promote digital integration, have experienced substantial transformations in their finance approaches (Van Veldhoven & Vanthienen, 2022). Digital transformation strengthens companies' access to diverse funding options, diminishes information asymmetry, and enhances operational efficiencies—elements that enable adjustments in capital structure (Luo & Jiang, 2022). Furthermore, in reaction to digitalization, companies in Europe may enhance their leverage ratios to maintain competitiveness and ensure sustained long-term growth, especially in sectors undergoing a swift technological transition.

This study's empirical findings indicate there is a significant positive effect of digital transformation on capital structure modification. Companies that have proactively used digital technology generally modify their financial structures more efficiently, enhancing their debt ratios in accordance with market conditions. The findings demonstrate that digital adoption improves financial flexibility, enabling companies to reorganize their funding to correspond with technological investments and changing business models. This underscores the strategic significance of digital transformation in corporate finance, illustrating that technology-driven enterprises exhibit greater agility in managing their capital structures.

This research enhances the current literature by providing a thorough examination of the relationship between digital transformation and capital structure adjustment, particularly in the European market. This paper fills in the gap in several ways; firstly, this research diverges from prior studies that concentrated exclusively on the financial determinants of capital structure by including the impact of technical improvements, thereby offering new perspectives on how digitalization affects corporate finance decisions (Teo Piaw et al., 2024). The results provide significant insights for policymakers, corporate executives, and investors, highlighting the critical role of digital transformation in financial decision-making. Secondly, this is the first empirical evidence that the relationship between digital transformation and the adjustment of capital structure is controlled by firm characteristics (firm size, tangibility, profitability, and non-debt tax shields), board characteristics (board size, board gender diversity, and board meetings) and macroeconomic variables (GDP and inflation). The existing literature has not fully studied how these control variables interact with digital transformation and capital structure adjustment within non-financial firms. The lack of integration of these gaps creates a space for understanding the specific difficulties and opportunities for European non-financial organizations.

The primary objective of this research is to investigate the impact of digital transformation on the adjustment of the capital structures of European companies. Also, the secondary objective is to bridge the gap by investigating how digital transformation impacts capital structure adjustment, with a specific focus on the control variables that affect this relationship. Specifically, this study emphasizes how technology might revolutionize debt management, equity distribution, and overall non-financial conditions. The objective of this research is to determine whether digital transformation can boost capital structure adjustment, streamline processes, and foster a culture of continuous improvement in European nations.

The structure of this paper is as follows: A review of the literature and hypothesis development are presented in Section 2 along with the theoretical background. Section 3 presents the sample used and the development of the model. Section 4 analyzes the results, while Section 5 concludes this empirical paper and highlights the implications and limitations of this research.

2. Literature Review

2.1. Theoretical Background

2.1.1. Trade-Off Theory

According to this theory, businesses try to weigh the advantages of leverage against the disadvantages of possible non-financial hardship. By potentially lowering operational risks and increasing non-financial sustainability, digital transformation can have an impact on this balance and enable businesses to more dynamically modify their capital structure adjustment ([Duwe & Duwe, 2022](#)). According to the trade-off theory hypothesis, businesses try to weigh the advantage of debt against the disadvantages of possible non-financial difficulties. According to the trade-off theory, businesses may modify their capital structure adjustment to fund digital expenditures relating to digital transformation, balancing the possible advantages of better operating efficiency against the risk of higher debt ([Serrasqueiro & Caetano, 2015](#)). The trade-off argument states that businesses weigh the advantages of debt against tax benefits, possibly increasing the disadvantages of non-financial hardships. This balance can be affected by digital transformation, which may lower operational risks and expenses and increase the appeal of debt ([Sdiq & Abdullah, 2022](#)). In capital structure adjustment, companies with more leverage may be able to reduce their overall cost of capital and make use of tax shields, both of which have a beneficial effect on the trade-off theory ([Cekrezi, 2013](#)).

2.1.2. Pecking-Order Theory

According to this theory, businesses prioritize their funding sources based on what will lead to the lowest cost, prioritizing internal funding, followed by debt, and treating equity issuance as a last resort. By improving an organization's capacity to generate internal revenue through higher efficiency and advancement, digital transformation can have an effect on the pecking order by reducing its dependence on external funding ([Kilic & Sakalsiz, 2023](#)). Moreover, according to this theory, businesses favor internal funding over external financing and favor debt over equity when external non-financial support is required. Through its effects on the non-financial decisions made by firms, digital transformation affects this idea. Due to increased operational effectiveness, firms undergoing digital transformation may generate more internal revenue and become less dependent on outside finance ([Adair & Adaskou, 2015](#)). This research demonstrates the relationship between the pecking order of firms and different attributes in the context of digital transformation. The results show that larger businesses might still favor internal finances, and technological developments provide more flexibility and allow greater effectiveness, eliminating the need to seek outside capital ([Castro et al., 2015](#)). In this theory, because of information irregularity, businesses prefer inside finance and steer

clear of external finance. This may result in reduced expenditure and more stable capital structure adjustment ([Frank et al., 2020](#)).

2.1.3. Agency Theory

Agency theory investigates the disputes regarding competing interests that exist between the shareholder and the leadership of a corporation. Enhancing openness and knowledge flow through digital transformation can help reduce agency difficulties and influence capital structure adjustment choice such that it better aligns with the needs of shareholders ([Chen & Yu, 2011](#)). The difference between the managers and shareholders is examined by agency theory. This theory suggests that businesses may experience a decrease in information asymmetries and agency costs if they implement digital innovation in the context of digital transformation. The resulting increased governance and openness may result in more effective decision-making and a possible decrease in the cost of capital ([Fang et al., 2023](#)). The premise that debt will help reduce agency costs among the managers and shareholders, aligning their interests and improving business performance, is supported by proof and agency theory. This is especially important since businesses use debt to fund their digital transformation, which can lower operational effectiveness and increase value overall ([Hoang et al., 2021](#)). In capital structure adjustment, debt can reduce the need to act in accordance with agency theory by aligning managers’ interests and reducing their diplomacy. This raises the corresponding company’s value and lessens the possibility of unnecessary administrative expenditure ([Ahmed et al., 2023](#)). The following table, Table 1, provides a summary of the expected impact of digital transformation on the adjustment of capital structures based on the three previously discussed theories.

Table 1. Summary of expected impacts based on the previously mentioned theories.

Variables	Trade-Off Theory	Pecking-Order Theory	Agency Theory
Digital transformation	+	+	+/-

2.2. Previous Studies and Hypothesis Development

Digital Transformation and Capital Structure Adjustment

Digital transformation modifies operational structures, improves efficiency, and influences non-financial performance; it may substantially influence a firm’s capital structure adjustment. Research demonstrates that digitization expedites capital structure adjustments, allowing firms to swiftly adapt to market conditions and enhancing their financial management capabilities ([Niu et al., 2023](#)). The adoption of digital transformation can boost profitability, drive innovation, and enhance overall company performance. These outcomes may influence how enterprises allocate their non-financial resources and capital expenditure ([Chen et al., 2023](#)). Capital structure adjustment is highly influenced by digital transformation, which also alters businesses’ operational methods, capital structure, and profitability. This results in a dynamic capital structure adjustment emphasizing the shift from equity to debt as enterprises enhance operational efficiency and reduce expenditures ([Xue & Zhang, 2024](#)). Moreover, the digital transformation of non-financial firms has been strongly connected with enhanced operational performance, influencing these firms’ decisions about capital structure adjustment ([Teng et al., 2022a](#)). Digital transformation significantly influences a firm’s capital structure adjustment since the transition from equity to debt is driven by enhanced operational performance and reduces the risk of bankruptcy due to digital transformation. Research has indicated that digital transformation expedites the alteration of capital structure adjustment, enabling organizations to respond more swiftly to both favorable and unfavorable changes ([Olaniyi et al., 2024](#)).

Digital transformation may accelerate capital structure adjustments by enhancing the stock market or modernizing the bond market. The idea here is that information asymmetry can be mitigated through digital transformation ([Liu & Liu, 2023](#)). In the realm of non-financial enterprises, digital transformation affects capital structure adjustment. Research analyzing companies listed from 2020 to 2023 revealed that factors such as accounts receivable percentages, managerial overhead ratios, and ownership structure substantially influence digital transformation initiatives. Consequently, these factors influence how these enterprises modify their capital structures ([Bela et al., 2024](#)). Researchers have found that the initial stage of a sound investment in research and development for digital transformation may not lead to significant progress, resulting in an excess of capital structure adjustment costs ([Zhai et al., 2022](#)). Non-financial firms generally require alterations to their financial structures to enable digital transformation ([Khandelwal et al., 2023](#)). To align with emerging digital activities, this even requires non-financial firms to restructure their resources and investments. For non-financial firms, effective capital structure adjustments enhance resource allocation efficacy, promote technological advancement, and mitigate hazards associated with digital transformation ([Warner & Wäger, 2019](#)). When the operational models of enterprises are subject to a digital transformation that significantly influences their capital structure adjustment, it not only entails technological innovation but also a revision of the enterprises' overarching strategic frameworks ([Libert et al., 2016](#)). Digital transformation increases the dissemination of capital structure adjustment data. Reducing insight asymmetry reduces perceived risk for investors, consequently reducing the cost of capital funding for non-financial firms ([João et al., 2023](#)). Furthermore, digital transformation allows enterprises to offer more reliable and promptly available non-financial information. Increased transparency and improved shareholder plans help to reduce the cost of equity financing ([Ren et al., 2023b](#)).

Based on the previous research, digital transformation enhances capital structure adjustment by allowing non-financial firms to refine their financial strategies and adapt more efficiently to evolving market conditions ([Sarang et al., 2021](#)). Prior studies have indicated that digitization improves the speed and efficacy of decision-making processes for capital allocation ([Nuñez Huerta, 2021](#)). By utilizing new technologies, non-financial firms can diminish information asymmetry, enhance transparency, and gain improved access to financial data ([Culata et al., 2012](#)). These enhancements not only reduce the cost of equity borrowing but also augment a firm's capacity to adjust its capital structure in reaction to external economic and competitive forces ([Elmoursy, 2020](#)). Consequently, digital transformation enhances financial resilience and enables more agile adjustments to capital structures. Based on the previous discussion and the critical valuation of previous studies, the hypothesis of this empirical paper is as follows.

H1: *Digital transformation has a positive relationship with capital structure adjustment.*

3. Methodology

3.1. Sample Used

This paper investigates the impact of digital transformation on capital structure adjustment in all European countries. The data were collected from the platform Refinitiv Eikon (LSEG). The total number of listed nonfinancial companies in Europe is 8945, and after cleaning the data on missing observations, the final sample included 514 companies active during the 2010–2023 period. Table 2 provides the details of the sampling procedure.

Table 2. Sampling procedure.

Sampling Procedure	Number of Countries	Total Population	Sample Size
1. Western Europe	9	1925	205
2. Eastern Europe	10	1903	37
3. North Europe	15	2738	250
4. Southern Europe	17	2379	22
Total	51	8945	514

3.2. Research Model

We applied the panel GMM regression to investigate the impact of digital transformation on the adjustment of capital structures and deal with the endogeneity problem (Bajaj et al., 2020; Zhang et al., 2022; Zhu et al., 2024). Endogeneity may arise from measurement mistakes, omitted variable bias, or simultaneity, potentially resulting in biased and inconsistent estimates if inadequately addressed. To address these problems, this empirical investigation includes the variables firm size, tangibility, non-debt-tax shields, profitability, board size, board gender diversity, and board meetings as possibly endogenous variables. These variables may be affected by unseen factors or concurrently determined alongside the dependent variable. To resolve this problem, suitable instrumental variables (IVs) were employed within the GMM framework. The instruments chosen are lagged values of the endogenous variables, guaranteeing correlation with the endogenous regressors while remaining uncorrelated with the error term. The application of the GMM technique guarantees robust and consistent parameter estimations, addressing heteroskedasticity and probable autocorrelation in the panel data.

The economic model is given in Equation (1):

$$\begin{aligned} \text{CapStAd}(i, t) = & \alpha + \beta_1 \text{CapStAd}(i, t-1) + \beta_2 \text{DT}(i, t) + \beta_3 \text{FSize}(i, t) + \beta_4 \text{Tang}(i, t) + \beta_5 \text{NTShield}(i, t) \\ & + \beta_6 \text{Prof}(i, t) + \beta_7 \text{BSize}(i, t) + \beta_8 \text{BGD}(i, t) + \beta_9 \text{BMeet}(i, t) + \beta_{10} \text{GDP}(t) + \beta_{11} \text{Inf}(t) + \varepsilon \end{aligned} \quad (1)$$

where

CapStAd is the adjustment of capital structure toward the optimal capital structure;

DT is digital transformation measured through data text mining via the ratio of keyword occurrences to the total word count in the annual report;

FSize is firm size, which is measured by the natural logarithm of the total assets;

Tang is tangibility, which is measured as fixed assets divided by total assets;

NTShield denotes non-debt tax shield, which is measured by dividing accumulated depreciation by total assets;

Prof is profitability, measured through return on assets;

BSize is board size, measured by the number of members on a board;

BGD is board gender diversity, measured by the percentage of females on a board;

BMeet is board meeting, measured by the number of board meetings in a year;

GDP is the growth in the Gross Domestic Product;

Inf is inflation, measured by the percentage of the consumer price index.

3.3. Measurement of Variables

Table 3 provides all the variables selected based on the previous studies discussed in the previous Section. In addition, the measures suggested by several authors in previous studies and the sources of the data have been provided.

Table 3. Means of measuring variables.

Variable	Measurements/measures	Reference	Source
Dependent Variable			
Capital structure adjustment	Net change in leverage (Act Lev _{i,t} – Act Lev _{i,t-1})	(Khalaf, 2017)	Refinitiv Eikon
Independent Variable			
Digital transformation	Content analysis (data text mining of annual reports), using the ratio of keyword occurrences to the total word count in the annual report	(Piaw et al., 2024)	Annual Report
Control Variable (Firm Characteristics)			
Firm Size	The natural logarithm of total assets	(Saldi et al., 2023)	Refinitiv Eikon
Tangibility	(Total assets – current assets)/total assets	(Jain et al., 2024)	Refinitiv Eikon
Profitability	Return on Assets	(Rachmawati, 2021)	Refinitiv Eikon
Non-debt tax shield	Accumulated depreciation to total assets	(Lebow et al., 2006)	Refinitiv Eikon
Control Variable (Board Characteristics)			
Board size	Number of directors on the board	(Joseph et al., 2023)	Refinitiv Eikon
Board gender diversity	Percentage of females on the board	(Martinez-Jimenez et al., 2020)	Refinitiv Eikon
Board meetings	Total number of board meetings	(López-Cabarcos et al., 2023)	Refinitiv Eikon
Control Variable (Macro-Economic Characteristics)			
Inflation	Consumer price index (CPI)	(Marcoulides et al., 2018)	World Bank
GDP	Growth in Gross Domestic Product	(Öztekin, 2015)	World Bank
Authors' analysis			

3.4. Model Development

3.4.1. Dependent Variable

Capital structure adjustment: (CapStAd) This variable constitutes a company's leverage with respect to adjusting its structure towards the desired capital structure ([Khalaf, 2017](#)). The net change in leverage that a company uses to fund its operations and growth is referred to as its capital structure adjustment. It is critical for creating a comprehensive non-financial organizational strategy and greatly influences an organization's value and success ([Meshack et al., 2022](#)). Thus, whenever the capital structure adjustment ratio ($\text{Act Lev}_{i,t} - \text{Act Lev}_{i,t-1}$) exceeds or falls short of the target, the aforementioned adjustment coefficient quantifies the magnitude of the response ([Iqbal-Hussain et al., 2015](#)). Consequently, it may be asserted that the costs associated with increasing leverage are less than those for reducing debt ([Khalaf, 2017](#)).

3.4.2. Independent Variable

Digital Transformation: This research's digital transformation variable was developed using a data-mining methodology, particularly by examining the frequency of pertinent terms in organizations' annual reports, specifically via the ratio of keyword occurrences to the total word count in the annual report ([Gurumurthy et al., 2020](#)). Natural language processing (NLP) was employed to identify and extract key terms related to digital transformation, including "big data", "blockchain", "artificial intelligence", "data analytics", "digital finance", "IOT", "digital innovation", "cloud computing", "multi-party security computing", "automation", and "cybersecurity", from corporate annual reports. A term frequency (TF) model was utilized to assess the relative significance of these phrases within each company's report, ensuring that frequently used words did not eclipse those explicitly representative of digital actions ([Bharadwaj et al., 2013](#)). This method provides an objective and quantitative assessment of a firm's digital transformation initiatives, serving as a data-driven indicator of the degree to which organizations prioritize and incorporate digital strategies into their operations ([Yufeng Chen et al., 2023](#)). The resultant variable functions as a significant input for evaluating the effects of digital transformation on the adjustment of the capital structures of non-financial companies in Europe.

3.4.3. Control Variables (Firm Characteristics)

Firm size: The size of a business significantly influences the capital structure adjustment process since larger organizations are often met with cheaper financing costs, enhanced access to capital markets, and less information asymmetry relative to smaller enterprises ([Rasiah & Kim, 2011](#)). Large corporations often possess more varied income sources, superior credit ratings, and robust affiliations with financial entities, enabling them to modify their capital structures more effectively in reaction to market dynamics ([Wahhab et al., 2021](#)). Conversely, smaller enterprises may face elevated borrowing expenses, financial limitations, and reduced adaptability in modifying their debt-to-equity ratios. In light of these dynamics, firm size is typically represented by total assets since this value offers a distinct and measurable indication of a company's entire scale and resource capacity. The total assets value reflects a firm's ability to generate capital and withstand financial disruptions, serving as a dependable metric for assessing capital structure modifications for enterprises of varying sizes ([Nuñez Huerta, 2021](#)).

Tangibility: Tangibility significantly influences the capital structure adjustment process since enterprises with a greater ratio of tangible assets generally have improved access to secured loan funding ([İltaş et al., 2020](#)). Tangible assets, including property, plant, and equipment (PPE), function as collateral, mitigating risk for lenders and decreasing borrowing expenses. Consequently, companies with significant asset tangibility are more inclined to modify their capital structures by augmenting leverage as necessary since they may obtain loans with greater ease ([Camisón et al., 2022](#)). In contrast, companies with reduced tangibility—such as those in the technology or service industries—may be subject to elevated borrowing costs due to insufficient collateral, complicating their ability to change debt levels effectively ([Vengesai,](#)

2023). Tangible assets affect the pace of capital structure adjustment since businesses with substantial collateral can more rapidly realign their leverage in reaction to market changes or desired capital structures (Alves & Lourenço, 2022).

Profitability: Profitability considerably impacts a firm's capital structure adjustment since more profitable enterprises often depend less on external loans and modify their capital structures at a slower rate than less profitable firms. The pecking-order hypothesis posits that enterprises with greater profits choose to finance their operations through internal funds (retained earnings) instead of incurring more debt, hence minimizing the necessity for frequent capital structure modifications (Jayathilaka, 2020). In contrast, less profitable enterprises, which may have greater financing limitations, are more inclined to modify their capital structures by augmenting leverage to satisfy funding requirements (Zambrano Fariás et al., 2022). Furthermore, profitability influences the rate of adjustment, as organizations with robust revenues may swiftly diminish excessive debt levels while aiming for an optimal capital structure, whereas financially weaker enterprises may encounter difficulties in making prompt modifications due to liquidity limitations. Consequently, profitability serves a dual function in capital structure modification, affecting both the trajectory and pace of financial decision-making (Puspitaningtyas et al., 2018).

Non-Debt Tax Shield: Non-debt tax shields (NDTSs), including depreciation, diminish a firm's taxable revenue without reliance on loan funding. Companies with elevated NDTs are less motivated to depend on interest tax deductions from debt, potentially hindering capital structure modifications towards more leverage (Nasution et al., 2017). In contrast, enterprises with lower NDTs may more actively modify their capital structures by raising debt to capitalize on interest tax shielding, hence expediting the adjustment process towards their target leverage ratio (Hristov et al., 2023).

3.4.4. Control Variables (Board Characteristics)

Board Size: The size of a board can impact the adjustment of capital structure by influencing the speed and efficacy of financial decision-making (Kalsie & Shrivastav, 2016). A large board may result in protracted capital structure revisions owing to coordination difficulties, varied perspectives, and possible bureaucratic hindrances in regard to achieving a consensus on financing choices. Conversely, smaller boards are often agiler and more stubborn, enabling the corresponding companies to modify their leverage more effectively in reaction to market dynamics and financial objectives (Elmoursy, 2020).

Board Gender Diversity: Gender diversity on boards can affect capital structure adjustments by improving risk evaluation and decision-making processes. Companies with more gender-diverse boards typically use more cautious financial strategies, resulting in gradual shifts towards increased debt, as female directors are generally linked to minimized risk tolerance. Gender-diverse boards may enhance governance quality and financial supervision, enabling more effective modifications to capital structures in alignment with long-term financial stability (Reddy & Jadhav, 2019).

Board Meetings: Board meetings are essential for capital structure modification as they enable strategic financial decision-making and supervision. An increased frequency of board meetings can facilitate expedited modifications to a company's capital structure by allowing for prompt deliberations on financing strategies, risk management, and leverage optimization. Holding meetings rarely may hinder the adjustment process by causing delays in decision-making and diminishing board involvement in capital structure planning (Yilmaz et al., 2023).

3.4.5. Control Variables (Macro-Economic Variables)

Inflation: Inflation can profoundly affect capital structure modification by altering financing expenses and debt management tactics (Živkov et al., 2020). In times of elevated inflation, companies may modify their capital structures by augmenting leverage since the actual value of debt diminishes, rendering borrowing more appealing (Ali & Asfaw, 2023). Nevertheless, inflation may result in elevated interest rates and economic instability, thereby hindering capital structure modifications as companies exercise greater caution around incurring extra debt (Fitzgerald et al., 2020).

GDP: GDP growth impacts capital structure modification by influencing economic stability, loan accessibility, and corporate profitability (Cracolici et al., 2010). In times of robust GDP development, companies may modify their capital structures by augmenting leverage, as elevated economic activity enhances profitability and diminishes default risk (Cohen Kaminitz, 2023). Conversely, during economic recessions, companies may decrease debt levels or decelerate capital structure modifications due to heightened uncertainty and stricter lending conditions (Bernow et al., 2017).

4. Results and Analysis

4.1. Descriptive Statistics

Table 4 highlights the descriptive statistics and places of interest in regard to significant points that enhance one’s understanding of the data. The descriptive data offer insights into the capital structure adjustments and digital transformation levels of enterprises. The capital structure adjustment values vary from −0.285 to 0.578, signifying that certain enterprises have markedly decreased their leverage, while others have considerably augmented it. A standard deviation of 0.058 indicates substantial diversity in the adjustment process among enterprises.

Table 4. Descriptive statistics.

	<i>CapStAd</i>	<i>DT</i>	<i>FSize</i>	<i>Tang</i>	<i>Prof</i>	<i>NTSheild</i>	<i>BSize</i>	<i>BGD</i>	<i>BMeet</i>	<i>GDP</i>	<i>Inf</i>
Mean	0.199	0.015	22.583	0.633	0.069	0.184	10.492	0.259	8.044	0.014	0.022
St Dev	0.058	0.001	1.671	0.203	0.116	0.030	3.765	0.143	2.347	0.025	0.024
Min	−0.285	0.009	15.008	0.111	−0.140	0	3	0	2	−0.057	−0.062
Max	0.578	0.032	27.211	1.000	1.493	0.318	26	0.75	12	0.060	0.083

Authors’ analysis.

The average value for non-financial enterprises in Europe concerning digital transformation is around 29 words counted in annual reports, indicating a moderate degree of digital adoption. The substantial standard deviation of 9.943 signifies significant variability among enterprises, indicating that although several companies have fully embraced digital transformation, others are still in the nascent phases of adoption. This variety underscores the varied strategies and investment levels employed in digital transformation among various organizations and sectors

4.2. Correlation Matrix

Table 5 displays the correlation matrix, clarifying the connection between the variables. The positive link between capital structure adjustment and digital transformation indicates that enterprises modifying their capital structures are more inclined to invest in digital innovation and technology-driven initiatives. Organizations experiencing digital transformation frequently require significant financial resources to invest in digitalization, prompting them to modify their capital structures by optimizing their debt/equity ratios.

Table 5. Correlation analysis.

	1	2	3	4	5	6	7	8	9	10	11
1. CapStAd	1										
2. DT	0.007	1									
3. FSize	-0.004	-0.033	1								
4. Tang	0.213	-0.038	0.248	1							
5. Prof	-0.101	0.053	-0.186	-0.171	1						
6. NTSheild	0.008	-0.020	-0.050	-0.007	-0.048	1					
7. BSize	-0.036	-0.005	0.437	0.057	-0.088	0.042	1				
8. BGD	-0.003	-0.008	0.125	0.008	-0.022	0.014	0.045	1			
9. BMeet	0.076	-0.006	-0.014	0.034	-0.052	0.058	-0.055	0.098	1		
10. GDP	-0.017	-0.002	0.003	-0.015	0.036	-0.007	0.006	0.028	0.014	1	
11. Inf	-0.014	-0.114	0.061	-0.002	-0.009	0.007	0.012	0.230	0.053	0.224	1
VIF	1.562	1.251	1.952	1.756	1.625	2.152	1.960	1.484	1.263	1.185	

Authors' analysis.

Table 5 (above) demonstrates a negative association of -0.004 between capital structure adjustment and firm size, suggesting that larger non-financial firms appear to participate in capital structure adjustment activities less, suggesting that having access to a sufficient quantity of resources does not inherently result in superior capital structure adjustment performance. Moreover, the impact of market conditions, including inflation and economic growth, is substantial, as they greatly affect non-financial firms' capital structure adjustment performance, highlighting the importance of including these control factors in any thorough examinations of capital structure adjustment.

Additionally, there is a significant positive connection, equal to 0.213, between capital structure adjustment and tangibility. These results indicate that non-financial firms that efficiently utilize their tangible assets might have a superior capacity to acquire debt funding, hence fostering growth and financial performance. These findings highlight the intricacy of capital structure adjustment dynamics, where diverse firms adopt various financial strategies. Non-financial firms must comprehend this connection in order to refine their capital structure adjustment approaches to improve performance and sustainability.

4.3. Panel GMM Regression Analysis

According to the results of the panel GMM regression analysis shown in Table 6, digital transformation positively and significantly impacts the capital structure adjustments of non-financial firms. The capital structure adjustments of these companies becomes more stable and appealing to investors as digital transformation activities expand, according to the highly significant coefficient, and this is in line with the results reported by [Santos \(2023\)](#). More specifically, this result suggests that digitally advanced enterprises may have greater development potential, enhanced operational efficiency, and increased profitability as well as a better capacity to manage their leverage efficiently and adapt their capital structures in response to financial and market conditions ([Tsou & Chen, 2023](#)). This suggestion indicates that companies engaged in digital transformation exhibit greater dynamism in financial decision-making while also maintaining a capital structure that aligns with their changing strategic goals ([Rothstein, 2024](#)). According to these findings, non-financial companies that embrace digital transformation have superior operational savings, innovation potential, and overall market competitiveness. The findings suggest that these firms are better positioned to encourage investment ([Bruszt & Langbein, 2020](#)). The dynamic trade-off theory posits that enterprises modify their capital structures over time to maximize the tax advantages of debt while mitigating bankruptcy risks. Digital transformation reduces adjustment costs, increases capital accessibility, and promotes financial decision-making, resulting in expedited and less expensive adjustments to capital structures ([Ahmed et al., 2023](#)). Moreover, the pecking-order theory posits that firms favor internal finance over external financing because of asymmetric information. Digital transformation enhances financial

openness and credibility, diminishes information asymmetry, and enables enterprises to acquire external finances on more advantageous terms (Bela et al., 2024).

In addition, there is a significant positive impact of firm size on the adjustment of capital structures, indicating that larger companies and those with more tangible assets are better able to manage their resources, maintain financial stability, and move toward their optimal capital structures (Chen et al., 2023). The beneficial effect of firm size on capital structure adjustment corresponds to trade-off theory, which posits that companies modify their capital structures to achieve an optimal debt ratio by weighing the tax benefits of debt against bankruptcy expenses (Ahmed & Abu Khalaf, 2025). Large corporations, owing to their financial robustness, adapt more effectively than smaller enterprises, which may encounter limitations. Moreover, dynamic trade-off models suggest that large enterprises have greater adjustment speed due to lower adjustment costs, including fewer constraints from lenders and decreased market friction in capital acquisition (Chen & Xu, 2023).

The size of a board and the frequency of its meetings have an important role in corporate financial decision-making, especially with respect to capital structure modifications. A larger board typically provides varied experience, improved governance, and enhanced oversight, hence augmenting the corresponding firm's capacity to effectively modify its leverage ratio (Abu Khalaf, 2024). Likewise, regular board meetings facilitate ongoing oversight, prompt decision-making, and proactive reactions to financial discrepancies, guaranteeing that companies can modify their capital structures in accordance with strategic objectives (Elmoursy, 2020). An increased board size correlates positively with enhanced decision-making, as it encompasses directors possessing diverse forms of financial acumen, industry insights, and risk management competencies (Epong & Anom, 2019). This diversity allows companies to assess various financing alternatives, enhance debt/equity ratios, and promptly adjust their capital structures in response to market fluctuations. Moreover, an effectively organized board helps alleviate agency issues, guaranteeing that managers prioritize their firm's best interests above inefficient financial approaches (João et al., 2023). Regular board meetings improve the speed and effectiveness of capital structure modifications by promoting active discourse on financial policies, debt management, and equity-financing (Alshaiba & Abu Khalaf, 2024). Holding more meetings enables boards to promptly address economic swings, interest rate variations, and investment prospects, thereby averting extended divergences from the ideal capital structure. Furthermore, regular meetings foster robust corporate governance, mitigating information asymmetry and improving access to capital markets (Joseph et al., 2023).

Profitability imposes a negative and significant influence on capital structure adjustment, as posited by the pecking-order hypothesis, which indicates that firms favor internal financing over external financing (Hristov et al., 2023). More profitable companies accumulate greater retained earnings, hence diminishing their need for debt or equity financing (Al-Kubaisi & Khalaf, 2023). Consequently, these organizations have less of an incentive to modify their capital structures, resulting in slower or less frequent adjustments in their leverage ratios (Jayathilaka, 2020). Moreover, highly profitable companies typically eschew superfluous financial risk and favor sustaining lower debt levels, further constraining the necessity for frequent capital structure modifications (Kim et al., 2023).

Likewise, gender diversity on boards may adversely affect capital structure adjustment because of variations in risk perception and decision-making approaches. Studies indicate that female board members are generally more risk-averse, favoring financial stability over bold financing modifications (Khalaf, 2017). This prudent strategy may result in postponed or conservative modifications to capital structures, as diverse boards prioritize long-term sustainability over swift reconfiguration of debt and equity (Reddy & Jadhav, 2019). Furthermore, heightened variety may prolong decision-making procedures since several perspectives must be evaluated prior to implementing substantial finance alterations. Thus, while gender diversity improves governance and ethical decision-making, it may impede a firm's capacity to optimize its capital structure effectively (Sarang et al., 2021).

Inflation adversely and substantially affects the modification of capital structure because of its influence on borrowing expenses, investment unpredictability, and corporate valuation. Elevated inflation results in

increased interest rates, rendering debt financing more costly and deterring companies from modifying their capital structures via further borrowing (Zhang et al., 2022). Moreover, inflation heightens economic uncertainty, prompting companies to choose a more conservative strategy for financial restructuring, as variable prices and expenses complicate the forecasting of future cash flows and repayment (Ali & Asfaw, 2023). Furthermore, inflation can diminish the actual value of liabilities, prompting enterprises to postpone capital structure modifications in expectation of additional inflationary effects (Ktit & Abu Khalaf, 2024). Consequently, companies in high-inflation contexts may find it challenging to optimize their capital structures, choosing instead to reduce financial risk and preserve liquidity, thereby impeding the adjustment process (Zou et al., 2024).

Table 6. Panel GMM regression results.

Dependent Variable: Capital Structure Adjustment		
Variables	Coefficient	p value
CapStAd _(t-1)	0.035	0.000
DT	0.068	0.000
FSize	0.096	0.000
Tang	0.062	0.000
NTSheild	0.021	0.218
Prof	-0.147	0.000
BSize	0.078	0.028
BGD	-0.051	0.000
BMeet	0.044	0.010
Inf	-0.054	0.062
GDP	0.030	0.255
Intercept	0.235	0.000
Country Dummies	Yes	
AR (1)	0.135	
AR (2)	0.172	
Hansen Test	0.404	
Wald Chi ²	1952.23 (0.000)	

4.4. Robustness of Results

In this part of the study, we employed the Panel Generalized Method of Moments (GMM) estimation model to validate the robustness of the results by integrating various proxies for the chosen variables. We employed alternative measures to guarantee that the conclusions would not be influenced by a particular variable's definition and maintain consistency across many specifications. The GMM methodology adeptly mitigates any endogeneity issues while enhancing the dependability of estimations. The outcomes derived from these robustness assessments substantiate the credibility of the principal findings, illustrating that the associations recognized by the basic model persist even when other proxies are employed. The results provided by the panel GMM regression hold, as evident in Table 7 below, suggesting that digital activities have a favorable impact on capital structure adjustment.

Table 7. Panel GMM regression results.

Dependent Variable: Capital Structure Adjustment		
Variables	Coefficient	<i>p</i> value
CapStAd _(t-1)	0.022	0.000
DT	0.059	0.000
FSize	0.088	0.000
Tang	0.057	0.000
NTSheild	0.020	0.352
Prof	-0.177	0.000
BSize	0.085	0.032
BGD	-0.047	0.000
BMeet	0.049	0.025
Inf	-0.053	0.081
GDP	0.035	0.284
Intercept	0.288	0.000
Country Dummies	Yes	
AR (1)	0.121	
AR (2)	0.198	
Hansen Test	0.452	
Wald Chi ²	1845.25 (0.000)	

5. Conclusions

This empirical investigation of the association between digital transformation and capital structure adjustment and control variables in regard to non-financial firms across four European regions (Western Europe, Eastern Europe, North Europe, and Southern Europe) provides significant illumination. By evaluating data from 8945 listed non-financial organizations, this research addresses a significant gap in the previous literature, which has mainly disregarded the relationship between digital transformation and capital structure adjustment in the European environment. According to the empirical results, digital transformation is vital to non-financial firms' ability to optimize their capital structures, increase financial flexibility, and lessen financing limitations. By highlighting the effects, the inclusion of control variables further improved our knowledge of how different factors affect capital structure adjustment. The findings highlight how crucial it is for non-financial companies to incorporate digital transformation into their strategic planning to improve financial stability and make long term investments. By lowering perceived risks and financing costs, digital tools and technologies not only boost access to financial markets but also streamline operations. Businesses can use these insights to match technological developments with their financial goals, guaranteeing long-term growth and competitiveness in the European market.

The beneficial effects of digital transformation on capital structure modification for non-financial enterprises in Europe have considerable implications for corporate financial strategies and investment choices. As companies progressively incorporate digital technologies and processes like automation, artificial intelligence, and big data analytics, they improve their operational efficiency, revenue generation, and overall financial stability. This enhanced financial performance enables enterprises to modify their capital structures more efficiently, optimizing their debt and equity composition in accordance with market conditions. Furthermore, digital transformation mitigates information asymmetry by augmenting transparency and financial reporting, resulting in heightened investor trust and enhanced access to external finance. Consequently, companies that actively engage in digital transformation are more likely to be met with advantageous financing conditions, allowing them to modify their leverage in a more strategic and timely fashion. The relationship between digital transformation and capital structure adjustment highlights the significance of technology investment

for long-term financial stability. Policymakers and corporate leaders in non-financial industries throughout Europe must acknowledge that digital transformation serves not just as a mechanism for improving competitiveness but also as a crucial factor for attaining financial flexibility. Companies that do not react to digital innovations may face increased funding limitations, complicating the efficient adjustment of their capital structures. Consequently, promoting digital adoption via government incentives, corporate training initiatives, and infrastructure expenditures can enhance enterprises' capacity to manage financial difficulties, optimize capital structures, and maintain long-term development in a progressive digital economy.

This study does have certain limitations: Firstly, although the sample size is representative, it is limited to 514 non-financial firms, which might not adequately represent the diversity seen in all European industries and geographical areas. Second, the scope may be constrained by the exclusive use of Refinitiv Eikon as the data source, which leaves out qualitative information or data from smaller, unlisted companies. Furthermore, the data's cross-sectional nature limits the capacity to examine causality or long-term consequences. This study makes important contributions to our understanding of digital transformation and how it affects non-financial organizations' financial decision making. The findings highlight the significance of digital transformation in promoting financial stability and growth, making them especially important for stakeholders in the non-financial sector, policy makers, and financial management.

Additionally, this research contributes to the growing conversation on digitalization in financial strategies by laying the foundation for future investigations into dynamic and wider industrial applications. For researchers, this research provides a rigorous framework for studying the substantial consequences of digital transformation on financial decision-making. It gives a platform from which future studies can study dynamic connections between digital transformation and other economic or industry-specific factors in diverse geographical and regulatory environments. Additionally, this research emphasizes the need for more detailed evaluations on topics such as how a different degree of digital adoption affects capital structure adjustment or how sector disparities within the non-financial sector affect them. Overall, this research highlights how digitalization can revolutionize non-financial firms' financial practices and lays the groundwork for future research on digital transformation in a more complex economic environment.

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