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Determinants of optimal capital structure for non-financial firms listed on the JSE

Master of Commerce (50% Research) in Finance

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ABSTRACT

This paper investigates the determinants of optimal capital structure while considering the influence of the cost of capital, specifically examining the relationship between firm-specific variables known to drive optimal capital structure (such as firm size, asset tangibility, growth, liquidity, and profitability) and the cost of capital. The analysis of these determinants in developing countries is intriguing due to the differences in firm characteristics compared to those in advanced economies. The study utilizes primary data sourced from Refinitiv Workspace for 189 firms across various sectors listed on the Johannesburg Stock Exchange (JSE) from 2015 to 2023, excluding financial services and insurance sectors. Panel econometric approaches, including Feasible Generalised Least Squares (FGLS) and the Generalised Method of Moments (GMM) regression method, are employed for analysis.

The findings of the study unveil several noteworthy relationships between independent variables and the Weighted Average Cost of Capital (WACC). Firm size, profitability, asset tangibility, and growth emerge as key determinants affecting WACC to varying degrees. Firm size and profitability exhibit positive associations with WACC, supported by statistically significant coefficients. This implies that increases in firm size and profitability correspond to higher WACC levels. Conversely, asset tangibility and growth demonstrate negative correlations with WACC, backed by statistically significant coefficients. Furthermore, firm size and profitability maintain their positive relationships with WACC across various estimation models, including Feasible Generalized Least Squares (FGLS) and Generalized Method of Moments (GMM). This consistency underscores the robustness of these relationships, with larger and more profitable firms consistently exhibiting higher WACC.

Keywords: firm size; asset tangibility; growth; liquidity; profitability; cost of capital; capital structure

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

1.0 Introduction

The main goal of this chapter is to discuss the theories of capital structure and introduce the study. The chapter is organized as follows: Section 1.1 MM Irrelevance Theory, Section 1.2 Trade-Off Theory, Section 1.3 discusses Pecking Order Theory, Section 1.4 discusses firm specific determinants of capital structure, Section 1.5 discusses the background and motivation, Section 1.6 discusses the research problem, Section 1.7 discusses the research objective, Section 1.8 discusses the research questions, Section 1.9 discusses the hypotheses, Section 1.10 discusses potential benefits of the study and section 1.11 concludes this chapter.

1.1Modigliani And Miller Irrelevance Theory

Modigliani and Miller (1958) initially hypothesised that a firm's capital structure has no impact on its value under ideal conditions where capital markets are free from taxes, transaction costs, and other frictions. However, the introduction of debt into a firm's capital structure leads to a reduction in taxable income due to the tax deductibility of interest payments, thereby enhancing firm value through the present value of interest tax shields (Barclay & Smith, 1999). Modigliani and Miller (1963) revised their proposition, acknowledging that the tax benefits of debt influence firms' after-tax returns and result in significant changes in market values, rendering firms within the same class no longer proportionally valued.

The use of debt in a firm's capital structure introduces business risk borne by shareholders (Bradley, Jarrell, & Kim, 1984; Myers & Majluf, 1984; Chipeta & McClelland, 2018). This heightened risk increases financial distress costs when a firm struggles to generate sufficient cash flows to meet its contractual obligations. Introducing bankruptcy costs and corporate taxes, where interest payments are tax-deductible, suggests the existence of an optimal debt-to-equity ratio (Warner, 1977; Kraus & Litzenberger, 1973; Robicheck & Myers, 1965; Hirshleifer, 1966).

Warner (1977) suggests that a firm's value may not always be a concave function of its debt obligation, especially when debt exceeds earnings in some states.

Addressing the puzzle of determining the optimal debt level, Jensen (1986) argues that it is the point at which firm value is maximised, balancing the marginal costs and benefits of debt. Debt serves as a mechanism to mitigate agency costs, particularly in firms with high free cash flows, leading to a positive increase in firm value.

1.2 Efficient Capital Markets

Fama's seminal work in 1970 introduced the concept of market efficiency, defining it as a market where prices always fully reflect all available information. To assess the nature of information in the market, the author investigates three subset tests. Weak-form tests: These tests examine whether stock market prices solely reflect historical prices. In other words, in a weak-form efficient market, past price movements cannot be used to predict future price movements. If historical prices contain all available information, then technical analysis based on past price data alone should not yield consistently profitable trading strategies. Semi-strong-form tests: These tests go beyond historical prices and consider whether stock market prices incorporate all publicly available information. This includes not only past prices but also other publicly available data such as financial statements, economic indicators, and news. In a semi-strong-form efficient market, investors cannot consistently achieve superior returns by trading on publicly available information, as stock prices already reflect it. Strong-form tests: The strongest form of market efficiency involves examining whether any individual investor or group has monopolistic access to information that allows for superior returns. In a strong-form efficient market, even insiders or those with privileged access to information cannot consistently outperform the market, as all relevant information is already reflected in stock prices. This implies that no one has an unfair advantage in accessing information that could lead to consistently profitable trading strategies.

The study by Myers seeks to explain why it is rational for firms to limit borrowing even when there are tax advantages to do so, and capital markets are strictly perfect, efficient, and complete (Myers, 1977).

The author points out in the absence of debt the optimal borrowing strategy is to issue no risky debt but where there are tax advantages there is a trade-off between tax advantages and the costs of the suboptimal future investment strategy. The discernment behind the limit on debt financing on a firm with already risky debt is, the more debt a firm tries to take on, it pays higher interest rates to compensate for the higher risk of default and these higher interest rates cannot be maintained hence the limit of a firm's debt financing. The author identifies the debt overhang problem, passing up on positive Net Present Value (NPV) projects, and its implication on the firm. In conclusion the author's theory in corporate borrowing predicts the debt value should be set equal to the amount that maximises the market value of a firm and this value will be inversely related to the ratio of firm value accounted for by growth opportunities.

1.3 Trade-Off Theory

According to Kraus and Litzenberger (1973), the trade-off theory of capital structure suggests that the optimal capital structure of a firm results from a delicate balance between the tax advantages of debt and the increased costs associated with financial distress. This concept highlights that increases in debt levels lead to higher bankruptcy costs while simultaneously reducing agency costs within the firm. The theory suggests that firms seek to strike an equilibrium where the benefits of debt, such as tax shields, are maximised, while the costs of financial distress are minimized (Myers, 1984).

According to Myers (2001), non-financial firms with access to US or international capital markets enjoy relatively easy access to financing. Consequently, these firms can adjust their capital structures at low costs, taking advantage of favourable market conditions to optimize their financial leverage. This highlights the importance of external financing opportunities and market conditions in shaping firms' capital structure decisions.

The predominate literature finds evidence supporting the notion that firms display targeting behaviour towards an optimal or target capital structure. Öztekin (2015), Chipeta (2012), Chipeta (2016), Auerbach (1985), and Gallizo, Vilanova, and Salazar (2014) contribute to this body of literature by demonstrating firms' tendencies to strive towards achieving a specific level of capital structure that maximises value or minimises costs.

However, empirical evidence from developing markets has presented a different perspective, aligning more closely with the pecking order theory. Chipeta and McClelland (2018), Rau, Kumar, and Madhavan (2018), and Pahujah and Sahi (2016) have found support for the pecking order theory, which posits that firms do not actively seek an optimal capital structure but instead rely on internal financing first, followed by debt, and finally equity issuance. This theory suggests that firms prioritize financing options based on their cost and the information asymmetry between managers and external investors.

1.3 Pecking Order Theory

The Pecking Order Theory posits that firms do not have a specific target or optimal capital structure but instead prioritize financing sources based on their cost and the information asymmetry between managers and external investors. Myers and Majluf (1984) expanded on the earlier work by Donaldson (1961) to develop this theory, revealing that managers prefer to use internal funds as the primary source of financing for investment opportunities. When external funds are necessary, managers choose debt over equity issuance, as debt is perceived as less costly.

This preference for internal financing followed by debt issuance stems from the existence of information asymmetry, where managers possess superior information about the firm's prospects compared to external investors. As a result, issuing safer securities, such as debt, is favoured over riskier ones to mitigate adverse selection problems. Internal equity is used first if available, followed by debt, with equity issuance considered a last resort due to the signalling costs associated with conveying adverse information to the market.

Myers and Majluf's (1984) seminal work, along with subsequent studies by Barclay and Smith (1999) and Booth (2001), further emphasised the principles of the Pecking Order Theory and its implications for firms' financing decisions.

Overall, the theory provides valuable insights into how firms navigate financing choices in the presence of information asymmetry, emphasizing the importance of internal funds and debt issuance in maintaining financial flexibility and mitigating adverse selection costs.

1.4 Firm-Specific Determinants of Capital Structure

It is well established that firm size, asset tangibility, growth, liquidity, and profitability are key firm-specific determinants of capital structure (Myers, 1984; Rajan & Zingales, 1995; Huang & Song, 2006; Chipeta & Deressa, 2016). Regarding firm size, several studies have identified a positive and significant relationship with the firm's debt-to-equity ratio (Chipeta & Deressa, 2016; Özde & Öztekin, 2015; Frank & Goyal, 2009). However, Pahuja and Sahi (2012) reported both positive and negative coefficients for firm size concerning the debt-to-equity ratio, leading to inconclusive findings regarding its impact on capital structure.

Analysing five factors influencing capital structure using a sample of thirty selected firms in India, Pahuja and Sahi (2012) found a positive and significant relationship between independent variables such as growth and liquidity and the dependent variable, debt-equity ratio. This finding diverges from results observed in developed economies, where firms with high growth prospects may rely more on internal financing or equity issuance rather than debt, as they seek to maintain flexibility and avoid the costs associated with servicing debt (Myers & Majluf, 1984; Booth, Aivazian, Demirguc-Kunt & Maksimovic, 2001).

Firm profitability and asset tangibility appear to be the most common predictors of capital structure (Chipeta & Deressa, 2016; Augustini, 2016; Rao, Kumar, and Madhavan, 2018). Profitable firms may have lower debt-equity ratios due to their ability to generate internal funds, reducing the need for external financing (Myers & Majluf, 1984). On the other hand, asset tangibility, referring to the proportion of a firm's assets that are tangible or physical, is often positively correlated with leverage as tangible assets can serve as collateral for debt financing (Rajan & Zingales, 1995; Vuran, Tas & Adiloglu, 2017).

These factors reflect the trade-off between the tax advantages of debt and the costs of financial distress, which influence firms' decisions regarding their capital structure (Bradley, Jarrell, & Kim, 1984). In contrary Rao, Kumar, and Madhavan (2018) conducted a study examining the capital structure complexities of Small and Medium Enterprises (SMEs) in India, revealing a negative correlation between tangibility and leverage in service SMEs.

The link between firm-specific variables as determinants of optimal capital structure and the cost of capital is crucial for understanding how firms finance their operations and the associated costs. Firm-specific variables such as firm size, asset tangibility, growth, liquidity, and profitability play significant roles in shaping a firm's capital structure decisions, which, in turn, influence its cost of capital. This paper attempts to examine the impact of these variables on the optimal capital structure by determining their relationships with cost of capital.

Firm Size: Larger firms often have access to more diverse funding options and may benefit from economies of scale, allowing them to obtain financing at lower costs. As a result, larger firms tend to have lower costs of capital compared to smaller firms (Rajan & Zingales, 1995). The predominant literature finds firm size as a negative determinant of the cost of capital. For example, within the emerging markets space, evidence from Egypt revealed results that were statistically significant, particularly for the cost of equity in actively traded firms (Omran & Pointon, 2004). Chipeta and Deressa (2016) found a direct and significant relationship between firm size and long-term debt ratio for Sub-Saharan African countries, specifically non-financial firms listed on the Johannesburg Stock Exchange (JSE), supporting existing literature. This suggests that larger firms, with their diversification and stable cash flows, are perceived as lower risk by creditors (Chipeta, 2016). Augustine's (2016) study echoes these findings in developed markets, concluding that large firms are associated with lower risk and, consequently, lower costs of capital.

Asset Tangibility: Tangible assets, such as property and equipment, can serve as collateral for debt financing, reducing lenders' risk and lowering the cost of debt for firms with higher tangible asset ratios (Huang & Song, 2006). Rajan and Zingales (1995) demonstrated that tangible assets, particularly in Japanese firms, are positively associated with the book leverage ratio, indicating that firms with higher proportions of fixed assets tend to borrow more, possibly due to the appreciation of land values during the 1980s. This supports the notion that tangible assets serve as collateral, reducing creditors' risk (Huang & Song, 2006; Vuran *et al.*, 2017). Mazumder and Rao (2022) further confirmed this relationship, showing that an increase in the tangible asset ratio led to a significant rise in the long-term debt ratio, promoting leverage.

Growth: Firms experiencing rapid growth may require additional funding to finance expansion opportunities. While growth can increase the demand for funds, it may also signal potential investment opportunities, affecting the firm's cost of capital (Pahuja & Sahi, 2012). The relationship between growth trajectories and information disclosures on cost of capital has been widely acknowledged in the literature (Hail & Leuz, 2009; Dutta & Nezlobin, 2017; Ellahie, Hayes, & Plumlee, 2022). Specifically, research suggests that firms with higher growth rates exhibit a more positive association between disclosure and risk premium, while firms with lower growth rates demonstrate a less negative association. This underscores the importance of considering growth dynamics when analysing the impact of information disclosures on the cost of capital.

Liquidity: Ortiz-Molina and Phillips (2010) suggested that asset liquidity enhances a firm's operational flexibility, leading to a reduction in its cost of capital. Their research indicated that industries characterized by high asset liquidity tended to have lower costs of capital compared to those with lower liquidity. Similarly, Nicodemus and Wamugo (2017) found a positive relationship between the asset ratio and the cost of capital among firms listed on the Nairobi Stock Exchange. Omran and Pointon (2004) highlighted liquidity as a significant determinant of the cost of capital within the food industry, with their study revealing that a substantial portion of the variation in the cost of capital could be explained by liquidity. Conversely, Pahuja and Sahi (2012) identified liquidity as a key factor influencing the debt-equity ratio but found no support for the hypothesis that more liquid firms should have a lower cost of equity.

Profitability: Profitable firms may have lower costs of capital due to their ability to generate internal funds, reducing the need for external financing. Additionally, profitability can signal stability and creditworthiness to investors and lenders, impacting the firm's cost of capital (Mukhongo *et al.*, 2022). Chipeta and Deressa (2016) observed a negative and statistically significant coefficient for profitability in eleven out of twelve sampled countries as a predictor of capital structure. Similarly, Vuran *et al.,* (2017) reported a negative and significant effect of profitability on capital structure, aligning with the pecking order theory. Evidence from the US suggests that the IT sector prefers debt, with profitability being one of the key variables influencing the cost of capital in the IT sector of the S&P 500 index (Nasimi, 2016). Kengere *et al.,* (2023) concluded that major determinants of the cost of capital, such as profitability, are significantly interdependent, supporting previous findings that profitability is negatively correlated with capital structure, and profitable firms tend to prefer internal funds.

Overall, firm-specific variables serve as important determinants of a firm's optimal capital structure, which, in turn, affects its cost of capital. By understanding these relationships, firms can make informed financing decisions to minimize their cost of capital and maximize shareholder value.

1.5 Background and Motivation

According to the World Bank global corporate debt increased substantially following the 2008-09 global financial crisis, the increase was more prominent in emerging markets rising from 56%-96% of its GDP and for developed markets matching the GDP increase rates (Abraham *et al*., 2020). It has also been found that corporate debt surged following the 2020 global pandemic by more than $21 trillion and for some businesses this was for the sole reason of keeping business operations running (Hacibedel & Qu, 2023; Buckley, Barau & Samaddar, 2021). Slow economic growth following the Covid19 global pandemic raises concerns of financial distress costs and countries are called to act now to curb the risks (Abraham, Cortina & Schmukler, 2020; Hacibedel & Qu, 2023).

Buckley, Barau and Samaddar (2021) also shows evidence of average annual increase rate of 5.5% between 2010 and 2019 in corporate debt for non-financial businesses in the United States. Borisova and Brown (2013) find evidence that financing frictions have an economically important effect on key corporate investment decision by finding a positive asset sale R&D link only in constrained firms. Intangible investments like R&D induce innovations which lead to higher overall economic growing firms, and this is dependent on mitigating financing constraints.

Machokoto, Areneke and Ibrahim (2020) found pervasive increase in corporate debt in South Africa post its liberation years. The evident increase is found robust against alternative techniques and definitions of corporate debts, changes in the composition of listed firms and firm characteristics. The author concludes the trend is not supported by firm characteristics deemed to predict increases in debt but gives credit to supply-side factors to be more important. Correia and Cramer (2008) finds low levels of debt-equity ratios in their study of cost of capital, capital structure and capital budgeting practices in South Africa's listed firms. The analysis of financing choices and firm-specific variables influencing capital structure in developing countries is intriguing due to the disparities in characteristics between firms in these economies and those in advanced nations. Understanding what drives optimal capital structure in these contexts is therefore of critical importance.

1.6 Research Problem

Extensive research has been conducted to identify the determinants of capital structure worldwide. Firm-specific determinants in developed markets have been extensively explored in the literature (Cook and Tang, 2008; Borisova & Brown, 2013; Özde, 2015; Graham, Leary & Roberts, 2015). Similarly, there has been an adoption of these studies to understand the dynamics of these determinants in emerging markets (Vuran, Taş & Adiloğlu, 2017; Chipeta & Deressa, 2016a; Chipeta, 2016; Rao, Kumar, & Madhavan, 2018; Machokoto *et al.,* 2020). Makina and Negash (2005) observed a decrease in the cost of capital across all sectors on the JSE following South Africa's liberation. However, a significant number of firms still experienced an increase in the cost of capital. Notably, their study did not exhaustively examine firm-specific variables, which could provide further insights into the topic.

Notwithstanding the above contribution, there is a lack of clarity on the following:

- In the context of developing markets, the question of optimal capital structure has not been resolved by empirical evidence.
- What variables drive optimal capital structure?

- Firm specific variables that minimise the overall cost of capital have not been sufficiently investigated.

1.7 Research objective

The main objective of this study is to examine the determinants of optimal capital structure for non-financial firms listed on the JSE.

The study is followed by the following sub-objectives:

- To examine the relationship between **size** and cost of capital.
- To examine the relationship between **asset tangibility** and cost of capital.
- To examine the relationship between **growth** and cost of capital.
- To examine the relationship between **liquidity** and cost of capital.
- To examine the relationship between **profitability** and cost of capital.

1.8 Research questions

The primary inquiry for this study revolves around identifying the determinants of optimal capital structure for non-financial firms listed on the Johannesburg Stock Exchange (JSE).

The sub-questions for the study are as follows:

- What is the relationship between **size** and cost of capital?
- What is the relationship between **asset tangibility** and cost of capital?
- What is the relationship between **growth** and cost of capital?
- What is the relationship between **liquidity** and cost of capital?
- What is the relationship between **profitability** and cost of capital?

1.9 Hypothesis

Detailed Hypothesis

The first hypothesis proposes a correlation between firm size and the cost of capital. It is argued by a few authors that larger firms often enjoy better loan terms and easier access to financial resources compared to smaller firms (Chipeta & Deressa, 2016; Rao, Kumar, & Madhavan, 2018). Due to their anticipated diversification, larger firms are deemed less susceptible to financial distress, resulting in a positive correlation between firm size and leverage (Bhaduri, 2002).

For instance, Embong, Mohd-Saleh, and Hassan (2012) explored the impact of disclosures on the cost of equity and firm size as the moderator of this relationship. This covered firms listed on the Main Board of Bursa Malaysia. They discovered a significant negative association between disclosures and the cost of equity, indicating reduced costs for larger firms and these results were not significant for smaller firms. These findings are corroborated by Agustini (2016), who observed that larger firms tend to have lower cost of capital, regardless of the adoption of IFRS reporting standards. This conclusion was based on an analysis involving 176 firms from thirty-one countries listed on the NYSE. Therefore, the following hypothesis is formulated and evaluated:

Ho_1: There is no statistically significant relationship between **size** and the cost of capital.

Ha_1: There is a statistically significant relationship between **size** and the cost of capital

The second hypothesis proposes a correlation between asset tangibility and the cost of capital. According to literature by Rajan and Zingales (1995) and Vuran *et al.,* (2017), firms with higher tangible assets can offer them as collateral to lenders, thus reducing the risk of agency costs. This asset backing enhances the security of the business. For example, Booth *et al.,* (2001) examined capital structure theories across various developing countries and found that firms with greater tangible assets tend to utilize more long-term debt. However, Chipeta and Deressa (2016) reported mixed results across Sub-Saharan countries, with some confirming a positive and statistically significant correlation between asset tangibility and long-term debt, while others indicated a negative correlation. Additionally, Omran and Pointon (2004) determined that tangible assets decrease the cost of capital by providing security for debtors to recover their funds through asset sales. Based on these findings, the below hypothesis is formulated and evaluated:

Ho_2: There is no statistically significant relationship between **asset tangibility** and the cost of capital.

Ha_2: There is a statistically significant relationship between **asset tangibility** and the cost of capital.

The third hypothesis proposes a correlation between growth and the cost of capital. Dutta and Nezlobin (2017) utilized Lemma proofs to demonstrate that a firm's cost of capital decreases as the accuracy of public disclosures improves, particularly when the firm's growth rate is below a certain threshold. Conversely, when the growth rate surpasses this threshold, the cost of capital tends to increase. The threshold growth rate is defined to be higher when the firm's cash flows are more persistent or when other firms in the economy are experiencing low growth rates. In addition, in the Kenyan capital market, Kengere, Njagi, Chonga, and Kamau (2023) found evidence of a positive correlation between the cost of capital and growth. They attributed this correlation primarily to the country's political and economic stability, which significantly influences firm-specific variables. Based on these findings, the below formulated hypothesis is evaluated:

Ho_3: There is no statistically significant relationship between **growth** and the cost of capital.
Ha_3: There is a statistically significant relationship between **growth** and the cost of capital.

The fourth hypothesis proposes a correlation between liquidity and the cost of capital. A significant focus has been placed on a firm's asset liquidity in determining its financial flexibility, particularly in cases of financial distress (Ortiz-Molina & Phillips, 2010; Shleifer & Vishny, 1992). For instance, Ortuz-Molina and Phillips (2010) examined firms listed on the New York Stock Exchange using the CRSP-CompStat Database and found that asset liquidity discount on the cost of capital is strongly counter-cyclical, with a more pronounced effect in industries with high asset liquidity. Additionally, it has been observed that increasing a company's investor base and enhancing information dissemination about the stock can boost stock liquidity (Amihud, 2000). Consequently, higher stock liquidity leads to decreased investor expected returns, thus lowering the cost of capital. This, in turn, enhances firm valuation due to higher cash flow valuations due to the lowering of cost of capital. In contrast Kengere *et al.,* (2023) found that in the developing market of Kenya, liquidity was identified as one of the firm-specific variables positively correlated with the cost of capital. Based on this evidence, the following hypothesis is formulated and evaluated:

Ho_4: There is no statistically significant relationship between **liquidity** and the cost of capital.
Ha_4: There is a statistically significant relationship between **liquidity** and the cost of capital.

The fifth hypothesis proposes a correlation between profitability and the cost of capital. Prior research suggests that the cost of financing tends to be lower for internal funds and increases with the uptake of debt and rises even higher with equity (Myers & Majluf, 1984; Barclay & Smith, 1999; Booth, 2001). For example, in Kenyan markets, profitable firms tend to rely on internal funds, while less profitable firms prefer debt financing before equity, leading to a positive correlation between the cost of capital and profitability (Kengere et.al, 2023). On the contrary, a study covering manufacturing companies registered on the Indonesia Stock Exchange found that profitability has a negative significant influence on capital structure, implying that an improvement in profitability would initiate a decrease in the proportion of debt within the capital structure (Rahayu & Saifi, 2020). Based on this evidence, the following hypothesis is formulated and evaluated:

Ho_5: There is no statistically significant relationship between **profitability** and the cost of capital.
Ha_5: There is a statistically significant relationship between **profitability** and the cost of capital.

1.10 Potential benefits of the study

The topic of capital structure has been extensively studied since the inception of the Modigliani and Miller Irrelevance theory. Significant research has been conducted to identify the variables influencing capital structure at the firm, industry, and country levels. Gallizo, Vilanova, and Salazar (2014) developed a model to determine the optimal debt level that maximizes firm value and found that 63% of firms, based on real data, did not statistically differ from the estimated debt level. However, existing literature and models have not explicitly addressed the question of how much debt a firm should ideally have. There has been evidence of increasing debt levels following the 2007/08 financial crisis, and these levels have been exacerbated by the 2020 global pandemic. This has raised concerns about financial distress, particularly given the elevated interest rates that inflate the cost of debt. Daniel and Minga (2005) conducted a study to explore the effects on the cost of capital following the liberalization of the JSE stock market. While the study did not specifically examine firm characteristics such as firm size, it found that most listed firms experienced a decrease in their cost of capital. However, a sizeable portion of firms also experienced increased levels of cost of capital.

Achieving clarity on the determinants driving optimal capital structure, particularly in minimizing the cost of capital, would be invaluable for firms. This understanding would greatly contribute to the overarching goal of maximizing firm value, as it enables firms to make informed decisions about their financing mix and capital allocation strategies.

1.11 Conclusion

Building upon the foundations of the MM Irrelevance Theory, Pecking Order Theory, and Trade-Off Theory, empirical evidence suggests that firm-specific variables play a crucial role in determining optimal capital structure. In the context of South Africa's developing market, there has been a notable increase in debt levels among firms listed on the JSE following significant economic events such as the liberation period and the 2008 global financial crisis (Machokoto et al., 2020). Understanding the drivers of optimal capital structure in this context is essential. By examining variables that have shown statistical significance in other markets, we can gain insights into the unique dynamics of capital structure in South Africa and similar developing economies.
Five null hypothesis and the alternative are developed for WACC as the dependent variable and the following independent variables: firm size, asset tangibility, growth, liquidity, and profitability.

The rest of the paper is structured as follows: Chapter 2 surveys the existing literature and develops the five null hypotheses and their alternatives, Chapter 3 presents the data and describes all pre-tests and models conducted, Chapter 4 discusses the results pertaining to firm size, asset tangibility, growth, liquidity, and profitability, and their relationship with the cost of capital for non-financial firms listed on the JSE, Chapter 5 provides additional test results and outlines the study limitations and finally, in Chapter 6, the paper concludes.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

The main goal of this chapter is to discuss the literature on capital structure and variables identified as its determinates. The chapter is organized as follows: Section 2.1 discusses the evolution of MM Irrelevance Theory, Section 2.2 discusses firm specific variables identified to drive capital structure, Section 2.3 discusses firm specific variables identified to drive capital structure and their relationship with cost of capital. Section 2.4 discusses country or industry specific variables driving capital structure and section 2.5 concludes this chapter.

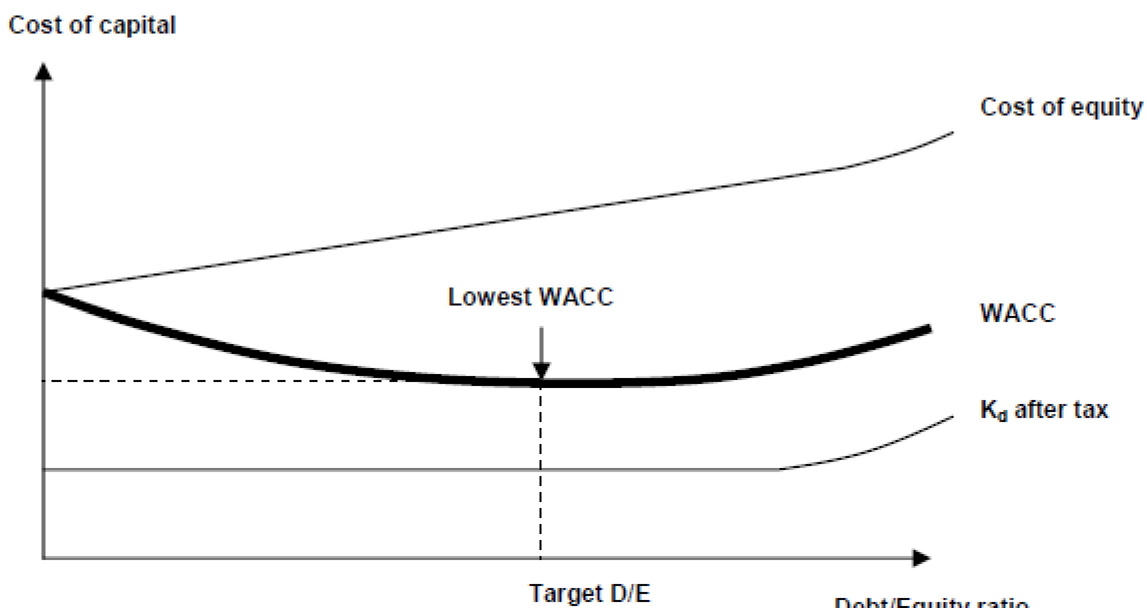
2.1 Evolution of the MM Irrelevance Theory

The process of obtaining capital to finance a firm's assets is fundamental to achieving both profit maximization and market value maximization (Modigliani & Miller, 1958). Capital structure, which reflects how a firm finances its assets, encompasses various options, including retained earnings, issuance of new equity, and borrowing through debt instruments (Bhaduri, 2002; Rao, Kumar, & Madhavan, 2018). There has been considerable debate surrounding the tax shield benefits associated with incorporating debt into a firm's capital structure. Barclay and Smith (1999) argue that firms opting not to utilize debt may miss significant value enhancement, driven by the tax advantages of debt offsetting individual tax increases, resulting in higher yields on corporate debts.

Early studies, following Modigliani and Miller's Irrelevance Theory (1958), focused on determining the optimal capital structure that maximizes a firm's market value, balancing the benefits of debt tax shields against the costs of financial distress (Kraus & Litzenberger, 1973; Bradley, Jarrell, & Kim, 1984; Mogugu, 2013). Myers (1984) suggests that there is no fixed optimal debt-to-equity ratio, citing transaction costs and asymmetric information as factors offsetting debt's tax benefits. Conversely, De Wet (2006) argues that, under certain conditions, the optimal capital structure involves a blend of equity and debt to maximize firm value.

Valuing a company as a going concern involves considering its expected future cash flows discounted at the weighted average cost of capital (WACC) (Brigham & Ehrhardt, 2007). Hawawini and Viallet (1999), referenced by De Wet (2006), assert that achieving the optimal capital structure involves finding the mix of debt and equity that minimizes WACC, ensuring maximum value creation for the firm.

Figure 1 WACC for different levels of financial gearing, with taxes and financial distress costs



Source: Hawawini and Viallet (1999:362)

Hawawini and Viallet (1999) as cited in De Wet (2006)

The above graph illustrates the trade-off theory of capital structure, depicting how changes in debt levels affect the WACC. Initially, as debt increases, WACC declines, reflecting the tax shield benefits associated with debt financing. However, beyond a certain threshold, further increases in debt lead to a rise in WACC due to the costs of financial distress, such as bankruptcy and increased risk perception by investors. This trade-off highlights the optimal point where the benefits of debt financing are maximized before the costs outweigh the advantages, emphasizing the importance of balancing leverage to minimize WACC and maximize firm value.

There are firm and country specific variables identified to drive capital structure, and this study will focus on these five firm-specific variables: size, tangibility, growth, liquidity, and profitability.

2.2 Traditional Variables driving Capital Structure

Bradley, Jarrell, and Kim (2009) developed a model evaluating the trade-off theory considering personal taxes and financial distress costs, among other factors. They found that when financial distress costs are significant, optimal financial leverage is inversely related to the variability of firm earnings. This is based on an inverse relationship found between optimal financial leverage and expected costs of financial distress, as well as non-debt tax shields.

A study investigating the capital structure complexities of Small and Medium Enterprises (SMEs) in India found that tangibility is negatively correlated with leverage in service SMEs, compared to a positive correlation for manufacturing SMEs (Rao *et al.,* 2018). This aligns with Myers' (1977) conclusion that firms with intangible investment opportunities are likely to have lower debt ratios due to potential underinvestment issues with high debt ratios. Conversely, mature companies with low levels of debt in their capital structure may face overinvestment issues due to higher cash flows from tangible assets.

Pahuja and Sahi (2012) analysed five factors affecting capital structure using thirty selected firms in India. The independent variables, such as growth and liquidity, showed a positive and significant relationship with the dependent variable, debt-equity ratio, consistent with the pecking order theory. This is contrary to results found in developed markets, where growth has a negative correlation with the debt-equity ratio. Profitable firms tend to have lower debt-equity ratios, as retained earnings are cheaper than external financing, supporting the Pecking Order Theory over the Trade-Off Model, as firms with high profitability may aim to reduce their tax liability through higher debt-equity ratios (Booth, 2001). Firm size has been found to have a positive and significant relationship with the firm's debt-to-equity ratio (Chipeta & Deressa, 2016; Özde & Öztekin, 2015; Frank & Goyal, 2009). However, Pahuja and Sahi (2012) found both positive and negative coefficients for firm size in relation to the debt-to-equity ratio, leading to inconclusive results.

2.3 Firm specific factors driving capital structure and cost of capital.

2.3.1 Firm size

Rao *et al.,* (2019) argue that larger firms have greater access to external funds, resulting in reduced costs of capital compared to smaller firms, a proposition supported by their findings on SMEs in India. There is a significant body of literature that finds a negative relationship between firm size and cost of capital (Augustini, 2016; Hail & Huis, 2009; Omran & Pointon, 2004). Augustini (2016) hypothesized that firm size is negatively correlated with the cost of capital, a relationship that would be stronger for countries with low inflation rates, among other country-level variables, consistent with Hail and Leuz (2009). The author's conclusion, based on a study of 176 companies from thirty-one countries listed on the NYSE across Europe, America, and the Asia Pacific, suggests that larger firms tend to have lower risk and consequently lower costs of capital, while smaller firms exhibit the opposite pattern.

Based on evidence from Egypt, Omran and Pointon (2004) found a negative coefficient for firm size and cost of capital, indicating that smaller firms tend to have higher costs of capital. These results were significant at a one percent level, with the findings even more pronounced for the cost of equity in actively traded firms. Similarly, in an examination of firm and country-specific determinants of capital structure for countries in Sub-Saharan Africa, non-financial firms listed on the JSE showed a direct and significant relationship between firm size and long-term debt ratio, supporting existing literature (Chipeta, 2016; Chipeta & Deressa, 2016). This implies that large firms, with their diversification and steady cash flows, are perceived as lower risk by creditors. Augustine's (2016) study concluded that large firms are associated with lower risk and, therefore, lower costs of capital.

Mulyati (2017) examined the impact of voluntary disclosure, stock beta, and firm size on the cost of equity for manufacturing firms listed on the Indonesia Stock Exchange (BEI) from 2013 to 2015. The study found no significant relationship between firm size and the cost of equity, failing to reject the null hypothesis. The author justified this result by arguing that the cost of equity is influenced by the level of risk in investing, and firm size alone does not provide assurance to investors. Larger firms may manipulate their financial statements to maintain a positive reputation, potentially increasing the perceived risk associated with their equity. Therefore, the level of risk cannot be accurately determined solely by considering firm size.

In another body of literature, the relationship between firm size and cost of capital is positive. Phoprachak (2018) found that the effect of firm size on corporate social responsibility disclosure and cost of capital, particularly in cost of debt, is positive and statistically significant in small firms listed of the Stock Exchange of Thailand. This is on the basis that when larger firms disclose their corporate social responsibilities, cost of debt decreases because of the interest financial institutions taking interest and lowering the cost of interest. The observation of these results is based on firm size being observed in total asset basis. Firm size is defined differently across various studies, with some defining it as the logarithm of total assets (Bhaduri, 2002; Omran & Pointon, 2004; Chipeta & Deressa, 2016; Agustini, 2016; Chipeta & McClelland, 2018), while others measure it as the logarithm of net sales (Pahuja & Sahi, 2012; Rajan & Zingales, 1995; Rao *et al.,* 2019).

2.3.2 Asset tangibility

Evidence from international data supports theories of capital structure indicating that if a larger part of a firm's assets is fixed, they reduce the risk of debtors suffering from agency costs, as these assets can serve as collateral (Rajan & Zingales, 1995). Rajan and Zingales (1995) found that, for Japanese firms, the association between tangible assets and the book leverage ratio was higher compared to other countries in the study, possibly due to the appreciation of land values during the 1980s, allowing Japanese firms with fixed assets like land to borrow more.

Similarly, Vuran, Tas, and Andiloglu (2017) agree that tangible assets serve as a guarantee to creditors, thereby affecting the level of debt. In a study of tangible assets and capital structure with a cross-country analysis, Mazumder, and Rao (2022) found that an increase in the tangible asset ratio from the 25th percentile to the 75th percentile led to a 23.20% increase in the long-term debt ratio. Tangible assets are positively associated with leverage, with statistically significant results at the 1% level.

The high value of fixed assets promotes a lower cost of capital because it provides security for debtors to recover their funds through the sale of these assets (Omran & Pointon, 2004; Augustini, 2016; Chipeta, 2016; Chipeta & Deressa, 2016).

Huang and Song (2006) discovered evidence suggesting that tangible assets positively influenced the long-term debt ratio in their study on listed Chinese firms, bringing an interesting study of firms primarily owned by the state. Drawing from the findings of Rajan and Zingales (1995), Omran and Pointon (2004), and Augustini (2016), it can be inferred from the literature that tangible assets can be used as collateral by debtors, potentially influencing the negative relationship with the cost of capital.

However, other authors argue that it is not just the fixed assets that influence the cost of capital, but the liquidity of those fixed assets instead (Shleifer & Vishny, 1992; Ortiz-Molina & Phillips, 2010;(Campello & Giambona, 2013)). An important factor to consider regarding fixed assets is that most of these assets are industry-specific and may create liquidity problems during a financial crisis). Shleifer and Vishny (1992) found that growth and cyclical assets are poor candidates for debt finance because, although they may have high debt capacity if they can be sold for fundamental value in the event of default, they become highly illiquid during a recession and attract high costs of debt when financed by debt. The authors concluded that optimal debt levels are constrained by asset illiquidity. Similarly, Omran and Pointon (2004) found that contracting and real estate sectors, which are characterized by fixed asset backing, tend to have high costs of capital.

2.3.3 Growth

Hail and Leuz (2009) conducted a study that investigated the effects of cost of capital and changes in growth expectations on firms cross-listed in the US. The study revealed several insights. Firstly, it found evidence of a larger reduction in the cost of capital for firms from countries with weak institutional structures, emphasizing the impact of disclosures on cost of capital as discussed previously. Secondly, the study discovered that not all valuation effects of cross-listed firms were solely due to the reduction in the cost of capital; a portion of these effects was attributed to growth opportunities expectations.

The relationship between information disclosures and cost of capital significantly depends on the growth trajectory of the firm (Dutta & Nezlobin, 2017). They predicted a positive relationship between disclosures and risk premium and found that higher growth rates increased the weight investors placed on the resale price risk component, thereby increasing the overall cost of equity. Motivated by Dutta and Nezlobin (2017), as well as other studies examining the relationship between risk premium and disclosures, (Ellahie, Hayes, & Plumlee, 2022) conducted a recent study re-examining the association between disclosures and risk premium, constrained by growth. Similarly, the authors hypothesised a more positive association between disclosure and risk premium for firms with higher growth rates and a less negative association for those with lower growth rates.

The results of Ellahie *et al.,* (2022) on firm-level tests using multivariate regression of risk premium on disclosures and the interaction of growth rate support their hypothesis. Specifically, there is a positive coefficient on the interaction term, indicating a conditional association between disclosures and risk premium that is generally negative for lower growth firms but less negative or positive for higher growth firms. Another study investigating determinants of capital structure finds that there is a positive and statistically significant coefficient on the growth variable indicating that the future growth opportunities of firms are a significant factor in the determination of leverage (Chipeta & Deressa, 2016). Wasara and Ganda (2019) investigated ten mining firms listed on the JSE and found a negative relationship between corporate sustainability disclosure and firm financial performance.

An important piece of literature to highlight given the water crisis in South Africa, Nyahuna and Doorasamy (2023), found that investors incentivise firms which initiate measures on water management and disclose these. They found that there is a statistically positive relationship between corporate water disclosures and financial performance in the form of Return of Assets (ROA), Net Profit Margin and Return on Equity (ROE). Firm size and leverage are adopted as control variables to minimise their impact on total financial performance. De Vries (2010) investigated firm variables that influenced cost of capital on the JSE and found, growth had a positive relationship with leverage with a 1% statistical level and the median Market-to- Book ratio of 1.6 indicating investors are willing to pay R0.60 more for the share price above the actual book value.

2.3.4 Liquidity

Ortiz-Molina and Phillips (2010) hypothesised that asset liquidity increases a firm's operating flexibility, thereby reducing its cost of capital. They found that firms in industries with high asset liquidity had lower costs of capital compared to those with low asset liquidity. This is influenced by a firm's ability to convert its assets into cash at fair or high prices and redeploy its assets during unfavourable circumstances. Additionally, a study on firms listed on the Nairobi Stock Exchange revealed a positive and significant effect of the asset ratio on the cost of capital; an increase in the asset ratio was associated with an improvement in the cost of capital (Nicodemus & Wamugo, 2017).

Omran and Pointon (2004) found evidence suggesting that liquidity is a significant factor affecting the cost of capital within the food industry. They investigated the determinants of the cost of capital by industry within an emerging economy and identified liquidity as a crucial determinant for the food sector. Their results indicated that 64%-78% of the variation in the cost of capital was explained by liquidity. Similarly, Pahuja and Sahi (2012) found liquidity to be one of the significant factors contributing to the debt-equity ratio, with statistically significant levels at less than 1%. However, they rejected the hypothesis that more liquid firms should have a lower cost of equity.

According to Mukhongo, Njeri and Kamau (2022), higher levels of a firm's cash dividend pay-out improve its survival levels by lowering the cost of debt, based on the signalling effect of dividend pay-outs to the market. Similarly, Amihud and Mendelson (2005) conclude that firms can enhance their stock prices by improving the liquidity of their stocks, as investors require liquidity premium to compensate them for the costs of buying and selling the firm's stocks, thereby reducing the expected return (cost of equity) for a given level of risk.

2.3.5 Profitability

Rajan and Zingales (1995) argued that in the short run, with dividends and investments fixed, and debt being the majority form of financing, changes in profitability will be negatively correlated to changes in leverage. Their study revealed that in Japan, Italy, and Canada, the correlation of leverage and profitability for larger firms had a stronger negative correlation compared to smaller firms, supporting the pecking order theory. This theory posits that firms with high profitability have low debt levels, and managers will utilize the cheapest available source of funds first, followed by debt and lastly equity (Myers & Majluf, 1984; Barclay & Smith, 1999; Booth *et al.,* 2001).

According to Rao *et al.,* (2019), profitability is a crucial independent variable used in empirical studies, assuming a negative relationship between profitability and leverage. This is supported by evidence of small firms facing challenges in accessing external funds and relying on internally generated funds, as reflected in the preferences of SMEs in India due to the high costs of accessing external funding. However, Pahuja and Sahi (2012) found profitability to have no impact on capital structure, with growth and liquidity being the most significant determinants. While they confirmed the negative relationship, they found it statistically insignificant.

In another study by Chipeta and Deressa (2016), profitability had a negative and statistically significant coefficient for eleven of the twelve sampled countries as a predictor of capital structure, consistent with the pecking order theory. Similarly, Vuran *et al.,* (2017) found that profitability has a negative and significant effect on capital structure, in line with the pecking order theory. Evidence from the US indicates that the IT sector prefers debt, and profitability is one of the important variables determining the capital structure with respect to total debt (long-term and short term) in the IT sector of the S&P 500 index (Nasimi, 2016). Kengere *et al.,* (2023) concluded that independent variables deemed major determinants influencing the cost of capital are significantly interdependent, with the results supporting other studies identifying profitability as negatively correlated with capital structure and the preference of internal funds by profitable firms.

2.4 Country/Industry Specific factors driving capital structure.

Country- or industry-specific factors have been identified as interconnected with certain firm-specific variables driving capital structure (Shleifer & Vishny, 1992; Machokoto *et al.,* 2020; Öztekin, 2015; Chipeta & Deressa, 2016; Augustini, 2016; Kengere *et al.,* 2023). Even though this study focuses on firm-specific factors, it is important to briefly recognize the crucial role that country or industry factors contribute to influencing capital structures.

Öztekin (2015) discovered that firms operating in countries with high inflation tend to have low levels of debt, and if they compete in industries with high median leverage, they would, in turn, have high leverage levels. Chipeta and Deressa (2016) reported that the legal system has a positive influence on debt issues for firms operating in countries with significant rule of law coefficients. This is supported by evidence of rising debt in South Africa following the lifting of sanctions post the end of apartheid (Machokoto *et al.,* 2020).

Each industry has its optimum leverage, and a firm-level optimum level of leverage depends on it (Shleifer & Vishny, 1992). According to Kengere *et al.,* (2023), the cost of capital in Kenya is determined by a combination of the level of regulation in the financial sector, inflation rates, political and economic stability, among other identified variables, and firms that understand these factors can maximize their return on investments by managing their cost of capital.

Augustini (2016) conducted a study examining the relationship between firm size and inflation on the cost of capital, as well as the role of IFRS adoption in that relation. Although the author did not find evidence of IFRS adoption bringing a positive impact on larger firms to have a reduced cost of capital, the second hypothesis, which investigated the cost of capital for firms operating in high levels of inflation versus those in low levels of inflation rates, was supported by the results. Specifically, firms in countries with high levels of inflation rates were found to have higher costs of capital than those in countries with low levels of inflation rates.

There are a few studies that has established that tangible assets serve an important role to creditors serving as collateral (Rajan & Zingales, 1995; Vuran et.al, 2017; Omran & Pointon, 2004;

Augustini, 2016; Chipeta, 2016; Chipeta & Deressa, 2016). Stronger institutional characteristics such as creditors' rights, financial development and borrowing constraints amongst others, reduces the extend tangible asset's influence to serve as collateral (Mazumder & Rao,2022). The author adds on to the existing literature on this subject by investigating whether the strength of the relationship between asset tangibility and leverage ratio could be influenced by different institutional environments. The results of the study revealed, the interaction effect between assets tangibility and long-term debt ratio is less positive for firms located in countries with strong financial development, stronger creditors' rights, and strong governance.

Cook and Tang (2008) examined the impact of macroeconomic conditions on capital structure adjustment speed. They found that firms adjust to target leverage faster in good economic states compared to bad states, with GDP growth rate being a defining variable. Furthermore, the study revealed that the speed of capital structure adjustment cannot be solely explained by firm size or other firm-specific variables. In support to this point, there is empirical evidence that South African firms adjust relatively fast towards a target leverage level (Chipeta & Deressa, 2016; Ramjee & Gwatidzo, 2012). Additionally, Hail and Leuz (2009) discovered that firms from countries with weak institutional structures experienced a more substantial reduction in the cost of capital upon cross-listing in the US. Their study investigated the influence of growth expectations on the cost of capital and the role of disclosures in this relationship.

(Campello & Giambona, 2013) finds evidence consistent with a credit supply-side perspective of capital structure, the research indicates that asset redeploy ability plays a significant role in determining leverage, especially for firms prone to encountering credit frictions, such as small, unrated firms. Moreover, the study reveals that asset redeploy ability is particularly advantageous for borrowing, especially during periods characterized by tight credit conditions.

In a study encompassing a sample of 4,079 observations from 567 firms listed in Vietnamese stock markets spanning from 2008 to 2017, Thi and Tran (2021) conclude that foreign investors exhibit a tendency to avoid investing in firms characterized by high state ownership due to concerns regarding the "double agency" problem.

This finding is particularly noteworthy given that a study conducted by Tran (2021), covering the same market during a similar period, reveals that foreign ownership exerts a negative impact on the cost of debt. Moreover, this effect is found to be more pronounced in non-state-owned enterprises and financially constrained firms.

2.5 Conclusion

The studies reviewed suggest that firm-specific factors such as firm size, tangible assets, growth, liquidity, and profitability play significant roles in determining capital structure and the cost of capital. However, the relationships between these variables and the cost of capital are not universally consistent across all studies. For instance, certain studies suggest a negative relationship between firm size and the cost of capital, indicating that larger firms have lower costs of capital due to their greater access to external funds (Rao *et al.,* 2019; Augustini, 2016). However, findings vary across studies, with some indicating a positive relationship between firm size and cost of capital (Phoprachak, 2018). Tangible assets serve as collateral, positively influencing leverage ratios and potentially reducing the cost of capital (Rajan & Zingales, 1995; Vuran *et al.,* 2017). However, asset liquidity also plays a crucial role, with illiquid assets constraining optimal debt levels (Shleifer & Vishny, 1992).

The relationship between growth and the cost of capital varies, with some studies suggesting a positive association between growth expectations and risk premium (Hail & Leuz, 2009). Firms with higher growth rates may experience higher costs of equity due to increased perceived risk (Dutta & Nezlobin, 2017). Asset liquidity affects a firm's operating flexibility, potentially reducing its cost of capital (Ortiz-Molina & Phillips, 2010). However, the impact of liquidity on the cost of capital varies across industries and regions (Mukhongo, Njeri, & Kamau, 2022). Profitability is negatively correlated with leverage, with profitable firms preferring internal funds over debt financing (Rajan & Zing, 1995; Rao *et al.,* 2019). However, findings regarding the relationship between profitability and the cost of capital are mixed (Pahuja & Sahi, 2012; Chipeta & Deressa, 2016). In conclusion, understanding the determinants of capital structure requires considering both firm-specific and external factors. The interplay between these variables shapes the financing decisions of firms and their cost of capital, ultimately impacting firm value and performance.

Table 1 - Summary of the determinants of optimal capital structure

Determinants	**Correlation**	**Empirical Literature**
Growth	+/-	Pahuja and Sahi (2012), (Booth, 2001), Bhaduri (2002)-,
Tangibility	-/+	Özde Öztekin (2015) +, Pahuja and Sahi (2012)-, Frank and Goyal (2009) +, (Rao et.al.,2018)-, Myers (1977)-, Chipeta and Deressa (2016) inconclusive, (Booth, 2001)-,
Profitability	-	Özde Öztekin (2015), Pahuja and Sahi (2012)-no relationship. Chipeta and Deressa (2016), Bhaduri (2002)-,(Booth et al., 2001)-,
Liquidity	+	Pahuja and Sahi (2012) +, Bhaduri (2002)
Firm Size	+/-	Pahuja and Sahi (2012) inconclusive, Özde Öztekin (2015) +, Frank and Goyal (2009) +, Chipeta and Deressa (2016), Bhaduri (2002) +,
Firm Earnings/Profits	-	Özde Öztekin (2015) -, Frank and Goyal (2009)-,
Industry Leverage	+	Özde Öztekin (2015) +, Frank and Goyal (2009) +,
Inflation	-	Özde Öztekin (2015) -, Frank and Goyal (2009) +
Market-to-book assets ratio	-	Frank and Goyal (2009)-
Dividend Paying	-	Frank and Goyal (2009)-
GDP Growth Rate	+	Cook and Tang (2008) +
Banking Sector Development	+	Chipeta and Deressa (2016) +, Pahuja and Sahi (2012) +,
Stock Market Development	+	Chipeta and Deressa (2016) +, Demirguc-Kunt and Maksimovic (1996) +
Strength of the legal system	+	Chipeta and Deressa (2016) +, Tchugoua (2014) +,

Source: Own construction

CHAPTER 3
RESEARCH METHODOLOGY

3.0 Introduction

The main goal of this chapter is to discuss the methodology of the study. The chapter is organized as follows: Section 3.1 discusses the data, Section 3.2 discusses the variables, Section 3.3 discusses the estimation model, Section 3.4 discusses panel data 3.5 concludes the chapter.

3.1 Data

Optimal capital structure is defined as the level at which firm value is maximized and cost of capital is the lowest (De Wet, 2006). The author examined three firms listed on the JSE, and the results proved firm value increases as debt levels rise. Firm value is determined as the present value of expected future cash flows discounted to today's value by its total weighted cost of capital (Ehrhardt & Brigham, 2003:442). The optimal capital structure will be a combination of debt and equity that minimises the total cost of capital.

This study uses data for non-financial firms listed on the JSE. Data is sourced from Refinitiv Workspace. In line with the existing capital structure literature, financial and insurance firms are omitted from the analysis due to the strict regulations governing their leverage. As a result, these firms may exhibit distinct capital structures compared to other industries. The sample period is a panel data for the period starting from 2015 to 2023, which covers the pre-covid and post-covid period. The sample period starts in 2015 due to data availability on the cost of capital variables. This period has shown rising debt levels on firms listed on the JSE (Machokoto et.al., 2020). The panel is unbalanced to allow for firms listing and delisting over the sample period. Overall, the study ends up with 189 firms with 1 476 firm year observations.

3.2 Variables

The dependent variable in this study is the Weighted Average Cost of Capital (WACC). The study uses cost of equity and cost of debt calculated from Refinitiv Workspace yielding an unbalanced panel data set for 250 firms comprising of 1 856 observations of cost of equity and 1 869 observations of cost of debt from 2015 till 2023. The criteria for the inclusion of an observation in the analysis were as follows:

- A minimum of three consecutive years of both the cost of equity and cost of debt
- Financial and Insurance firms are omitted.
- Company's financial data is sourced from Refinitiv Workspace to fill missing gaps in data that remains.
- All independent variables are then matched to the firms that remain in their respective periods.

The formula to calculate WACC is as follows:

$$\text{WACC} = \frac{E}{E+D} * k_e + \frac{D}{E+D} * k_d(1\text{-t})$$

Where:
E = market value of equity
D= market value of debt
k_e= cost of equity
k_d= cost of debt
t= corporate tax rate
Note: $\frac{E}{E+D}$= Equity ratio
$\frac{D}{E+D}$= Long term debt ratio
Ratios sourced from Refinitiv Workspace

According to Correia and Cramer (2008), firms should use the incremental after-tax cost of debt to determine the firm's WACC. After calculating the values of the dependent variable and applying the criteria for inclusion, the number of companies observed is reduced to 189 firms and the number of observations is reduced to 1 476.

3.2.1 Effective cost of equity

It has been established that companies that calculate the cost of equity all use a variant of the Capital Asset Pricing Model (CAPM) to determine the cost of equity ((Correia & Cramer, 2008; Graham & Harvey, 2001). The CAPM approach states that the company's cost of equity is made up of the risk-free rate plus an equity market premium adjusted by the relative volatility of the company's share price to the underlying market portfolio.

More formally: $Ke = Rf + \beta\ (Rm - Rf)$
where:
Ke= cost of equity
Rf = risk-free rate
β = the firm's equity beta
Rm = the return on the market portfolio

Following the results of Correia and Cramer (2008) on South African firms, most firms use the 10-year government bond yield as the proxy for the risk-free rate. The study further confirms that South African firms listed on the JSE used Bloomberg betas to use in the CAPM model for cost of equity calculation with an overwhelming 83% respondent rate. The equity (market) risk premium (Rm – Rf), reflects the additional return that investors require above the risk-free rate for investing in the market portfolio. Refinitiv Workspace uses CAPM to calculate the cost of equity and used as is into calculating WACC.

3.2.2 Effective cost of debt

The cost of debt represents the effective interest rate a company pays on its debt obligations. Long-term debt, encompassing all interest-bearing financial commitments due beyond one year and net of premium or discount, serves as a significant component in this calculation. To estimate a company's cost of debt, one common approach involves dividing the total interest expense by the average interest-bearing liabilities throughout the year (Francis, LaFond, Olsson, & Schipper, 2005). Weighted cost of debt represents the weighted average interest rate of the total fixed rate long term debt (Refiniv Workspace). The below formula reflects the relationship between interest expenses and the company's overall debt burden:

$$\text{Cost of debt} = \text{Interest expenses} / \text{All interest-bearing liabilities} \qquad (1)$$

Table 2- Summary of Variables

Independent Variables	Definition	Study	Sources
Firm size	The size of the company and is calculated as the logarithm of total assets. *Logarithm of total assets*	Agustini (2016); Chipeta and McClelland (2018); Chipeta & Deressa, 2016; Bhaduri (2002); Omran and Pointon (2004);(Vuran et al., 2017)	Refinitiv Workspace
Asset tangibility	The collateral value of assets and is calculated as fixed assets divided by total assets. *Fixed assets/Total assets*	Pahuja and Sahi (2012); Chipeta and McClelland (2018); Rao, Kumar, & Madhavan(2018);Chipeta & Deressa (2016);Makalesi& Taheri(2020); (Omran & Pointon, 2004); (Vuran et al., 2017)	Refinitiv Workspace
Growth	The growth prospects of the company and is calculated as the annual percentage change in the total assets. $\frac{Total\ Assets_{t} - Total\ Asset.}{Total\ Assets_{t-1}}$	Pahuja and Sahi (2012); Chipeta and McClelland (2018); Chipeta & Deressa (2016); Bhaduri (2002)	Refinitiv Workspace

Independent Variables	**Definition**	**Study**	**Sources**
Liquidity	The ease at which an asset can be converted into cash and is calculated as Current assets less inventory divided by current liabilities. $\frac{Current\ assets - inventory}{Current\ liabilities}$	Pahuja and Sahi (2012); Rao, Kumar, & Madhavan (2018)	Refinitiv Workspace
Profitability	The profitability of assets and is calculated as earnings before interest and taxes (PBDITA/EBITDA) divided by total assets. P*BDITA /Total assets*	Rao, Kumar, & Madhavan (2018); Chipeta & Deressa; (Vuran et al., 2017); (2016); Chipeta and McClelland (2018)	Refinitiv Workspace
COVID	Covid variable is created by allocating 1 for years 2020-2021 and zero for other periods.		Manual Input
REIS	REIS variable is created by allocating 1 for all REIS firms and zero otherwise		Manual Input
FoodProd	FoodProd variable is created by allocating 1 for all FoodProd firms and zero otherwise		Manual Input
Dependent Variable	**Definition**	**Sources**	

Independent Variables	**Definition**	**Study**	**Sources**
WACC	The WACC represents the firm's average after-tax cost of capital from all sources. $WACC = \frac{E}{E+D} * k_e + \frac{D}{E+D} * k_d(1\text{-}t)$ Where: E = market value of equity D= market value of debt k_e= cost of equity k_d= cost of debt t= corporate tax rate *Note:* $\frac{E}{E+D}$= Equity ratio $\frac{D}{E+D}$= Long term debt ratio *Ratios sourced from Refinitiv Workspace*	Hamada (1972); (Correia & Cramer, 2008); (Graham & Harvey, 2001)	Refinitiv Workspace
Cost of Equity	Ke = Rf + β (Rm – Rf) Where: Rf= Risk Free Rate (RSA 10y Government Bond Yield) B= Beta Rm = Market Return		Refinitiv Workspace
Cost of Debt	Interest Expense / Long-term debt		Refinitiv Workspace

Source: Own construction

3.3 Estimation Model

The next step is to determine the influence of firm specific variables identified to drive capital structure on cost of capital as shown in equation 1:

$$WACC_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 Tang_{it} + \beta_3 Grow_{it} + \beta_4 Liq_{it} + \beta_4 Prof_{it} + \varepsilon_{it} \tag{2}$$

Where:

$WACC_{it}$= is the Weighted Cost of Capital for firm *i* at time *t*
β_0 = is the constant
$\beta_1, \beta_{2\dots}$ = is the coefficient of the independent variable
$Size_{it}$ = is the size for firm *i* at time *t*
$Tang_{it}$ = is asset tangibility for firm *i* at time *t*
$Grow_{it}$ = is growth for firm *i* at time *t*
Liq_{it} = is the liquidity for firm *i* at time *t*
$Prof_{it}$ = is the profitability for firm *i* at time *t*
ε_{it} = is the error term

These variables are defined in Table 2.

3.4 Panel Data

Hsiao (2003) defines panel or longitudinal data as a set of data that combines observations of many different subjects (cross-sectional data) and data that is recorded over certain time intervals (time-series data). Panel data is used to capture multiple firms at a single point in time and observe each entity over multiple time periods. Panel data also provide the possibility of generating more accurate predictions for firm outcomes than time-series data alone. To analyse panel data, fixed effects models or random effects models will be used. The models are used to control for firm level heterogeneity (Chipeta & Deressa, 2016).

Specification tests for panel data

Regression analysis investigates the relationship between a dependant variable and one or more independent variable identified to predict its responses (Oke, Akinkunmi & Etebefia, 2019). The authors conclude, for a regression model to be dependable and acceptable in estimating the population parameters, there are a few assumptions made about the model and they focused on multicollinearity. For the purposes of this study, (Daoud, 2009), highlights the following assumptions to be imperative: heteroscedasticity, multicollinearity, serial correlation, and linearity. The author asserts should any of the assumptions be breached, the model is no longer reliable, and its results in estimating the dependent variable inaccurate. It is therefore advisable that these assumptions are met to make accurate conclusion.

Multicollinearity shows that independent variables have a strong relationship (correlated) and leads to overstated variances (Daoud, 2009; Oke et.al, 2019; Yousef, 2022). This is a statistical phenomenon which could lead to some of the independent variables to be statistically insignificant when they in fact should be significant (Daoud, 2009). The author identifies two types of multicollinearities: data-based if the data is collected poorly and structural if new independent variables are generated from existing variables. Conditions under which multicollinearity can be observed is when there are large changes in the estimated coefficients influenced by an addition or deletion of a variable and may be present if their algebraic signs are not in line with prior expectations. Furthermore, another condition under which multicollinearity can be observed is when large changes in the coefficients occur because of altered data points and may be present if coefficients of variables expected to be important have large standard errors.

To measure multicollinearity, one must examine the changes in one independent variable not explained by another independent variable. This is referred to as tolerance and it is measured by:

$$1 - R^2 \tag{3}$$

Where:

R^2 = Proportion of variance on dependent variable explained by the independent variable

Tolerance values less than 0.10 indicate collinearity.

Variance Inflation Factors (VIF) is another measure which can be used to detect multicollinearity due to overstated variances. VIF is considered more superior to just correlation measures amongst any two variables (Oke et.al, 2019; Daoud, 2009). This measure can be calculated as part of the regression analysis and will be part of the output. It can also be calculated by using the following formula:

$$\text{VIF} = \frac{1}{1-R^2} \tag{4}$$

Table 3: VIF Interpretation

VIF Value	Conclusion
VIF = 1	Not Correlated
1 < VIF ≤ 5	Moderately Correlated
VIF > 5	Highly Correlated

Daoud (2009)

Heteroscedasticity means that the variance of the error term is not constant and its presence (white noise is coloured) in data means filtered data will not be stationary (Olawale & Adebayo,2022). The error term in a regression model captures the residual that does not explain the relationship between the independent variable and the dependent variable, and heteroscedasticity is the variance of this error term changing as a function of anything else not in the model (Astivia & Zumbo, 2019). Homoscedasticity, the opposite of heteroscedasticity, is the ideal outcome of the data which means that the variance of errors within the data is the same for all levels of the independent variable (Osborne & Waters, 2002; Osborne & Waters, 2019).

The violation of other assumptions can result in heteroscedasticity and it's coefficient from heteroscedastic regression results are not BLUE (Best linear unbiased estimators) under Ordinary Least Squares regression (Flatt & Jacobs, 2019).

Regression analysis also assumes error terms are statistically independent, meaning time series data is not influenced by past values (Flatt & Jacobs, 2019). If the errors in a regression model are not independent, the data has an issue of serial correlation, and its implication is making the parameter estimation inefficient (Li & Anderson, 2020; Flatt & Jacobs, 2019). Negative serial correlation may suggest overfitting or misspecification of the model. Two methods that can be used to test for statistical independence of error terms: graphical and numerical. A scatterplot of the residuals against time should display a random plot (rectangular shape) otherwise independence is violated. The Durbin-Watson coefficient is a numerical serial correlation measurement of the residual differences over time and its value is between 0 and 4 (Flatt & Jacobs, 2019). A value close to 2 indicates no serial correlation, while values below 2 suggest positive serial correlation, and values above 2 suggest negative serial correlation. According to Flatt and Jacobs (2019), the coefficient should ideally be close to 2, and values between 1.2 and 1.6 indicate only a minor violation of the assumption of no serial correlation.

Table 4: Durbin-Watson Coefficient Interpretation

Durbin-Watson (DW) Value	Conclusion
DW = 2	No Serial Correlation
$0 < DW \leq 2$	Positive Serial Correlation
$2 < DW \leq 4$	Negative Serial Correlation

Flatt and Jacobs (2019)

It is essential to perform a log transformation as part of the data analysis process. This involves computing the natural logarithm of the data. The purpose of this transformation is to mitigate skewness and stabilize variance within the dataset, which is crucial before conducting any specification tests.

3.5 Conclusion

In the regression model, the Weighted Average Cost of Capital (WACC) serves as the dependent variable, while firm size, asset tangibility, growth, liquidity, and profitability are independent variables. The measurement of these variables are as follows: firm size is calculated as the logarithm of totals assets; asset tangibility is the ratio of fixed assets divided by total assets; growth is the annual change in total assets divided by total assets; liquidity is the current assets less inventory divided by current liabilities and profitability is EBITDA/PBITDA divided by total assets. The data analysis process involves several key steps to ensure the reliability and validity of regression analysis results. Firstly: Log Transformation of data aims to address skewness and stabilize variance by applying the natural logarithm to the dataset. Secondly:
Pre-estimation Tests: Various diagnostic tests are conducted to assess data properties and confirm that regression assumptions are met:

- Unit Root Test: Evaluates the presence of a unit root in time series data to determine its stationarity.
- Heteroskedasticity Test: Utilizes the Wald test to detect heteroskedasticity, a condition where the variance of errors varies across observations.
- Serial Correlation Test: Employing the Wooldridge test, this evaluates whether errors exhibit correlation across time, indicating serial correlation.
- Multicollinearity Test (Correlation Matrix): Assesses the degree of multicollinearity, where independent variables display high correlations with each other.

Lastly, regression analysis using Feasible Generalized Least Squares (FGLS): This estimation method is chosen when data exhibits heteroskedasticity and serial correlation. FGLS extends ordinary least squares (OLS) by accounting for these conditions, enhancing the accuracy of parameter estimation.

CHAPTER 4
RESULTS

4.0 Introduction

The main goal of this chapter is to discuss the results of the study. The chapter is organized as follows: Section 4.1 discusses the specification tests results, Section 4.2 discusses the estimation results, Section 4.3 concludes this chapter.

4.1 Specification tests results

One crucial specification test emphasized is heteroscedasticity, especially when employing the Ordinary Least Squares (OLS) estimation model. OLS assumes that the error term in the regression model is independent and identically distributed (i.i.d) with a mean of zero and constant variance (homoscedasticity). The presence of heteroskedasticity violates this assumption. The Wald test is utilized to check for heteroskedasticity, and if the results indicate its presence, as seen in Table 7, it renders the OLS model inappropriate. This test examines whether the variance of the errors in the regression model is constant. A significant result from the Wald test ($p<0.05$) would indicate the presence of heteroskedasticity, suggesting that the assumptions of homoskedasticity may be violated.

The VIF output in Annexure A revealed values exceeding one for all independent variables, with a mean VIF of 5.92. According to the VIF interpretation outlined in Table 3, this indicates high correlation among the independent variables, suggesting the presence of multicollinearity. This poses challenges in discerning the genuine relationship between the independent variables and the dependent variable, rendering the fixed effects model unsuitable for the analysis.

The Random Effects model assumes that unobserved effects are random and uncorrelated with the observed independent variables. To assess for serial correlation, which occurs when errors are correlated across time, the Wooldridge test is employed. The null hypothesis of the Wooldridge test posits no serial correlation in the errors. However, with a low p-value observed in Table 7, the null hypothesis is rejected, indicating the presence of serial correlation. Consequently, the feasible Generalized Least Squares (FGLS) estimation model is utilized, allowing for heteroscedasticity, and relaxing the assumption of constant error variance. FGLS estimation is conducted to address various violations of classical linear regression assumptions (Mwangi, Makau, & Kosimbei, 2014).

In Table 6, correlations between the dependent variable, considered paramount, and the independent variables are depicted alongside the addition of a new independent variable. The analysis of the correlation matrix reveals that none of the independent variables exhibit a correlation coefficient surpassing 0.70. This observation indicates that the data can be effectively modelled without encountering the challenges posed by multicollinearity, thereby enhancing the reliability of subsequent analyses and interpretations.

Firm size and tangibility. With a statistically significant correlation coefficient of 0.1377, there is a positive association between firm size and tangibility. This means larger firms would also have higher levels of tangible assets. However, the magnitude of the coefficient indicates the relationship may not be strong or highly predictive.

Tangibility and profitability. A statistically significant correlation of 0.1764 is also found between tangibility and profitability and again the magnitude of the coefficient indicates the relationship may not be strong or highly predictive.

Firm size and profitability. Size and profitability have a statistically significant correlation of negative 0.1074, suggesting larger firms would tend to have lower profitability. It can still be argued the magnitude of the coefficient indicates the relationship may not be strong or highly predictive.

Table 5 reveals the results of the Fisher Unit Root Test. The results of this test are crucial because they confirm data stationarity. There is confidence that the regression analysis has no risk of spurious results.

Table 5 FGLS Unit root test results

Variable	Test Statistic	Order of Integration	Decision
WACC	696.48	Level	Stationary
Size	763.10	Level	Stationary
Tangibility	995.63	Level	Stationary
Growth	2232.48	Level	Stationary
Liquidity	896.72	Level	Stationary
Profitability	1103.35	Level	Stationary

Source: Own construction

Table 6 GMM Unit root test results

Variable	Test Statistic	Order of Integration	Decision
WACC	465.84	Level	Stationary
Size	1036.84	Level	Stationary
Tangibility	988.31	Level	Stationary
Growth	2232.48	Level	Stationary
Liquidity	1245.34	Level	Stationary
Profitability	943.36	Level	Stationary
Leverage	1003.38	Level	Stationary

Source: Own construction

In Tables 7 and 8, the correlation matrix is presented using the FGLS and GMM estimation models, respectively. The results from Table 7 are discussed in section 4.1, where the relationships between firm-specific variables and the cost of capital are analysed in detail. The relevance of Table 8 is later expanded on in section 4.3, under the robustness checks, to confirm the consistency and reliability of the findings by examining alternative estimation techniques and ensuring the validity of the results.

Table 7 FGLS Correlation Matrix

Variable	WACC	Size	Tangibility	Growth	Liquidity	Profitability
WACC	1.0000					
Size	0.1252*	1.0000				
Tangibility	-0.0411	0.1377*	1.0000			
Growth	-0.0505	-0.0415	-0.0457	1.0000		
Liquidity	-0.0160	-0.0140	-0.1297*	-0.0485	1.0000	
Profitability	0.0203	-0.1074*	0.1764*	0.0878	0.0806*	1.0000

Source: Own construction (*, **, *** indicates significance at 99%, 95% and 90% confidence level)

Table 8 GMM Correlation Matrix

Variable	WACC	Size	Tangibility	Growth	Liquidity	Profitability	Leverage
WACC	1.0000						
Size	0.2412*	1.0000					
Tangibility	0.0162	0.1345*	1.0000				
Growth	-0.0233	-0.0215	0.0413	1.0000			
Liquidity	-0.0053	-0.0565*	-0.0781*	-0.0108	1.0000		
Profitability	0.2167*	0.2342*	0.0571*	0.0185	0.0045	1.0000	
Leverage	-0.0416	-0.0388	0.0183	-0.0167	0.0065	0.0097	1.0000

Source: Own construction (*, **, *** indicates significance at 99%, 95% and 90% confidence level)

In Table 9, the heteroskedasticity and serial correlation according to the FGLS estimation model are presented.

Table 9 FGLS Heteroskedasticity and Serial correlation results

Test	Test statistic	p-value
Wald test for groupwise heteroskedasticity	3.0e+35	0.0000
Wooldridge Serial Correlation test	21.512	0.0000

Source: Own construction

The reported p-value for the Wald test concerning groupwise heteroskedasticity is recorded as zero, indicating compelling evidence against the null hypothesis. The null hypothesis posits that there is no presence of heteroscedasticity. Given the p-value of zero and the large t-statistic for the Wald test which indicates a significant deviation from the null hypothesis, there is strong evidence against the null hypothesis and leads to the conclusion that heteroskedasticity is indeed present within the dataset. Similarly, the p-value for the Wooldridge serial correlation test is also reported as zero, signifying substantial evidence against the null hypothesis. The null hypothesis suggests the absence of serial correlation in the errors. However, with such a minuscule p-value, the null hypothesis is refuted, thus affirming the presence of serial correlation within the errors of the model.

4.2 Empirical results

Table 10 reports the FGLS estimation results for equation 1. The Wald test is used to assess the joint significance of all coefficients in the model. Overall, the regression model has good explanatory power since the Wald test statistic is statistically significant at a 1% level.

<u>Table 10 FGLS Estimation Model Results</u>

Variable		Coefficient	Standard Error	p-value
	Dependent variable: WACC			
Size		0.0671***	0.0058	0.0000
Tangibility		-0.0345***	0.0071	0.0000
Growth		-0.0294***	0.0065	0.0000
Liquidity		-0.0086	0.0103	0.404
Profitability		0.0543***	0.0119	0.0000
Covid		0.0298	0.0490	0.543
REIS*Tang		0.1873	0.3179	0.556
FoodProd*Liq		0.1929*	0.0926	0.037
Constant		0.7856***	0.0930	0.0000
	Number of observations			739
	Diagnostics			
	Wald test			184.72***

Source: Own construction (*, **, *** indicates significance at 10%, 5% and 1% confidence level)

The relationship between firm size and WACC.

The coefficient between the firm size variable and WACC is estimated to be 0.0671. This positive coefficient suggests that there is a positive relationship between firm size and WACC, indicating that larger firms tend to have higher WACC values. These findings present a contradiction to the existing literature, which suggests that larger firms may benefit from economies of scale and a perception of lower risk due to diversification, ultimately lowering their cost of capital (Augustini, 2016; Rao *et al.,* 2019). However, as firms grow and take on additional debt, there reaches a point where higher debt levels lead to an increase in WACC due to costs of financial distress and an elevated perception of risk by investors. This observation aligns with the predictions of the trade-off theory.

Furthermore, the coefficient of 0.0671 is deemed statistically significant at any conventional significance level, indicating that the relationship between firm size and WACC is unlikely to be due to random chance. This coefficient signifies the extent to which WACC increases with every one-unit increase in firm size, holding all other variables constant.

Given the statistical significance of the coefficient, there is strong evidence to reject the null hypothesis (Ho_1) that the coefficient is equal to zero, supporting the existence of a positive relationship between firm size and WACC (Ha_1).

The relationship between asset tangibility and WACC.

The coefficient between the asset tangibility variable and WACC is estimated to be -0.0345. This negative coefficient suggests that there is a negative relationship between asset tangibility and WACC, indicating that firms with high asset tangibility tend to have lower WACC values. These findings align with previous research in the literature, suggesting that firms with substantial fixed assets can serve as collateral to debtors, thereby reducing the risk associated with agency costs and providing a means for funds to be recovered when necessary (Rajan & Zingales, 1995; Omran & Pointon, 2004; Augustini, 2016; Vuran *et al.,* 2017).

Furthermore, the coefficient of -0.0345 is deemed statistically significant at any conventional significance level, indicating that the relationship between asset tangibility and WACC is unlikely to be due to random chance. This coefficient signifies the extent to which WACC decreases with every one-unit increase in asset tangibility, holding all other variables constant.
Given the statistical significance of the coefficient, there is strong evidence to reject the null hypothesis (Ho_2) that the coefficient is equal to zero, supporting the existence of a negative relationship between asset tangibility and WACC (Ha_2).

The relationship between growth and WACC.

The coefficient between the growth variable and WACC is estimated to be -0.0294. This negative coefficient suggests that there is a negative relationship between growth and WACC, indicating that firms with high growth levels tend to have lower WACC values. The adoption of high-quality corporate governance practices, such as those outlined in King II, following the liberation of South Africa has had positive impacts on firms listed on the JSE. For instance, the adoption of corporate social disclosure has been shown to result in financial benefits in mining companies (Wasara & Ganda, 2019). Previous research indicates that the negative relationship between the cost of capital and information disclosures is influenced by the firm's growth trajectory (Wasara & Ganda, 2019). These findings are consistent with (de Vries, 2010; Nyahuna & Doorasamy, 2023), whom found the relationship between disclosures, growth and equity costs for the firms listed on the JSE, highlighting the relevance and applicability of these results in the South African context.

Furthermore, the coefficient of -0.0294 is deemed statistically significant at any conventional significance level, indicating that the relationship between growth and WACC is unlikely to be due to random chance. This coefficient signifies the extent to which WACC decreases with every one-unit increase in growth, holding all other variables constant.

Given the statistical significance of the coefficient, there is strong evidence to reject the null hypothesis (Ho_3) that the coefficient is equal to zero, supporting the existence of a negative relationship between growth and WACC (Ha_3).

The relationship between liquidity and WACC.

The coefficient between the liquidity variable and WACC is estimated to be -0.0086. This negative coefficient suggests that there is a negative relationship between liquidity and WACC, indicating that firms with high liquidity levels tend to have lower WACC values. These findings are in support of literature that found asset liquidity to increase a firm's flexibility and therefore reducing the cost of capital (Omran and Pointon, 2004; Ortiz-Molina & Phillips, 2010; Mukhongo *et al.*, 2022).

Given the high p-value of 0.404, the coefficient of -0.0086 is deemed statistically insignificant at any conventional significance level, indicating that liquidity levels may not be a significant determinant of the firm's cost of capital. The evidence fails to reject the null hypothesis (Ho_4) that the coefficient is equal to zero and rejects the existence of a relationship between liquidity and WACC (Ha_4).

The relationship between profitability and WACC.

The coefficient between the profitability variable and WACC is estimated to be 0.0543. This positive coefficient suggests that there is a positive relationship between profitability and WACC, indicating that profitable firms tend to have higher WACC values. These results support the proposition of the trade-off theory, which suggests that highly profitable firms have an incentive to utilize debt to reduce their taxable income through the tax deduction of interest expenses. Consequently, as the level of debt increases, the cost of capital, particularly the cost of debt, also rises, leading to a positive relationship between WACC and profitability.

Furthermore, the coefficient of 0.0543 is deemed statistically significant at any conventional significance level, indicating that the relationship between profitability and WACC is unlikely to be due to random chance. This coefficient signifies the extent to which WACC increases with every one-unit increase in profitability, holding all other variables constant.

Given the statistical significance of the coefficient, there is strong evidence to reject the null hypothesis (Ho_5) that the coefficient is equal to zero, supporting the existence of a positive relationship between profitability and WACC (Ha_5).

*The relationship between Covid interaction term or REIS*Tangibility interaction term and WACC.*

Creating an interaction term for the years 2020 and 2021 allows for an investigation into whether the global financial crisis induced by the COVID-19 pandemic has impacted the Weighted Average Cost of Capital (WACC). This interaction term enables an assessment of whether the influence of firm size, asset tangibility, growth, liquidity, and profitability on WACC has varied during the COVID-19 pandemic years compared to other years. Omran and Pointon (2004) found that the real estate sector tends to exhibit high costs of capital due to its high fixed asset nature, which constrains optimal capital structure due to inflexibility. Therefore, introducing an interaction term for *Real Estate Investment and Services (REIS) * tangibility* allows for this specific assessment. The REIS and tangibility interaction term has a coefficient of 0.1873, deemed statistically insignificant at any conventional significance level. This suggests that not only is there no evidence to support that firms in the REIS sector have high WACC because of the impact of change in tangibility, but also the statistically significant negative relationship observed earlier between asset tangibility and WACC is not supported by firms in the REIS sector.

Similarly, the coefficient of 0.0298 for the COVID interaction term suggests the change in the effect of the independent variable on the dependent variable (WACC) during the years affected by the COVID-19 pandemic (2020 and 2021), compared to other years. However, with a high p-value of 0.543, the coefficient of 0.0298 between the interaction term and the independent variable during the COVID-19 pandemic years is deemed statistically insignificant at any conventional significance level. This indicates that there is no significant difference in the effect of COVID on the cost of capital during the pandemic years compared to other years. These results can be explained by the theory of efficient capital markets, Fama (1970), which states available information is incorporated into asset prices rapidly. Therefore, any impact of COVID-19 on the cost of capital may have been quickly factored into asset pricing during the pandemic years.

As a result, the perceived effect of the pandemic on the cost of capital might not have differed significantly from other years when markets faced different types of shocks or uncertainties.

*The relationship between FoodProd*Liq interaction term and WACC*

The coefficient between the interaction term of food production and liquidity and WACC is estimated to be 0.1929. This positive coefficient suggests that there is a positive relationship between food production and liquidity interaction term and WACC, indicating that firms in the food production sector with high levels of liquidity tend to have high WACC values. The impact of liquidity on the cost of capital differs across industries and regions (Mukhongo, Njeri, & Kamau, 2022). These results align with the findings of Omran and Pointon (2004), who identified liquidity as a significant determinant of the cost of capital within the food industry. In their study, they observed that liquidity explained a substantial portion, ranging from 64% to 78% of the variation in the cost of capital.

Furthermore, the coefficient of 0.1929 is deemed statistically significant, indicating that the relationship between is unlikely to be due to random chance. This coefficient signifies the extent to which WACC increases with every one-unit increase in the interaction term, holding all other variables constant.

Given the statistical significance of the coefficient, there is strong evidence to reject the null hypothesis that the coefficient is equal to zero, supporting the existence of a positive relationship between liquidity in food production sectors and WACC.

4.3 Robustness Test and Results

Blundell and Bond (1998) introduced a dynamic panel data model that addresses endogeneity and unobserved heterogeneity in panel data analysis. This model is widely used in empirical economics and social sciences research, particularly when dealing with longitudinal data and potential issues of omitted variable bias and simultaneity. The model employs lagged values of the dependent variable and other explanatory variables as instruments to address endogeneity.

The following equation is used to estimate the model:

$$WACC_{it} = \alpha WACC_{it-1} + \beta_1 Size_{it} + \beta_2 Tang_{it} + \beta_3 Grow_{it} + \beta_4 Liq_{it} + \beta_4 Prof_{it} + n_i + n_t + \varepsilon_{it} \tag{5}$$

Where:

$WACC_{it}$= is the Weighted Cost of Capital for firm *i* at time *t*

α = is the constant

$WACC_{it-1}$ = is the one year lagged WACC

$\beta_1, \beta_{2\ldots}$ = is the coefficient of the independent variable

$Size_{it}$ = is the size for firm *i* at time *t*

$Tang_{it}$ = is asset tangibility for firm *i* at time *t*

$Grow_{it}$ = is growth for firm *i* at time *t*

Liq_{it} = is the liquidity for firm *i* at time *t*

$Prof_{it}$ = is the profitability for firm *i* at time *t*

n_i = is the unobserved firm-specific effects

n_t = is the time specific effects

ε_{it} = is the error term

Table 11 reports the results of the System GMM estimation technique and the problem of endogeneity in panel data is addressed by Sargan test. The Sargan test tests for over identifying the restrictions and its null hypothesis assumes the over identification of restrictions, failing to reject the null hypothesis implies validity of the model. The test statistic is 11.67 with a p-value of 0.112, indicates there is no sufficient evidence to reject the null hypothesis that the over-identifying restrictions are satisfied. The lagged WACC positive coefficient of 0.62 is statistically significant at a 1% level, indicating a positive impact of the past firm cost of capital onto the current. The p-value for the Wald test is significant at the 1% level, suggesting that the overall model is statistically significant and fits the data well. The AR (1) test is significant at the 10% level, indicating weak positive autocorrelation in the errors at lag one. However, the AR (2) test is insignificant at all conventional levels, suggesting no significant higher-order autocorrelation. Overall, these results suggest weak serial correlation in the residuals.

Table 11 Two Step System GMM Estimation Model Results

Variable		Coefficient	Standard Error	p-value
	Dependent variable: WACC			
WACC. L1		0.6172***	0.0881	0.0000
Size		0.4370**	0.1534	0.005
Tangibility		-0.2823	0.3314	0.396
Growth		-0.0517	0.2739	0.061
Liquidity		0,0070	0.0062	0.265
Profitability		2.8058***	0.4181	0.0000
Leverage		-0.0024	0.4212	0.996
Covid		4.9326	4.8489	0.310
Covid*Size		-0.2846	0.2997	0.344
Covid*Tang		0.6758	0.9014	0.454
	Number of observations			1169
	Diagnostics			
	Wald test			797.82***
	AR (1)			0.075
	AR (2			0.258
	Sargan test			0.112

Source: Own construction (*, **, *** indicates significance at 99%, 95% and 90% confidence level)

The coefficients of firm size and profitability, as well as their respective p-values on the two-step GMM model suggest a robust positive and statistically significant relationship between these independent variables and WACC, supporting the FGLS results. The coefficient for growth maintained the negative relationship with WACC with a higher value and its p-values is 0.061, very close to 0.05 and considered statistically significant. The coefficient for asset tangibility maintained the negative relationship with WACC at a higher value as well however the p-value is statistically insignificant failing to reject their respective null hypothesis. Liquidity coefficient reported a very similar values as per the FGLS model with a positive relationship instead and the p-value remained statistically insignificant failing to reject the hypothesis.

The Covid interaction term has a p-value that is statistically insignificant, which indicates there is no significant difference in the effect of the independent variable on WACC during the pandemic years compared to other years. Another interaction term which is of interest is that of leverage and WACC, the coefficient of -0.0024 suggests higher leverage is associated with a decrease in WACC, however this coefficient carried a very high p-value making this relationship statistically insignificant and not supported by the data. The were no additional insights provided by the interaction term of covid and size or covid and tangibility given the statistical insignificance of the coefficient values.

The GMM estimation model is demonstrated with winsorised variables at 95^{th} percentile and 99^{th} percentile. The report for these results is under Annexure B. The coefficients for asset tangibility, growth, liquidity, and profitability all have a negative relationship with WACC however they are all statistically insignificant at 95^{th} and 99^{th} percentile. Similarly to the GMM results, asset tangibility and growth have negative coefficients with WACC, however liquidity and profitability have reported positive coefficients under with WACC, Firm size has a positive coefficient with WACC at the 95^{th} percentile which reflects the results under the GMM model for this variable and a negative relationship at the 99^{th} percentile, however they are also statistically insignificant.

Research limitations.

Acknowledging the limitations of the sample, particularly its focus on listed firms, is an essential step in ensuring the credibility and applicability of the study's findings. While the results may offer valuable insights into the behavior of listed firms, caution should be exercised when generalizing them to the broader population of South African firms, including unlisted ones.

The challenges encountered in data quality and availability are common in empirical research, especially in emerging markets like South Africa. These challenges can indeed restrict the sample size and may impact the robustness of the analysis. Future studies should strive to address these issues by employing more extensive datasets or exploring alternative data sources to improve the reliability of the findings.

Exploring the impact of a lower cost of capital on firm value represents a promising avenue for further research. Understanding how changes in the cost of capital influence firm value can provide valuable insights for corporate decision-makers, investors, and policymakers. By delving deeper into this relationship, scholars can contribute to the existing literature and offer practical implications for financial management practices.

In summary, by acknowledging the limitations of the current study, addressing data challenges, and exploring new research avenues, scholars can advance our understanding of the complex dynamics between the cost of capital and firm value, ultimately benefiting various stakeholders in the corporate finance landscape.

4.4 Conclusion

There is a positive relationship between firm size, profitability, the interaction term of liquidity and the food industry and WACC. Their coefficients are statistically significant at any conventional significance level, indicating that the relationship between these independent variables and WACC is unlikely to be due to random chance. Their respective coefficients of 0.0671,0.0543 and 0.1929 signify the extent to which WACC increases with every one-unit increase in them, holding all other variables constant. Given the statistical significance of these coefficients, there is strong evidence to reject the null hypothesis (Ho_1, Ho_5) that the coefficient is equal to zero, supporting the existence of a positive relationship between firm size or profitability and WACC (Ha_1, Ha_5).

There is a negative relationship between asset tangibility, growth, liquidity and WACC. The coefficients for asset tangibility and growth are statistically significant at any conventional significance level, indicating that the relationship between these independent variables and WACC is unlikely to be due to random chance. Their respective coefficients of -0.0345 and -0.0294 signify the extent to which WACC increases with every one-unit decrease in them, holding all other variables constant. Given the statistical significance of these coefficients, there is strong evidence to reject the null hypothesis (Ho_2, Ho_3) that the coefficient is equal to zero, supporting the existence of a positive relationship between asset tangibility or growth and WACC (Ha_2, Ha_3). Liquidity has a coefficient of -0.0086 and it is statistically insignificant therefore failing to reject the null hypothesis (Ho_4) and rejecting the existence of a relationship between liquidity and WACC (Ha_4).

The robust results reveal a positive relationship between firm size, profitability and WACC. The coefficients for firm size and profitability are statistically significant at any conventional significance level, indicating that the relationship between these independent variables and WACC is unlikely to be due to random chance. Their respective coefficients of 0.4370 and 2.8058 signify the extent to which WACC increases with every one-unit increase in them, holding all other variables constant. Given the statistical significance of these coefficients, there is strong evidence to reject the null hypothesis (Ho_1, Ho_5) that the coefficient is equal to zero, supporting the existence of a positive relationship between firm size or profitability and WACC (Ha_1, Ha_5). These results have proven to be robust. Liquidity has a coefficient of 0.0069 and it is statistically significant, there is strong evidence to reject the null hypothesis (Ho_4) and rejecting the existence of a relationship between liquidity and WACC (Ha_4). Asset tangibility has a coefficient of -0.2822 and it is statistically insignificant therefore failing to reject the null hypothesis (Ho_2) and rejecting the existence of a relationship between liquidity and WACC (Ha_2).

CHAPTER 6
CONCLUSION

The primary objective of this study is to empirically investigate the relationship between firm-specific variables known to influence optimal capital structure—such as firm size, asset tangibility, growth, liquidity, and profitability—and the cost of capital for non-financial firms listed on the JSE from 2015 to 2023. To achieve this aim, the study employs several econometric models for analysis. Specifically, the Feasible Generalised Least Squares (FGLS) model is utilized as it is deemed appropriate in the presence of heteroscedasticity and serial correlation of independent variables. Additionally, to address endogeneity concerns, the Generalised Method of Moments (GMM) approach is employed, ensuring the robustness of the results obtained.

The findings revealed several significant relationships between independent variables and the Weighted Average Cost of Capital (WACC). Specifically, firm size, profitability, asset tangibility, and growth exhibit varying degrees of influence on WACC. Firm size and profitability display positive relationships with WACC, supported by statistically significant coefficients. This indicates that as firm size and profitability increase, WACC also increases. The coefficients of 0.0671 for firm size and 0.0543 for profitability quantify the extent of WACC's increase with each one-unit increase in these variables, holding other factors constant.

Asset tangibility and growth demonstrate negative relationships with WACC, supported by statistically significant coefficients. A one-unit decrease in asset tangibility and growth corresponds to decreases in WACC, as indicated by coefficients of -0.0345 and -0.0294, respectively. Liquidity, however, exhibits a negative relationship with WACC but lacks statistical significance, suggesting no significant impact of liquidity on WACC.

Furthermore, firm size and profitability continue to show positive relationships with WACC, supported by statistically significant coefficients. These relationships remain robust across different analyses (FGLS and GMM), indicating that larger firms and more profitable firms tend to have higher WACC. Given the statistical significance of these coefficients, there is strong evidence to reject the null hypothesis (Ho_1, Ho_5) that the coefficient is equal to zero, supporting the existence of a positive relationship between firm size or profitability and WACC (Ha_1, Ha_5). Moreover, growth persists in displaying a negative relationship with WACC, although its statistical significance marginally misses the conventional threshold in the GMM estimation model. Nonetheless, its robustness across models implies its functional impact on WACC. However, liquidity and asset tangibility fail to exhibit robust relationships with WACC across different estimation models. Despite their statistical insignificance, they indicate positive and negative relationships with WACC, respectively.

RESEARCH LIMITATIONS AND RECOMMENDATIONS

Overall, these findings underscore the importance of specific firm characteristics in influencing WACC. Larger and more profitable firms tend to have higher WACC, while factors such as asset tangibility and liquidity exhibit varying degrees of influence. The original sample for this study spanned the period from 1995 to 2023; however, due to data availability and consistency challenges in the data, the sample was restricted to 2015-2023. Valuable insights were gained by focusing on non-financial firms listed on the JSE during this period, but these findings may be limited in their generalisation ability to different economic contexts.

Further research may be needed to explore additional determinants of WACC and its implications for firm financial decision-making. This is particularly pivotal for the management team when making financing decisions involving debt and equity to find an optimal capital structure that minimizes the cost of capital. Such considerations directly impact long-term strategies aimed at enhancing shareholder wealth. Given the varying degrees of influence that asset tangibility and liquidity have on WACC, it is crucial for management to remain cognizant of the implications of maintaining healthy levels of these ratios. This awareness can help ensure that financing decisions align with the firm's overall financial strategy and risk profile.

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5 APPENDIX A

FGLS STATA Output Screenshots

Table 12 - Heteroskedasticity

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (162)  =    3.0e+35
Prob>chi2 =       0.0000
```

If $p<0.05$ there's evidence of heteroskedasticity in the data.

Table 13 - Serial correlation

```
. xtserial lnwacc lnsize lntang lngrowth lnliq lnprof

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,     103) =     21.512
           Prob > F =      0.0000
```

If $p<0.05$ there's evidence of serial correlation in the data.

Table 14 - Multicollinearity

VIF

```
. vif, uncentered
```

Variable	VIF	1/VIF
lnsize	12.05	0.082975
lnprof	9.43	0.106090
lngrowth	4.66	0.214796
lntang	2.36	0.424541
lnliq	1.11	0.900650
Mean VIF	5.92	

Table 15 - Correlation matrix

```
. pwcorr lnwacc lnsize lntang lngrowth lnliq lnprof, star(5)
```

	lnwacc	lnsize	lntang	lngrowth	lnliq	lnprof
lnwacc	1.0000					
lnsize	0.1252*	1.0000				
lntang	-0.0411	0.1377*	1.0000			
lngrowth	-0.0505	-0.0415	-0.0457	1.0000		
lnliq	-0.0160	-0.0140	-0.1291*	-0.0485	1.0000	
lnprof	0.0203	-0.1074*	0.1764*	0.0878*	0.0806*	1.0000

Table 16 - Stationarity tests

```
Fisher-type unit-root test for lnwacc
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =    188
Ha: At least one panel is stationary        Avg. number of periods =   7.69

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
```

		Statistic	p-value
Inverse chi-squared(372)	P	696.4828	0.0000
Inverse normal	Z	-3.0230	0.0013
Inverse logit t(909)	L*	-7.2412	0.0000
Modified inv. chi-squared	Pm	11.8961	0.0000

```
Fisher-type unit-root test for lntang
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots           Number of panels       =    189
Ha: At least one panel is stationary        Avg. number of periods =   7.76

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Included                      ADF regressions: 0 lags
```

		Statistic	p-value
Inverse chi-squared(370)	P	995.6289	0.0000
Inverse normal	Z	-18.2133	0.0000
Inverse logit t(929)	L*	-18.5692	0.0000
Modified inv. chi-squared	Pm	22.9986	0.0000

```
Fisher-type unit-root test for lnsize
Based on augmented Dickey-Fuller tests
--------------------------------------
Ho: All panels contain unit roots           Number of panels       =    189
Ha: At least one panel is stationary        Avg. number of periods =   7.80

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Included                      ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(374)   P      763.0963       0.0000
 Inverse normal             Z     -12.1183        0.0000
 Inverse logit t(939)       L*    -12.1713        0.0000
 Modified inv. chi-squared Pm      14.2268        0.0000
------------------------------------------------------------------------------
```

```
Fisher-type unit-root test for growth
Based on augmented Dickey-Fuller tests
--------------------------------------
Ho: All panels contain unit roots           Number of panels       =    189
Ha: At least one panel is stationary        Avg. number of periods =   6.85

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(374)   P     2232.4774       0.0000
 Inverse normal             Z     -23.9854        0.0000
 Inverse logit t(909)       L*    -42.3741        0.0000
 Modified inv. chi-squared Pm      67.9527        0.0000
------------------------------------------------------------------------------
```

```
. xtunitroot fisher lnliq, dfuller lags(0)
(145 missing values generated)

Fisher-type unit-root test for lnliq
Based on augmented Dickey-Fuller tests
--------------------------------------
Ho: All panels contain unit roots           Number of panels       =    176
Ha: At least one panel is stationary        Avg. number of periods =   7.56

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(352)   P      896.7195       0.0000
 Inverse normal             Z       -8.7321       0.0000
 Inverse logit t(874)       L*     -12.8363       0.0000
 Modified inv. chi-squared Pm       20.5299       0.0000
------------------------------------------------------------------------------
```

```
Fisher-type unit-root test for lnprof
Based on augmented Dickey-Fuller tests
--------------------------------------
Ho: All panels contain unit roots           Number of panels       =    184
Ha: At least one panel is stationary        Avg. number of periods =   6.95

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included
Drift term:   Not included                  ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(346)   P     1103.3515       0.0000
 Inverse normal             Z      -10.5155       0.0000
 Inverse logit t(819)       L*     -18.4160       0.0000
 Modified inv. chi-squared Pm       28.7902       0.0000
------------------------------------------------------------------------------
```

Estimation Model

Table 17 – Generalised Least Squares

xtgls lnwacc lnsize lntang lngrowth lnliq lnprof, panels(heteroskedastic) corr(independent)

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   no autocorrelation

Estimated covariances      =       162          Number of obs      =       739
Estimated autocorrelations =         0          Number of groups   =       162
Estimated coefficients     =         6          Obs per group:
                                                             min =         1
                                                             avg =  4.561728
                                                             max =         8
                                                Wald chi2(5)       =    184.72
                                                Prob > chi2        =    0.0000
```

lnwacc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnsize	.0671193	.0057647	11.64	0.000	.0558208	.0784179
lntang	-.0344973	.0070701	-4.88	0.000	-.0483544	-.0206402
lngrowth	-.0294208	.0064954	-4.53	0.000	-.0421515	-.0166901
lnliq	-.0086124	.0103108	-0.84	0.404	-.0288212	.0115964
lnprof	.0542922	.0118672	4.57	0.000	.0310329	.0775516
_cons	.7855572	.0929761	8.45	0.000	.6033274	.9677869

Table 18 - Estimation Model Results with Industry Dummy variable

lnwacc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnsize	.0619157	.0137845	4.49	0.000	.0348986	.0889328
lntang	-.0575732	.0234164	-2.46	0.014	-.1034684	-.011678
lngrowth	-.0327165	.018377	-1.78	0.075	-.0687348	.0033018
lnliq	.0056168	.0207656	0.27	0.787	-.0350831	.0463166
lnprof	.1035	.0352279	2.94	0.003	.0344547	.1725454
covid	.0298703	.0490837	0.61	0.543	-.066332	.1260727
software	-.3990283	.2560249	-1.56	0.119	-.9008279	.1027713
softwareprof	2.156049	1.719544	1.25	0.210	-1.214195	5.526293
reit	.0764593	.1136131	0.67	0.501	-.1462182	.2991368
reis	-.5019959	.1994891	-2.52	0.012	-.8929874	-.1110045
reistang	.1873381	.3179397	0.59	0.556	-.4358123	.8104884
pharm_bio	.0288906	.1740849	0.17	0.868	-.3123095	.3700907
supp_services	-.1985477	.1402195	-1.42	0.157	-.4733728	.0762774
chem	.1815081	.1904618	0.95	0.341	-.1917902	.5548064
mining	-.0000287	.1045271	-0.00	1.000	-.2048981	.2048407
food_prod	-.6769149	.200497	-3.38	0.001	-1.069882	-.283948
food_prodliq	.1929603	.0926378	2.08	0.037	.0113935	.3745271
ind_metals	.3522651	.1649882	2.14	0.033	.0288941	.6756361
const_mat	-.1047	.099916	-1.05	0.295	-.3005317	.0911318
gen_ind	-.077704	.1253555	-0.62	0.535	-.3233963	.1679884
ind_eng	-.0214077	.2472725	-0.09	0.931	-.506053	.4632375
food_drug	-.3138626	.1307183	-2.40	0.016	-.5700657	-.0576595
telecoms	-.0866614	.1203651	-0.72	0.472	-.3225727	.1492499
media	-.3180204	.1590231	-2.00	0.046	-.6296998	-.0063409
travel	-.2050539	.1336363	-1.53	0.125	-.4669761	.0568684
travel	-.2050539	.1336363	-1.53	0.125	-.4669761	.0568684
life_ins	-.1191307	.1954905	-0.61	0.542	-.5022851	.2640237
nonlife_ins	0	(omitted)				
oil_gas	0	(omitted)				
ind_trans	.1828269	.1587972	1.15	0.250	-.1284099	.4940637
health	-.2781603	.1836279	-1.51	0.130	-.6380643	.0817437
automobiles	.117319	.2944594	0.40	0.690	-.4598108	.6944488
tech_hard	-.1517762	.167387	-0.91	0.365	-.4798487	.1762963
alt_energy	0	(omitted)				
for_paper	-.065431	.1949536	-0.34	0.737	-.4475329	.3166709
educ	.2523045	.1628841	1.55	0.121	-.0669424	.5715514
manuf	0	(omitted)				
_cons	1.066936	.2464854	4.33	0.000	.5838331	1.550038

6 APPENDIX B

GMM STATA OUTPUT

Table 19 - Correlations

	wacc	size	tang	growth	liq	prof	lev
wacc	1.0000						
size	0.2412*	1.0000					
tang	0.0162	0.1345*	1.0000				
growth	-0.0233	0.0215	0.0413	1.0000			
liq	-0.0053	-0.0565*	-0.0781*	-0.0108	1.0000		
prof	0.2167*	0.2342*	0.0571*	0.0185	0.0045	1.0000	
lev	-0.0416	-0.0388	0.0183	-0.0167	0.0065	0.0097	1.0000

Table 20 - Unit root test

Variable	Test Statistic	p-value	Order of Integration	Decision
WACC	465.84	0.0013	Level	Stationary
Size	1036.84	0.0000	Level	Stationary
Tangibility	988.31	0.0000	Level	Stationary
Growth	2232.48	0.0000	Level	Stationary
Liquidity	1245.34	0.0000	Level	Stationary
Profitability	943.36	0.0000	Level	Stationary
Leverage	1003.38	0.0000	Level	Stationary

Estimation Model Results with Industry Dummy variable

Table 21 - Two-step system GMM

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: co_id                           Number of obs      =      1169
Time variable : year                            Number of groups   =       176
Number of instruments = 18                      Obs per group: min =         2
F(10, 175)    =    608.87                                      avg =      6.64
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
        wacc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        wacc |
         L1. |   .6172773   .0880906     7.01   0.000     .4434206    .7911341
             |
        size |   .4370146   .1543988     2.83   0.005     .1322912    .7417379
        tang |  -.2822552   .3314498    -0.85   0.396    -.9364087    .3718982
      growth |  -.0517135   .0273854    -1.89   0.061    -.1057617    .0023347
         liq |   .0069719   .0062405     1.12   0.265    -.0053444    .0192883
        prof |   2.805847   .4181841     6.71   0.000     1.980514     3.63118
         lev |  -.0023763   .4211768    -0.01   0.996    -.8336161    .8288635
       covid |   4.932556   4.848856     1.02   0.310    -4.637205    14.50232
   covidsize |  -.2846003   .2997451    -0.95   0.344    -.8761809    .3069804
   covidtang |   .6757514   .9014057     0.75   0.454    -1.103274    2.454777
       _cons |  -4.587719   2.473606    -1.85   0.065    -9.469658    .2942193
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.78  Pr > z =  0.075
Arellano-Bond test for AR(2) in first differences: z =   1.13  Pr > z =  0.258
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(7)    =  11.67  Prob > chi2 =  0.112
```

Table 22 - One-step system GMM.

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: co_id                           Number of obs      =      1169
Time variable : year                            Number of groups   =       176
Number of instruments = 18                      Obs per group: min =         2
F(10, 175)    =    797.82                                      avg =      6.64
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Robust
        wacc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        wacc |
         L1. |   .4309197   .1687817     2.55   0.012       .09781    .7640293
             |
        size |   .3171832   .1503795     2.11   0.036     .0203922    .6139741
tangibility  |  -.2978726   .3021913    -0.99   0.326    -.8942811    .2985359
      growth |  -.0553355   .0263867    -2.10   0.037    -.1074125   -.0032585
         liq |   .0054296   .0064808     0.84   0.403     -.007361    .0182203
        prof |   2.743884   .3503378     7.83   0.000     2.052453    3.435315
         lev |  -.2717793    .336424    -0.81   0.420    -.9357499    .3921913
       covid |   2.677187   4.686074     0.57   0.569    -6.571308    11.92568
   covidsize |  -.1336296   .2846863    -0.47   0.639    -.6954901    .4282309
   covidtang |   .4518755   .7951587     0.57   0.571     -1.11746    2.021211
       _cons |  -1.172683    2.48196    -0.47   0.637    -6.071111    3.725745
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.00  Pr > z =  0.045
Arellano-Bond test for AR(2) in first differences: z =   1.42  Pr > z =  0.154
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(7)    =  11.67  Prob > chi2 =  0.112
  (Not robust, but not weakened by many instruments.)
```

Table 23 - One-step system GMM with industry dummies.

NB: The one-step GMM yields meaningful results with industry dummies.

Dynamic panel-data estimation, one-step system GMM

```
Group variable: co_id                       Number of obs      =      1169
Time variable : year                        Number of groups   =       176
Number of instruments = 46                  Obs per group: min =         2
F(38, 175)    =     14.27                                  avg =      6.64
Prob > F      =     0.000                                  max =         8
```

wacc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
wacc						
L1.	.4041217	.1884901	2.14	0.033	.0321153	.7761282
size	.3412973	.1812783	1.88	0.061	-.0164758	.6990703
tangibility	-1.200794	.8049541	-1.49	0.138	-2.789462	.387873
growth	-.0684968	.0276553	-2.48	0.014	-.1230777	-.0139159
liq	.0015219	.005805	0.26	0.793	-.0099348	.0129787
prof	3.055848	.3820722	8.00	0.000	2.301786	3.80991
lev	-.076687	.2765651	-0.28	0.782	-.6225193	.4691453
covid	2.579379	4.7263	0.55	0.586	-6.748506	11.90726
covidsize	-.1308642	.2864352	-0.46	0.648	-.6961764	.434448
covidtang	.4993694	.8218247	0.61	0.544	-1.122594	2.121333
software	-.6371633	1.04601	-0.61	0.543	-2.701582	1.427255
reis	-1.088448	1.048899	-1.04	0.301	-3.158569	.9816729
pharm_bio	-.1836265	.6778662	-0.27	0.787	-1.521472	1.154219
supp_services	-1.518031	1.037102	-1.46	0.145	-3.564869	.5288066

supp_services -1.518031 1.037102 -1.46 0.145 -3.564869 .5288066

chem	.589308	1.173094	0.50	0.616	-1.725925	2.904541
gen_ret	-1.070788	.599493	-1.79	0.076	-2.253954	.1123794
mining	-.5148041	.5693468	-0.90	0.367	-1.638474	.6088658
food_prod	-6.434551	4.442179	-1.45	0.149	-15.20169	2.332589
food_prodliq	2.140008	1.836854	1.17	0.246	-1.485229	5.765246
ind_metals	.6980698	1.07719	0.65	0.518	-1.427885	2.824025
const_mat	-1.271713	.6232964	-2.04	0.043	-2.501858	-.0415672
gen_ind	-1.387217	.643896	-2.15	0.033	-2.658018	-.1164162
ind_eng	-1.110703	.9145085	-1.21	0.226	-2.915588	.6941828
food_drug	-2.173947	.7851268	-2.77	0.006	-3.723483	-.6244108
telecoms	-.5807521	1.190252	-0.49	0.626	-2.929848	1.768344
media	-1.72759	.7858173	-2.20	0.029	-3.278489	-.1766916
travel	-.8368418	.6723213	-1.24	0.215	-2.163743	.4900598
life_ins	-1.281678	.7802657	-1.64	0.102	-2.82162	.258264
nonlife_ins	1.259252	.7594371	1.66	0.099	-.2395824	2.758087
oil_gas	.6406233	.8627435	0.74	0.459	-1.062098	2.343345
ind_trans	-.9352538	1.016705	-0.92	0.359	-2.941835	1.071328
health	-2.046894	.7874761	-2.60	0.010	-3.601067	-.4927212
automobiles	-.6428009	.5116444	-1.26	0.211	-1.652589	.3669868
tech_hard	-1.599251	.7711371	-2.07	0.040	-3.121177	-.0773252
alt_energy	.4672473	.6405862	0.73	0.467	-.7970216	1.731516
for_paper	-.9248779	.4427522	-2.09	0.038	-1.798699	-.0510566
educ	.2586934	.7162622	0.36	0.718	-1.154931	1.672317
manuf	1.060862	.6989585	1.52	0.131	-.318611	2.440335
_cons	-.1069921	3.352527	-0.03	0.975	-6.723582	6.509598

```
Arellano-Bond test for AR(1) in first differences: z =  -2.11  Pr > z =  0.035
Arellano-Bond test for AR(2) in first differences: z =   1.26  Pr > z =  0.206

Sargan test of overid. restrictions: chi2(7)    =  11.31  Prob > chi2 =  0.126
  (Not robust, but not weakened by many instruments.)
```

Table 24 - With winsorised variables at the 95th percentile (2 Step system GMM)

```
Dynamic panel-data estimation, two-step system GMM

Group variable: co_id                           Number of obs      =       660
Time variable : year                            Number of groups   =       144
Number of instruments = 18                      Obs per group: min =         1
F(10, 143)    =   1628.04                                      avg =      4.58
Prob > F      =     0.000                                      max =         8
```

wlwacc	Coef.	Corrected Std. Err.	t	P>|t|	[95% Conf.	Interval]
wlwacc L1.	.6912279	.10249	6.74	0.000	.4886367	.8938192
wlsize	.0271807	.0643242	0.42	0.673	-.0999685	.1543298
wltang	-.228156	.2551409	-0.89	0.373	-.732491	.276179
wlgrowth	-.3836645	.7407616	-0.52	0.605	-1.847922	1.080593
wlliq	-.1038819	.1000756	-1.04	0.301	-.3017006	.0939369
wlprof	-.6013198	1.257515	-0.48	0.633	-3.087041	1.884401
wllev	.2081235	.456049	0.46	0.649	-.693345	1.109592
covid	-3.238625	2.390171	-1.35	0.178	-7.963258	1.486007
covidsize	.2298209	.1501264	1.53	0.128	-.0669328	.5265746
covidtang	.0591493	1.056562	0.06	0.955	-2.029349	2.147647
_cons	2.095048	1.116175	1.88	0.063	-.1112865	4.301383

```
Arellano-Bond test for AR(1) in first differences: z =  -4.80  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.99  Pr > z =  0.321

Sargan test of overid. restrictions: chi2(7)    =  42.72  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
```

Table 25 - With winsorised variables at the 95th percentile (1 Step system GMM)

Dynamic panel-data estimation, one-step system GMM

Group variable: co_id		Number of obs	= 660
Time variable : year		Number of groups	= 144
Number of instruments = 18		Obs per group: min	= 1
F(10, 143)	= 2998.07	avg	= 4.58
Prob > F	= 0.000	max	= 8

wlwacc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
wlwacc						
L1.	.6975164	.0721095	9.67	0.000	.5549781	.8400547
wlsize	.0043955	.0471536	0.09	0.926	-.0888126	.0976037
wltang	-.1740337	.1960307	-0.89	0.376	-.561526	.2134587
wlgrowth	.126454	.5409348	0.23	0.815	-.9428075	1.195716
wlliq	-.1024483	.0782003	-1.31	0.192	-.2570263	.0521297
wlprof	-.7214091	.9572019	-0.75	0.452	-2.613503	1.170684
wllev	.120935	.3214292	0.38	0.707	-.5144315	.7563015
covid	-2.170391	1.898171	-1.14	0.255	-5.922492	1.581709
covidsize	.1696796	.118282	1.43	0.154	-.0641274	.4034867
covidtang	.2806033	.8142424	0.34	0.731	-1.328903	1.89011
_cons	2.381493	.893432	2.67	0.009	.6154533	4.147534

Arellano-Bond test for AR(1) in first differences: z = -5.51 Pr > z = 0.000
Arellano-Bond test for AR(2) in first differences: z = 0.73 Pr > z = 0.463

Sargan test of overid. restrictions: chi2(7) = 42.72 Prob > chi2 = 0.000
(Not robust, but not weakened by many instruments.)

Table 26 - With winsorised variables at the 99th percentile (2 Step system GMM)

The results when the data is winsorised at the 99th percentile are like those when the data is winsorised at the 95th percentile, as shown below.

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: co_id                           Number of obs      =      1058
Time variable : year                            Number of groups   =       172
Number of instruments = 18                      Obs per group: min =         1
F(10, 171)    =   3379.05                                      avg =      6.15
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
      w2wacc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      w2wacc |
         L1. |   .9050219   .0605642    14.94   0.000     .7854721    1.024572
             |
      w2size |  -.0256252   .0433871    -0.59   0.556    -.1112685    .0600181
      w2tang |  -.2095854   .1697382    -1.23   0.219    -.5446374    .1254667
    w2growth |  -.2746239   .3623912    -0.76   0.450    -.9899601    .4407123
       w2liq |  -.0180804   .0616367    -0.29   0.770    -.1397472    .1035864
      w2prof |  -.0920184   .7825189    -0.12   0.907    -1.636659    1.452622
       w2lev |  -.1551614   .3224423    -0.48   0.631    -.7916413    .4813185
       covid |  -1.340485   3.078466    -0.44   0.664    -7.417173    4.736203
   covidsize |   .1132347   .1853229     0.61   0.542    -.2525805    .4790498
   covidtang |    1.14766   .6945812     1.65   0.100    -.2233974    2.518718
       _cons |   1.327503   .5634983     2.36   0.020     .2151948    2.439811
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -6.61  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.37  Pr > z =  0.711
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(7)     =  61.97  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
```

Table 27 - With winsorised variables at the 99th percentile (1 Step system GMM)

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: co_id                           Number of obs      =      1058
Time variable : year                            Number of groups   =       172
Number of instruments = 18                      Obs per group: min =         1
F(10, 171)    =   4951.89                                      avg =      6.15
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Robust
      w2wacc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      w2wacc |
         L1. |   .9155961    .048175    19.01   0.000     .8205017     1.01069
             |
      w2size |  -.0192339   .0323899    -0.59   0.553    -.0831695    .0447017
      w2tang |  -.1223174    .145016    -0.84   0.400    -.4085695    .1639346
    w2growth |  -.1874098   .2946463    -0.64   0.526    -.7690222    .3942025
       w2liq |   -.010747    .047355    -0.23   0.821    -.1042226    .0827287
      w2prof |   .4784491   .6691599     0.71   0.476    -.8424283    1.799326
       w2lev |  -.1604689    .244634    -0.66   0.513    -.6433601    .3224224
       covid |  -.7918547   2.208364    -0.36   0.720    -5.151019     3.56731
   covidsize |   .0851795   .1339636     0.64   0.526    -.1792558    .3496147
   covidtang |    .961182   .5538489     1.74   0.084    -.1320792    2.054443
       _cons |   1.002456   .4652497     2.15   0.033     .0840838    1.920828
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -7.02  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.46  Pr > z =  0.648
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(7)    =  61.97  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
```

Table 28 - Difference GMM

Note: The difference GMM is not providing the diagnostic test results, namely the Wald test and Sargan test for both the 2-step and 1-step models. Moreover, the coefficient of the lagged dependent variable is insignificant, which suggests that the use of difference GMM is not appropriate.

```
Dynamic panel-data estimation, two-step difference GMM
------------------------------------------------------------------------------
Group variable: co_id                           Number of obs      =       990
Time variable : year                            Number of groups   =       176
Number of instruments = 7                       Obs per group: min =         1
F(0, 176)     =         .                                      avg =      5.63
Prob > F      =         .                                      max =         7
------------------------------------------------------------------------------
             |              Corrected
        wacc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        wacc |
         L1. |   .9212795   3.240541     0.28   0.777    -5.474039    7.316598
             |
        size |   106.8693   362.8463     0.29   0.769    -609.2203    822.9588
 tangibility |   365.3085   1145.234     0.32   0.750     -1894.85    2625.467
      growth |  -22.07934   69.80518    -0.32   0.752    -159.8423    115.6836
         liq |   38.56405   132.4359     0.29   0.771    -222.8027    299.9308
        prof |  -50.09685   207.3371    -0.24   0.809    -459.2837      359.09
         lev |   77.73297   258.6313     0.30   0.764    -432.6848    588.1508
------------------------------------------------------------------------------

------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -0.30  Pr > z =  0.766
Arellano-Bond test for AR(2) in first differences: z =   0.28  Pr > z =  0.782
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(0)    =   0.00  Prob > chi2 =      .
  (Not robust, but not weakened by many instruments.)
```

Dynamic panel-data estimation, one-step difference GMM

Group variable: co_id		Number of obs =	990
Time variable : year		Number of groups =	176
Number of instruments = 7		Obs per group: min =	1
F(0, 176) =	.	avg =	5.63
Prob > F =	.	max =	7

wacc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
wacc						
L1.	.9212795	3.240541	0.28	0.777	-5.474039	7.316598
size	106.8693	362.8463	0.29	0.769	-609.2203	822.9588
tangibility	365.3085	1145.234	0.32	0.750	-1894.85	2625.467
growth	-22.07934	69.80518	-0.32	0.752	-159.8423	115.6836
liq	38.56405	132.4359	0.29	0.771	-222.8027	299.9308
prof	-50.09685	207.3371	-0.24	0.809	-459.2837	359.09
lev	77.73297	258.6313	0.30	0.764	-432.6848	588.1508

Arellano-Bond test for AR(1) in first differences: z = -0.30 Pr > z = 0.766
Arellano-Bond test for AR(2) in first differences: z = 0.28 Pr > z = 0.782

Sargan test of overid. restrictions: chi2(0) = 0.00 Prob > chi2 = .
(Not robust, but not weakened by many instruments.)

TECHNICAL CARE	Yes or No
Are all information sources (books, journals, e-mail messages, web pages) that have been cited in the text, included in the List of References at the end of the assignment and *vice versa*?	
Is the list of references ordered alphabetically? (Entries in the list of references should not be numbered or bulleted)	
Have you used the correct referencing method in the text, as well as in the list of references? (APA style of referencing)	
Have you correctly indicated the sources of all tables / figures taken or adapted from the literature? (Such references are provided below the table or figure)	
4. APPENDICES	
Do all the appendices have appropriate descriptive titles?	
Are the pages of all the appendices numbered up to the last page?	
Have all the appendices been tagged / "flagged" for easy cross-referencing?	
Are all the appendices included in the Table of Contents with their correct page numbers?	
Have you included appropriate cross-references in the body text (e.g., see Appendix A) to the material included in the appendices?	
5. GENERAL TECHNICAL CARE	
Have you checked your assignment for spelling and grammatical errors?	
Have you used capital letters and abbreviations correctly?	
Have you consistently rounded off all numeric values in the assignment to two (2) decimals?	
Have you consistently “justified” the body text of the assignment (i.e., aligned the text evenly along both the left and right margins to form a square box)?	
Are all headings numbered correctly?	
First and second order headings should not be underlined.	
There should be no full stops at the end of headings.	
Have you used an A4 paper setting?	
Have you consistently used 1.5 line spacing in the body of the text? (You may use single line spacing in tables)	
Is the font size of the body text correctly set at 12 pt?	

Have you consistently used the same font type (i.e., Times New Roman) and font size (12 pt) for the body text?	
Are the left and right margins set to 2 cm?	
Have all pages printed correctly?	